English in architecture

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ENGLISH IN ARCHITECTURE

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ENGLISH IN ARCHITECTURE

Lidija Kraljević

Građevinski i arhitektonski fakultet Osijek,

Sveučilište Josipa Jurja Strossmayera,

Osijek, veljača 2022.

“Architecture is the learned game, correct and magnificent, of forms assembled in the light.”

Le Corbusier

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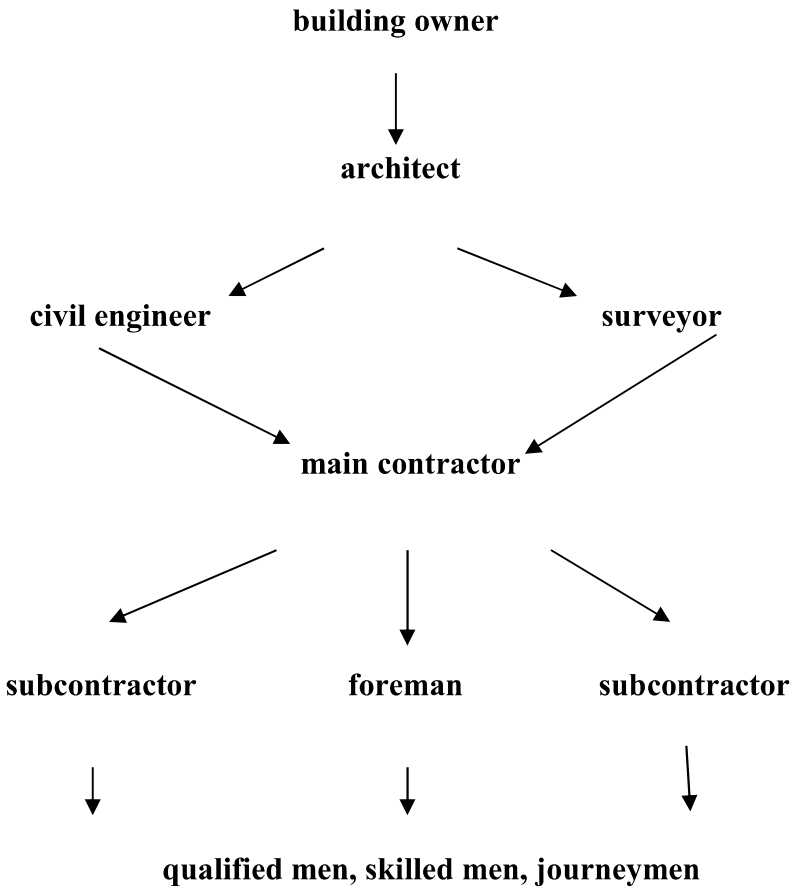
TEXTS FOR FURTHER STUDY

Building in general

The term building, in its broadest sense, applies to any man-made structure intended for permanent use or to a construction process itself.

Buildings serve diverse social needs but, basically, they provide space for safe and comfortable living and working conditions. Made from different construction materials and appearing in a wide range of shapes and functions, they are always adapted to various environmental conditions, specific uses, aesthetic trends, and economics**.**

The practice of designing, constructing, and operating buildings results from a common effort of different groups of professionals and trades. Depending on the size, complexity, and purpose of a particular building project, the construction team can consist of the following construction professionals and tradesmen:



(brick layer, concrete worker, rod bender, plasterer, carpenter, tin smith, electrician, roofer…).

It is believed that the first shelters were made about 500,000 years ago by an early ancestor of humans, Homo erectus. Much later in the history, humans started to create other types of primitive structures, as for e.g. stone circles and megaliths.

From 3,050 BC to 900 BC the ancient Egyptians, using only primitive tools and instruments, built first great stone structures (pyramids, temples, and shrines) with an amazing accuracy and precision.

The term classical architecture refers to architecture of ancient Greece and Rome, especially from the 5th century BC in Greece to the 3rd century AD in Rome. Many later architects were influenced by the styles and forms of classical architecture which they revived in the architectural style known as neoclassical architecture.

Between about 1075 and 1125 heavier, stocky Romanesque architecture with rounded arches dominated Medieval Europe. This architecture, heavily influenced by the Romans, is recognized by its massive quality, thick walls, round arches, sturdy piers, groin vaults, large towers and decorative arcading.

During the second half of the twelfth century the Gothic style was developed in England and France engendering impressive and marvellous cathedrals throughout Europe. [1]

EXERCISES:

I Match the words on the left with the definitions on the right

Architect	is the one who accurately determines the terrestrial or three-dimensional position of points and the distances and angles between them.
Civil engineer	is a person in charge of a group of workers, a particular operation, or a section of a plant.
Surveyor	deals with the design and construction of stationary structures for civilian use.
Contractor	deals with planning and designing of buildings, and participates in supervising the construction of a building
Foreman	is an individual that contracts with another organization or individual (the owner) for the construction of a building, road or other facility

II Write at least three appropriate adjectives in front of the following nouns:

_____ pyramid

_____ architecture

_____ cathedral

_____ conditions

III Insert the missing word

The _____ of the Great Pyramid's construction is most remarkable. The base is an almost perfect _____, covering an area of about 5 hectares. The difference between the longest and shortest sides is only 20 centimetres, and the four 90˚ corner _____ are accurate to better than 3,5 arc minutes. Furthermore, the pyramid is _____ true north with a greater accuracy than any known structure, astronomical site or monument. The most accurate north oriented structure of modern times is the Paris _____. It is 6 minutes of a degree off true north, whereas the Great Pyramid is only 3 minutes of a degree off true north. These 3 minutes of a degree off true north is due to either a _____in the earth's pole or movement of the African continent. It was initially exactly_____ to true north. The pyramid itself is _____ to contain some 2.3 million blocks of _____ so its total weight would have been 6 000 000 tons. Granite blocks were used in some internal_____, such as the King's Chamber, while limestone blocks were used for most of the body of the pyramid. A typical limestone block _____ about 3 tons. The heaviest granite blocks weigh more than 70 tons. It was originally 147 meters tall, but some of its _____ stones are gone now and it stands about 140 meters high.
(shift, estimated, angles, square, accuracy, oriented, observatory, aligned, limestone, weighs, upper, features) [1.1]

IV Translate the text

According to common perception the pyramids were built, with the begrudging help of great armies of slaves, by the ancient pharaohs of Egypt as tombs for preserving their royal bodies. Pyramids were meant to be monuments to the pharaoh's greatness, filled with great treasures for the afterlife. To construct these massive shrines, the pharaoh's copied the oldest and largest pyramid of all, the Great Pyramid of Giza. The Last "Wonder of the World" is thirty times larger than the Empire State Building and its features are so large they can be seen from the Moon.

- Only a solid stone mountain could endure the Pyramid's immense weight. And indeed, a flat solid granite mountain happens to be located just beneath the surface of the ground directly under the Pyramid.
- The Pyramid is located at the exact centre of the Earth's land mass. That is, its East-West axis corresponds to the longest land parallel across the Earth, passing through Africa, Asia, and America. [1.2]

Ancient geniuses

Imhotep was not only the first engineer and architect in history known by name but also one of the world's most versatile geniuses. Since he possessed many qualities and talents, he has often been called the Leonardo da Vinci of Egypt.

Imhotep was an inventor of the pyramid, sage, architect, high priest, physician, astronomer, poet, philosopher and scribe. He was also the chief adviser to pharaoh Zoser in both religious and practical matters, and was in charge of the departments of the Judiciary, Treasury, War, Interior, and Agriculture.

Around 2550 BC, inspired by the ancient Egyptian belief that a tomb "should allow the deceased to mingle with the circumpolar stars, thus fulfilling his stellar destiny", Imhotep designed his famous six-stepped pyramid at Sakkara. First he built one low mastaba (a type of an early Egyptian tomb structure), and then added five more on top of it, each smaller than the one before, creating thus an imaginary stairway to the heavens.

The Step Pyramid was the first grandiose work in stone which marked the beginning of a revolutionary period that eventually led to the polished, smooth-faced pyramids of the later Egyptian master builders. Imhotep was the first who used limestone on a large scale as a construction material, and here the concept of a monumental royal tomb in the form of a pyramid was first truly realized.

Imhotep was accredited with the first known use of columns in building design and the idea of building coating.

Despite being a common man, he was, long after his death, raised to deity and proclaimed a god of medicine and healing.

In the early 1st century **Marcus Vitruvius,** Roman architect and engineer, wrote his treatise, partly based on his own experience, and partly on theoretical works of some Greek architects. This great book, which is the oldest surviving engineering work, emphasises the importance of the following three engineering principles:

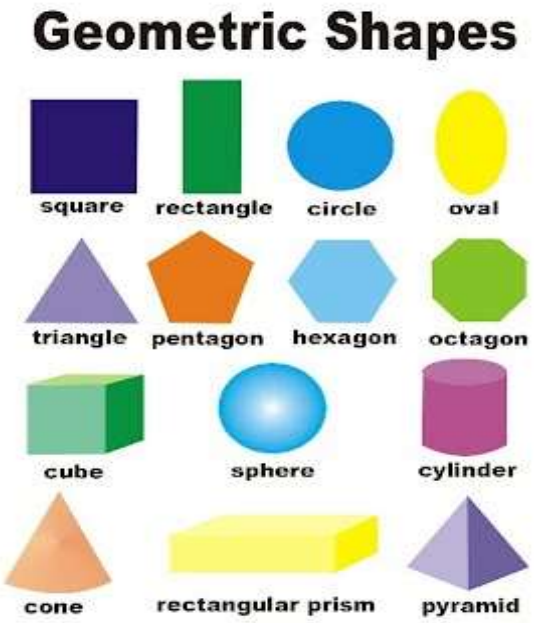
durability - a structure should remain in good condition

utility - a structure should be useful and functional

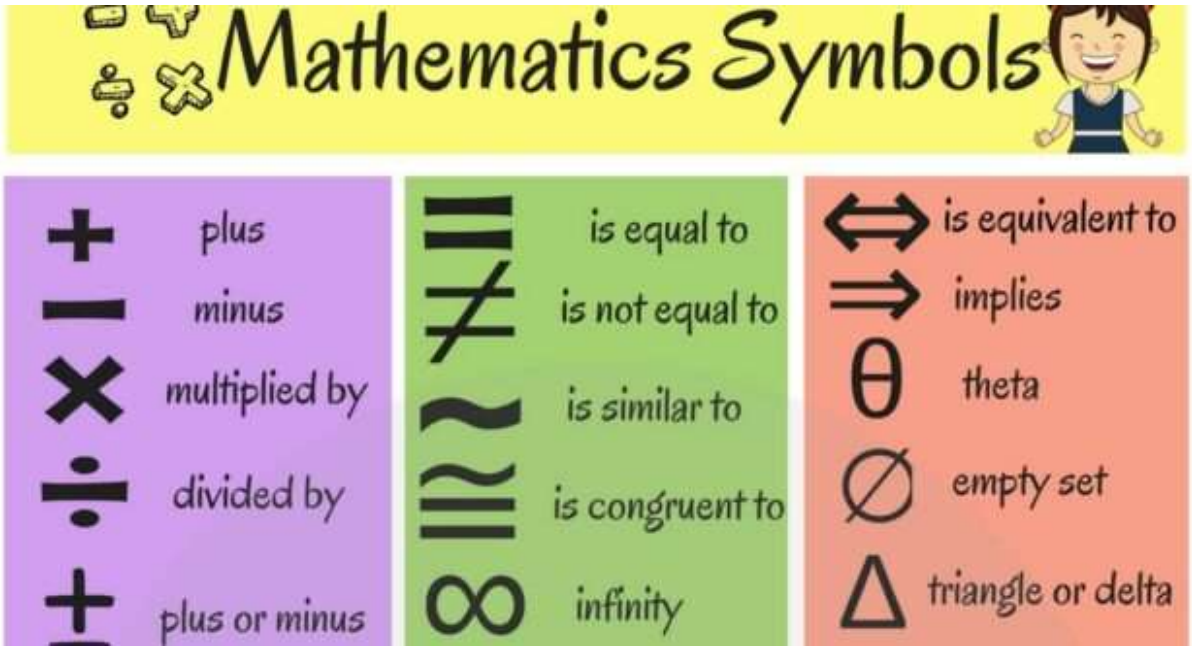
beauty - a structure should satisfy aesthetic requirements.

This work, one of the most important sources of Roman building methods, was used as a classic text book from ancient Roman times to the Renaissance. [2]

LEARN MORE:



Some common geometric shapes (1)



Some common mathematical symbols and terms (2)

EXERCISES:

I Answer the questions

1. What was Imhotep's greatest architectural achievement?
2. Why did he construct a tomb in the form of a pyramid?
3. Why is Imhotep's stepped pyramid considered the first major work in stone?
4. What do you know about Marcus Vitruvius?
5. Why is *De Architectura* one of the most influential books on architecture?

II Choose the more appropriate word in the brackets

Ferrous metals are very (liable, possible) to corrosion by oxidation or by some other (chemical, chemic) (act, action) and they have therefore to be (prevented, protected) in some (method, way). A (rise, raise) in temperature will (make, cause) the pipe to (expand, increase) in length and in order to (prevent, eliminate) stresses from being set up in the metal expansion joints are fitted which (reduce, release) the stresses by (allowing, permitting) the pipe to expand or contract freely. (taken from: English in Civil engineering, Z. Čulić)

III Fill in the blanks with the appropriate prepositions and then translate

According ___ feng shui, there are some key factors to consider when choosing a site to build or purchasing an existing structure:

1. **Environmental factors.** Avoid areas near major highways, industry, airports, train stations, hospitals, prisons, cemetery, high tension and cell towers. Living in close proximity_____ any of the aforementioned can have a negative impact ___ wellbeing.
2. **Square or rectangular architecture.** In feng shui the architectural shape has a tremendous impact on health and prosperity. How stable a structure is depends _____ its shape. Square and rectangular shapes symbolize stability, dependability and a sense ___ security; certainly attributes one should look ____ in a building. Furthermore, in a regular shape structure, all 8 compass directions are fully expressed. This is an important concept in feng shui, as these directions correspond ____ body parts, organ systems and life qualities.
3. **Choose natural building materials.** Homes contain a vast amount ____ synthetic materials in their construction design. Waterproofing, foundations, insulation, flooring, adhesives, lighting, fabrics and paints are just a few examples ____ potential irritants. Incorporating natural materials such as real hardwood, stone, bamboo, cotton or silk fabrics, organic paint and healthy plants are all examples of ways to counteract the negative side effects ____ synthetic emissions.

IV Explain the meaning of the following words and use them in your own sentences

durability, cemetery, building site

_____

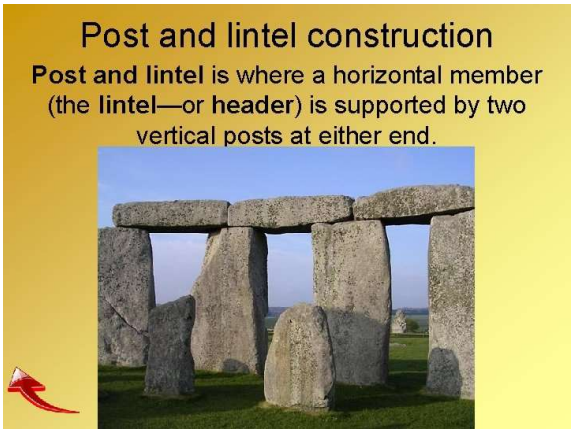
_____

_____

Lesson 3

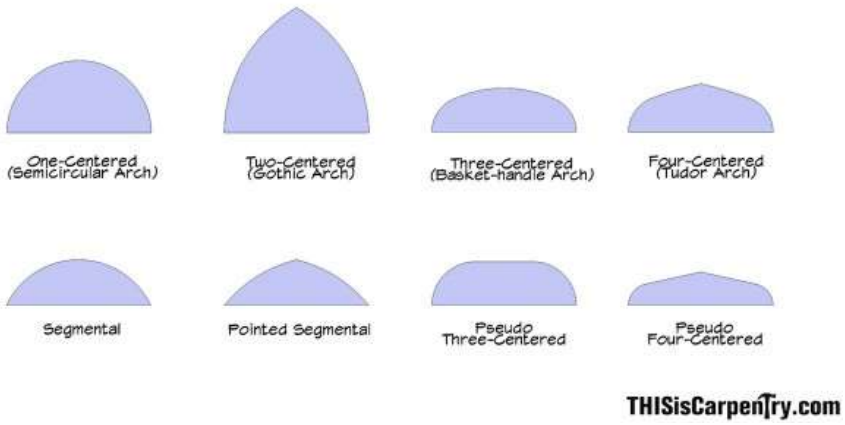
Structural forms: arches and vaults

The simplest structural form, called post-and-lintel, consists of a post or column supporting a horizontal beam or lintel. This form can be recognized in surviving examples such as the Parthenon or in Roman buildings constructed on the Greek model, such as the Pantheon in Rome. The typical post-and-lintel building had a form of either a cube or a rectangle and was made from limestone, of which ancient Greece had an abundance.



Post-and-lintel construction (3)

Whereas Greek architecture is characterized by post and lintel stone construction and columns, Roman architecture is most closely associated with the arch and vault, which is considered to have been the main Roman contribution to modern architecture. The arch and vault can carry much heavier loads and create large internal spaces without the need for additional supporting columns within a central space. An arch is a typically curved structural member that spans an opening and serves as a support (e.g. for the wall or other weight above the opening). A vault is a ceiling of brick, stone, or concrete built in the principle of the arch.
Until the 19th century the arch and vault were the only alternative to the much more limited and simpler post-and-lintel structure.



Different arch shapes (4)

In order to construct the arch, builders had to use wooden centerings, or temporary supports, which held the arch until the piers and arch were finished and self-supporting.

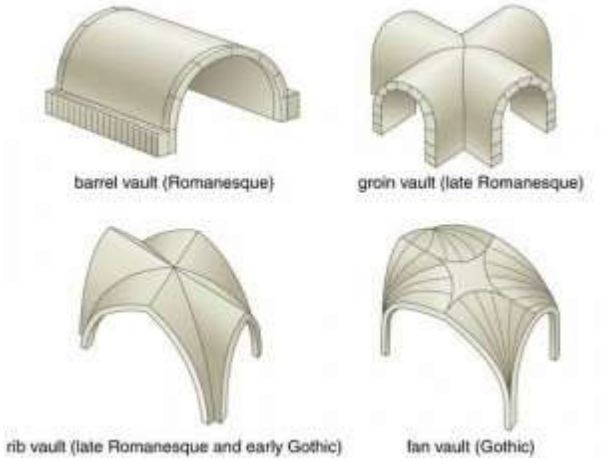
The vault is a continuous series of arches. It is characterized by thrust, which pushes on the walls. When the vault is built with a form, the construction process goes through the following stages:

1. Setting up the form
2. Adjusting the form
3. Starting the vault
4. Laying the mortar
5. Laying the block
6. Laying the keystone
7. Removing the form
8. Balancing the thrust.

Concrete vaulted structures, with their large spans and curvilinear forms, visible in buildings such as the Pantheon and the Basilica of Maxentius, count among most significant Roman contribution to art and architecture.

The Romans built three basic types of vaults:

- Barrel or Tunnel Vault
- Groin(ed) or Cross Vault
- Cloister Vault



Different vault shapes (5)

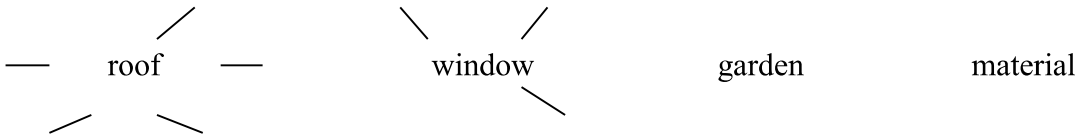
The variety of vaults enabled the construction of different structures such as large rooms, tombs, drains, bridges, bath houses and consequently, it resulted in other more advanced structures, like domes. [3]

EXERCISES:

I Fill in the correct word derived from the word in capitals

1. _____ buildings are responsible for consuming 27% of the total amount of energy consumed within Europe. (RESIDE)
2. Japanese architecture is deeply _____ by the environment. (INFLUENCE)
3. Everything that is received from the earth should be_____ given back (FREE)
4. There are three _____ characteristics in "natural" design from which we can learn. (DEFINE)
5. A grant was given for the _____ of a new sport facility. (CONSTRUCT)
6. Progress in computer technology has been _____ fast. (BELIEVABLE)
7. Local _____ are angry about the new rubbish damp. (RESIDE)
8. Painting the exterior of the house improved its_____ immensely. (APPEAR)

II Think of as many adjectives of as you can to make collocations to complete the spidergrams



III Fill in the missing words

Pont du Gard is the Roman aqueduct _____ to the city of Nîmes, in southern France. It is the highest of all Roman aqueducts and _____ of the greatest and best-preserved pieces of Roman architecture in France. The Pont du Gard was _____ in the late 1st century BC or the early 1st century AD _____ to channel water from a spring 50 km _____ Nîmes. It was constructed of masonry, without the use of mortar, and _____ of three tiers of arches. The lowest level, _____ was broadened in 1747 to accommodate a road bridge, has six wide arches. Above this level are 11 arches _____ similar dimensions, and on the topmost tier, 35 smaller arches _____ support the covered water channel of the aqueduct itself. The Pont du Gard is part of ____ impressive system of channels and tunnels constructed on the site ____ Roman engineers on a gradient of 0.07 centimetres per meter. Having survived intact _____ a period of some 2000 years the bridge attests _____ the superior engineering and design skills of the ancient _____. [3.1]

IV Find the opposite words

different - _____ , the highest - _____, temporary - _____,

simple - _____ , internal - _____, curved - _____

V Match the words and then use them in your own sentences

marble	column
site	heating system
ground	investigation
watertight	building
multy - story	water
non-polluting	concrete

LEARN MORE:

Basilica of Maxentius, also known as Basilica of Constantin, is the pearl of Roman engineering work. At the time of construction, it was not only the largest structure to be built and but also very unique since it took both aspects from Roman baths as well as typical Roman basilicas. The Basilica was the last non-Christian building built in the Roman Forum, all that followed were churches, and most of those were built into the remains of roman civic structures or temples.

The Basilica was the last and certainly one of the most impressive buildings of the Roman forum. The platform on which it was built is solid concrete, 100 meters long and 65 meters wide. The central nave was a single open space 80 meters long, 25 meters wide, and 35 meters high. The side aisles, each with their three barrel-vaults, were 16 meters wide and 24.5 meters high. The skeleton of the Basilica was good late-Roman concrete faced with brick. Although the outside was plain and perhaps never sheathed in stone, the inside was richly decorated with carved and colored architectural marble and statuary. In front of the piers supporting the central and side vaults were eight marble columns. The ceiling was decorated with hexagonal and octagonal coffers and was probably modeled on the inside of Hadrian's Pantheon dome. The bronze tiles, used for roof covering, were later reused on the Saint Peter's Basilica.

Of the original building there have remained only three vaults, but it is still possible to see the complete outline of the building with partial walls surrounding it.[3.2]

Lesson 4

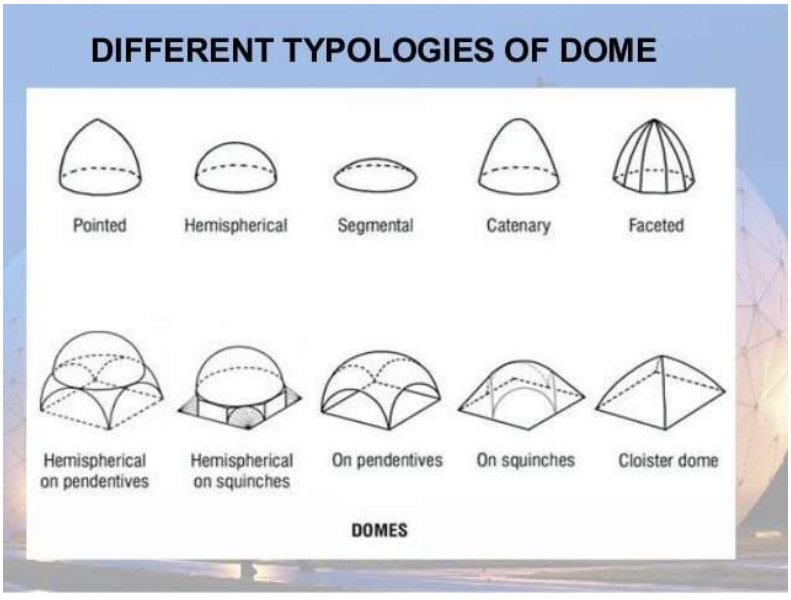
Dome as a structural form

A dome is a curved roof or vault, usually of hemispherical shape. When properly built domes are, like arches, structurally very strong and thus able to span large openings without any interior supports. A dome, which is basically an arch rotated 360 degrees on its axis, is a continuous geometric form with no perpendicular changes in surface direction. It encloses the maximum volume with a minimum of surface area. Though it structurally resembles the arch, it is more stable due to compression from all sides.

The dome can be recognized in the architecture of the Romans such as the Pantheon, the churches of the Renaissance, and in state capitol buildings in the U.S. today.

The first technically more advanced domes appeared in the ancient Middle East, India, and the Mediterranean. The Romans frequently used advanced large-scale domes to shape large interior spaces of temples and public buildings. In Western Europe they became popular again during the Renaissance period. The first great Italian Renaissance dome was the majestic octagonal dome built (1420-1436) by the architect Filippo Brunelleschi for Florence Cathedral. In Rome the slow process of rebuilding of Saint Peter's Basilica occupied several generations of Renaissance architects. The reconstruction plan for the church with a monumental dome was finally begun in 1546 under the supervision of Michelangelo. Its grandiose multi-ribbed dome, 41.7 metes in diameter, became the prototype for domes throughout the world.

Until the 19th century, domes were constructed of masonry and/or wood, and frequently reinforced with iron chains around the base to counteract the outward thrust of the structure. New technologies and materials, such as reinforced concrete, steel, aluminium, laminated wood, or plastic, developed in the nineteenth and twentieth centuries, enabled the construction of taller, stronger, wider, and lighter domes.



Different types of domes (6)

Some types of domes are:

Corbel dome
It consists of purely horizontal layers. As the layers get higher, each is slightly cantilevered, or corbelled, toward the center until meeting at the top.
Onion dome
They are found mostly in eastern architecture, particularly in Russia, Turkey, India, and the Middle East. The typical example is the Taj Mahal dome.
Oval dome
It is closely associated with the Baroque style. The largest oval dome was built in the basilica of Vicoforte by Francesco Gallo.
Umbrella dome
It is also called pumpkin, melon, or parachute dome. The central domes of the Hagia Sophia and St. Peter's Basilica use this method. [4]
EXERCISES:

I Find the word in the text which means
An original model on which something is patterned is .....
A polygon of eight angles and eight sides is .....
The length of a straight line through the centre of an object is.....
A building for religious practice is .....
The act of watching over the work or tasks of another is .....

II Comprehension questions
1. Why is a dome an advanced structural form?
2. What materials did ancient builders use to construct their domes?
3. How did modern materials influence dome construction?
4. What are some basic dome types?
5. Can you name some famous domes?

III Give the adjective from the following nouns
compression, tension, ductility, plasticity, endurance, malleability, deformation, brittleness, flexure, height, width, length

IV Replace the underlined word with an expression of a similar meaning

1. Wood decomposes when <u>exposed</u> to moisture and dryness.
2. Modern materials <u>have mostly substituted</u> traditional materials.
3. Earthquake hazards must <u>be taken into account</u> as part of an extensive geologic analysis.
4. Before any arch <u>can be erected</u>, it is necessary to provide temporary timber framing.
5. The <u>primary</u> <u>object</u> of site investigations is to determine site suitability.

V Underline the correct word
1. The tourists wanted to see the wrecks/ruins/remnants of the ancient temple.
2. The future shopping mole will be easily equipped/accessible/affordable to everyone in the town.
3. I should choose a more challenging trade/work/profession like civil engineering.
4. Most of the rubbish/residue is dumped in landfill sites.
5. The children were told to discard/deposit the cans in the recycling bin.

Lesson 5

Building Materials

Building or construction materials are any materials used for a construction purpose.

Building materials can be divided into two general groups: natural or artificial. Natural building materials, such as wood, clay, sand, or rocks, can be found in nature, which means that they are industrially unprocessed or just minimally processed. In contrast to natural building materials, artificial building materials are man-made or industrially produced and processed. The most common artificial building materials is concrete, steel, brick, plastics, glass, etc. Both materials have their uses in building practice and they are chosen according to and dependent on different needs of specific specialty trades, such as carpentry, plumbing, roofing and insulation work.

Stone and wood are probably the most common building materials. Throughout the history and all over the world they have been used for creating most different kinds of structures.

Although wood has become relatively scarce and expensive, it remains an important building material. Wood is a product of trees, and sometimes other fibrous plants, used for construction purposes when cut or pressed into lumber and timber, such as boards, planks and similar materials.

Rock is the most durable building material available. There are many types of rock throughout the world, all with differing attributes that make them better or worse for particular uses.

Its main draw-back as a material is its weight and awkwardness. Its energy density is also considered a shortcoming, as stone is hard to keep warm without using large amounts of heating resources.

Many kinds of stone lend themselves to building. The most commonly used kinds of stone are: limestone, granite, marble, and sandstone.

Some regions lack both timber and stone; their people used the earth itself, tamping certain mixtures into walls or forming them into bricks to be dried in the sun. Building with stones or bricks is called masonry.

The Romans invented natural cement that, combined with some other ingredients, produced concrete. Concrete is the most important modern building material, with billions of tons produced each year worldwide.

In the 19th century, steel became cheaper and thus more available, and in the 20th century some other modern building materials, such as aluminium, plastic and glass came into massive use.

Today smart materials, which are materials that change their properties in response to external conditions, are being introduced into civil infrastructure systems, and so are new developments in metals, with new high-strength steel alloys and non-corrosive steels that are changing engineering practice. [5]

EXERCISES:

I Underline the most suitable form and then translate the text

Wood is one of the most environmentally-safe building materials for home construction; it *uses/gets/disposes* less overall energy than other products and causes *fewer/smaller/greater* air and water impacts. It has great bearing capacity compared to its lightness in weight. After earthquakes most of the *existing/ undamaged/erected/* buildings are made of logs. Also, wood has some other remarkable advantages. Wood is an inexpensive material. Forest is a wood factory which *designs/creates/produces* wood using only solar energy. Only minimum amounts of power are *consumed/required/demanded* for maintaining the forest, tree-felling and transport. In comparison, the production of a cubic meter of steel requires about 320 times more energy than for providing a cubic meter of wood. In processing and production too, wood requires far less energy than other building materials. *Besides that/Because of that/ Likewise*, wood is a durable material. The oldest log houses in the world are over 800 years old. Additionally, wood is a beautiful, warm, strong and flexible.

II Give synonyms for the following words

remarkable - _____, amount - _____, to maintain - _____ to require - _____, durable - _____

III Match the words

A	B
warmth	friendly
renewable	wood
genuine	capacity
environmentally	building material
green	source

IV Fill in with the missing prepositions

to dispose ..... forces equal .... each other

filled ..... sand deal ..... quantity

a mixture consisting ..... built .... logs

result ..... new methods subject ..... various stresses

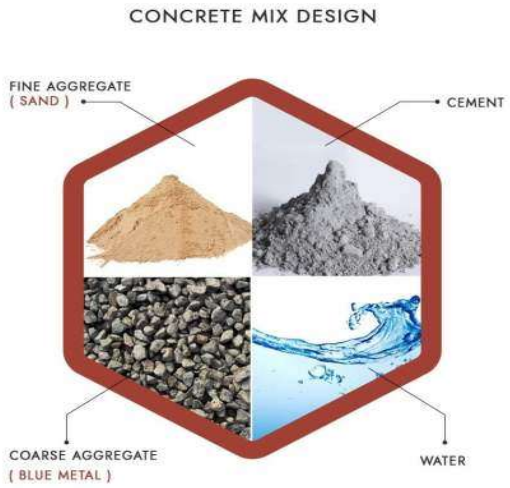
consisting ... piles to speed ... construction

Lesson 6

Concrete

Concrete is a rock-like material of remarkable strength and durability that has been used as an architectural material for almost 2000 years since the Roman times.

It is basically a mixture of cement, other materials such as fly ash and slag cement, aggregate, water, and chemical admixtures. The word concrete comes from the Latin word "concretus" meaning compact or condensed.



Typical concrete mix constituents (7)

Even the best concrete has a tensile strength barely one tenth of its compressive strength, a property it has in common with all stones. However, the invention of reinforced concrete, which is today the most commonly used structural material, eliminated this shortcoming.

In reinforced concrete, bars of steel are embedded in the concrete so that the steel takes the tension and concrete the compression. For example, the bottom of a beam supported at its ends is always in tension, while its top is in compression. Steel bars set near the bottom of the beam prevent the concrete from cracking under tension and make the beam work as if it were made of a material, like steel or wood, capable of resisting both kinds of stress.

Combining the compressive strength of concrete and the tensile strength of steel, reinforced concrete can be poured into forms and given any shape suitable to the channeling of loads. It can be sculpted to the wishes of the architect rather than assembled in prefabricated shapes. It is economical, available almost everywhere, fire-resistant, and can be designed to be lightweight to reduce the dead load.

Concrete is plastic and malleable when newly mixed, strong and durable when hardened. This explains why one material, concrete, can build skyscrapers, bridges, sidewalks and superhighways, houses and dams. The key to achieving a strong, durable concrete rests in the careful proportioning and mixing of the ingredients.

Typical concrete mix (8)

Ready-mixed concrete is the most common concrete form. It's batched at local plants for delivery in the trucks with revolving drums.

Ideal as it is for construction, concrete too has many unfortunate properties. If not properly wetted, or cured, while it hardens, it shrinks and cracks, allowing humidity to rust the reinforcing bars. Moreover, it continues to stretch or shorten, creeps, under constant tension or compression loads, up to three or more years after hardening. It is also difficult to plan, difficult to place, and difficult to repair.

Precast concrete is a kind of concrete which is cast in a reusable mould or form, then cured in a controlled environment and transported to the construction site. [6]

EXERCISES:

I Answer the questions

1. What is concrete?
2. What are some favorable properties of concrete?
3. What is the greatest disadvantage of concrete?
4. How can it be eliminated?
5. What are some other shortcomings of concrete?
6. What are the two most used kinds of concrete in modern construction industry?

II Make nouns of these adjectives

strong, durable, fire-resistance, reusable, reinforcing, compressive, humid

III Explain the meaning of the following words

revolving drum, ingredient, malleable, shortcoming

IV Fill in the missing words given below and then translate

Concrete should be mixed until it is ..... in appearance and all the ingredients are evenly distributed. Mixers should not be ..... above their rated capacities and should be operated at approximately the ..... for which they were designed. If the ..... of the mixer become worn or coated with hardened concrete, the ..... action will be less efficient. Worn blades should be replaced and the hardened concrete removed periodically, ... after each production of concrete. Mixing for long periods of time at high speeds, about 1 or more hours, can result in concrete strength ....., temperature rise, ... loss of entrained air, and accelerated slump loss. Concrete mixed in a transit mixer should be delivered and ..... within 1 1/2 hours or before the ..... has revolved 300 times after the introduction of water to cement and aggregates or the cement to the aggregates. Mixers and agitators should always be operated within the ..... of the volume and speed of rotation designated by the equipment manufacturer.

(drum, limits, loss, excessive, speeds, discharged, uniform, loaded, blades, mixing, preferably)

V Architecture Quiz

1. Which school of Architecture did Walter Gropius establish?

2. What is the name given to a Buddhist burial mound?

3. What is the name given to a court inside a castle?

4. Where would you find a Lych gate?

5. What is the name given to the central aisle in a church?

6. What is the name of the style of design popular during the reign of George IV?

7. What style of Architecture is associated with Giorgio Vasari?

8. Who designed many of the famous phantastic art nouveau buildings in Barcelona?

9. What is the name given to a piece of decorated glass over a door?

10. What is the name given to a column used to support a handrail?

ANSWERS 1. Bauhaus 2. Stupa 3. Bailey 4. At the entrance to a grave yard 5. Nave 6. Regency 7. Gothic 8. Gaudi 9. Fanlight 10. Balustrade

Lesson 7

Steel

Steels are a large family of metals. All of them are alloys in which iron is mixed with carbon and other elements. Steels are described as mild, medium- or high-carbon steels according to the percentage of carbon they contain, although this is never greater than about 1.5%.

A British inventor called Henry Bessemer is generally credited with the invention of an efficient steelmaking process in 1856. Although malleable iron products have been around for more than 2,000 years, steel is still produced using technology based upon the Bessemer process.

Steel derives its mechanical properties from a combination of chemical composition, heat treatment and manufacturing processes. While the major constituent of steel is iron, the addition of very small quantities of other elements can have a marked effect upon the properties of the steel. The strength of steel can be increased by the addition of alloys such as manganese, niobium and vanadium. However, these alloy additions can also adversely affect other properties, such as ductility, toughness and weldability. Minimizing the sulphur level can enhance ductility, and toughness can be improved by the addition of nickel. The chemical composition for each steel specification is therefore carefully balanced and tested during its production to ensure that the appropriate properties are achieved.

Steel is undoubtedly the best metal for sheet metal fabrication shops. Among the many reasons to mass-produce steel, it's easy to recycle, strong, and globally prosperous. [7]

Did you know that:

1. 75 % of all major appliances are comprised of steel.

2. Modern steel buildings, like The Empire State Building (1930) in New York and U.S. Steel Tower (1971) in Pittsburgh, are designed to easily assemble and disassemble.

3. Because steel and iron expand when heated, the Eiffel Tower (1887), is about 6 inches taller in the summer than the winter.

4. Steel bridges are four to eight times lighter than those built from concrete. The Golden Gate Bridge (1937) required 83,000 tons of steel whereas half of that amount would be required today.

5. More than 600 steel cans are recycled every second in the United States.

6. Recycling a single steel can saves enough energy to power a 60W light bulb for almost 4 years. [7.1]

Skyscrapers

Usually the word *skyscraper* refers to a very tall building that towers above the other buildings along a city's skyline. The word skyscraper was originally a nautical term that referred to the tall sails on a sailing ship. Debatably, the first skyscraper erected is the Home Insurance Building in Chicago, which was 10 stories, supported by steel and constructed in 1895. In fact, the building weighed 1/3 of what it would have weighed if it had been constructed from stone. In 1890, two additional floors were built on top of the original 10-story building.

Skyscraper Design

Without effective load balancing designs, today's skyscrapers could have never been built. The structural design, which is a precise balance of economics, engineering, and construction, is of extreme importance due to the multitude of people and valuable commodities skyscrapers shelter. The weight of a skyscraper mainly consists of dead load, the load exerted by the building itself. Any extra weight from people, furniture, vehicles, etc. is known as live load. In addition, wind and other unexpected sources can be load providers. The design of a skyscraper is mainly dictated by how the total load is to be distributed. Skyscraper designs are categorized as steel frames, shear walls, concrete core, or tube designs.

Shear Walls

In a shear wall design, the weight of the structure is distributed through the walls. These structures are often made of brick or cinder block-materials with high compressive strength. The shear wall design is primarily used in small projects such as urban brownstones or suburban housing. As the load exerted on the building increases, shear walls must increase in bulk, meaning skyscrapers would need considerably large walls. Because of this, for tall buildings, this system is only used in conjunction with other supporting systems.

Steel Frame

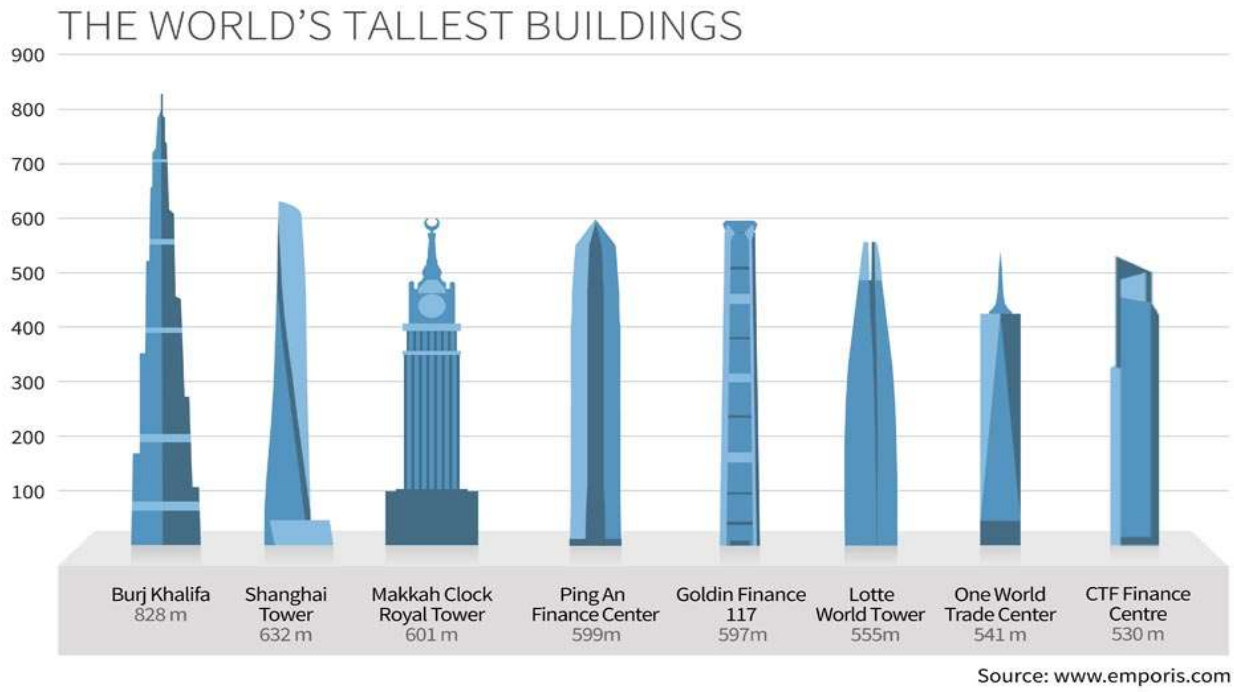
When one thinks of a skyscraper, the steel frame design comes to mind. This design is characterized by a large steel box, containing smaller steel boxes inside. This 3D grid is simple and efficient for most low-rises, but has its' drawbacks for high-rise structures. As the building's height increases, the space between steel beams must decrease to compensate for the extra weight, resulting in less office space and the need for more material.

Tube Frame

The tube design is a recent innovation used to maximize floor space and increase resistance to lateral force in any direction. The buildings skin (outside) consists of closely aligned supporting columns. This design only leaves about one-half of the building's exterior left for windows. Depending on the designer's outlook, this can be an advantage or disadvantage. The decreased window space helps those who suffer acrophobia (a fear of heights) comfortably occupy the space; however, it decreases the visibility and openness offered by other designs. The tube frame design was made popular by the World Trade Centres, whose ultimate failure, some believe was due to the tube frame design.

Concrete Core

This is the most common design for modern skyscrapers as it is fast to build and provides a strong centre. All the utilities, elevators, and stairwells are centralized in this design, making it easier for building modifications and repair. This design can be dangerous. If a part of the core is damaged, everything above that section will be cut off from ground access. This happened in the WTC during the September 11, 2001 terrorist attacks, making it impossible for many people to escape the burning towers. [8]



The highest skyscrapers in the world (9)

Lesson 9

Bridges

A bridge is a structure built to span a physical obstacle (such as a body of water, valley, road, or rail) without blocking the way underneath. It is constructed for the purpose of providing passage over the obstacle, which is usually something that is otherwise difficult or impossible to cross.

Even before any actual construction is done, substantial work may needed in the form of tests. Boreholes will be made to check the condition of the ground, in conjunction with any available geological maps. Records of wind speed and direction will be consulted, and new measurements made if necessary. In the case of a river or sea crossing, records of water levels and velocities will be needed. Models of the bridge or of parts may be tested aerodynamically and hydro-dynamically, and of course mechanical tests will be made. Computer simulations will supplement these tests, enabling a great variety of applied forces to be investigated. There may also be investigations into the effects on people and on the natural environment.

Excavation for foundations may have to be taken to great depths, through unsuitable ground, often below water level, before solid rock is reached. Keeping out water and preventing diggings from collapsing can require major feats of engineering in themselves.

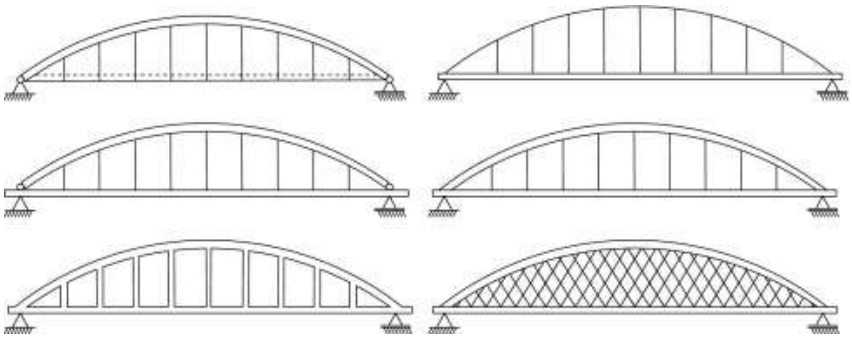
Above ground, until spans are joined, wind can be a great hazard. Before the Pont du Normandie was completed, there was serious discussion about the use of active stabilisers to keep the long thin cantilevers in place. The pillars of the towers of big suspension bridges may have to be stabilized by temporary cables until they are completed and joined at the top.

Some very large arches have been built by treating the halves as cantilevers until they meet in the middle. Whether or not this method is used, joining the parts of any big structure is a very serious matter. The stresses in the separate parts are different from those that will apply in the complete system. If the parts are just left to rest against each other, or joined as they meet, the resulting stresses may be far from those that are required. Some form of jacking will often be required.

Furthermore, the temperature and wind may make life difficult for the builders. There have been occasions when heaters or ice-packs have been used.

The main types of bridges are:

- arches
- beam bridges
- cable-stayed bridges
- cantilever bridges and
- suspension bridges.



Some examples of arch bridge designs (10)

EXERCISES:

Fill in the gaps with the appropriate words given below:

Viaducts - Viaduct vs Bridge

A frequent point of ..... are viaducts; what are they and how are they different from bridges? All viaducts are bridges, and yet not all bridges are viaducts. The ..... lies in their primary use, position and construction.

A viaduct usually refers to long bridges or series of bridges connected to one another by arch bridge structures that carries a road or a railway across a valley or a .....Viaducts mainly connect two points of the terrain which are similar in ..... in order to carry mostly rail and road traffic. They are built over gorges, canyons, valleys and sometimes water. Unlike more complex and ..... construction of bridges, viaducts consist of the main carrying surface which is supported by arches of equal spans mostly built of stone or concrete.

Bridges, on the other hand, are usually built over bodies of water. They are much larger and more expensive to build using different materials such as stone, concrete, and steel.

No other high bridge in history caught the eye of the …… more than the opening of the Millau Viaduct in 2004. Comprised of 8 ……. cable stayed spans totalling 2460 m, the viaduct is the tallest bridge structure in the world with a pier and …….. rising 335 m above the ground. With a …… 277 m above the Tarn River, it is also the highest cable stayed bridge in the world, a record it retained until 2012 when Mexico's Baluarte bridge opened. The bridge has rightfully been described as beautiful, breath-taking, spectacular and ..... [9.1]

(consecutive, gorge, media awe-inspiring, confusion, roadway, height, difference, diversified, mast)

Lesson 10

Green Building

A design that is green is one that minimizes the negative human impacts on the natural surroundings. It endorses the belief that humankind can exist, multiply, build, and prosper in harmony with nature without inflicting irreversible damage to the long-term habitability of the planet.

Green building (also known as green construction or sustainable building) refers to both a structure and the application of processes that are environmentally responsible and resource efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition.

Energy efficiency

Green buildings often include measures to reduce energy consumption – both the embodied energy required to extract, process, transport and install building materials and operating energy to provide services such as heating and power for equipment.

Water efficiency

Reducing water consumption and protecting water quality are key objectives in sustainable building. One critical issue of water consumption is that in many areas, the demands on the supplying aquifer exceed its ability to replenish itself.

Materials efficiency

Building materials typically considered to be 'green' include lumber from forests that have been certified to a third-party forest standard, rapidly renewable plant materials like bamboo and straw, recycled stone,and recycled metal that are non-toxic, reusable, renewable, and/or recyclable.

Elements of modern green building include:

- Leed technologies and best practices in developing a property
- energy-efficient use of construction materials and building resources
- use of low-carbon steel and concrete
- replacing gas-fired boilers with electric (and renewable) HVAC systems, heat pumps, etc...
- energy-efficient appliances and windows, and water-saving appliances (such as Energy Star products)
- quality insulation
- cool roofs
- rainwater collection systems
- solar PV on the property.

Some reasons to consider designing a green building:

- to protect the earth's resources and life in general
- to lower construction costs.
- to increase productivity [10]

TEXTS FOR FURTHER STUDY

Universities lead the way

Stanford University is a school with a history of environmental awareness. But lately this awareness is translating into action, influencing the construction of academic buildings, dorms, and handling food waste. New faculty members are hired for such positions as sustainable food coordinator. There are new environmental teaching programs and research underway. Here's a few examples of how the school is embracing the green life.

The new Jerry Yang and Akiko Yamazaki Environment and Energy Building, nicknamed Y2E2, consumes 57 percent less energy than a traditional equivalent. It includes four atria providing natural light and a system monitoring indoor and outdoor air temperature, telling the windows to open and close to naturally cool the building.

Jonas Ketterle, a senior mechanical engineering major, is leading the development of a green dorm, which will serve as a lab for energy-conscious living. Researchers will collect data on the dorm's environmental effects, and energy-consumption meters will allow each resident to track his or her usage.

The school's Arbuckle and Cool cafés now offer compost bins, and the dorm eateries supervised by Stanford Dining Services will offer bins starting soon. Although there were problems in the past with diners sorting their trash, sustainable foods coordinator Erin Gaines thinks the problems can be resolved through proper education and labelling and by switching many of the items to compostables.

The university offers a number of incentive programs to encourage employees to use alternative transportation. For example, every day a staffer uses alternative transportation they can submit an entry for a bimonthly prize drawing. The programs appear to be working: the percentage of employees who drive to work has dropped from 72 percent in 2002 to 52 percent in 2007.

In 2004, the school launched the Initiative on the Environment and Sustainability with the central goal of promoting environmental sustainability and helping societies learn to meet their resource demands without undermining the ability of the planet to provide for future generations. The university has introduced a number of interdisciplinary environmental learning programs, including Earth Systems, an interdisciplinary graduate program in environment and resources.

Stanford is hardly alone as an environmentally ambitious school. To date, 486 colleges and universities have signed the fast-growing Presidents Climate Commitment to set climate neutral targets and integrate sustainability into their curriculums. Such indicators of environmental awareness and stewardship on college campuses are an encouraging sign, suggesting that up-and-coming generations will have the knowledge and understanding to tackle the climate-related problems we will face in the future. [11]

It's Easy Being Green: Modern Hanging Gardens

If you've ever been downtown in a big city on a summer day, then you've probably experienced the "urban heat island effect." "Urban forests" overgrown with asphalt and concrete soak up sunlight throughout the day and then release it slowly at night, resulting in hotter urban temperatures.

One study at NASA reported that man-made surfaces (rooftops, parking lots, buildings) can be 68° to 104° F hotter than a vegetated area after basking in the sun. Leaves and grasses, on the other hand, actually cool the air through a process called evapotranspiration. The EPA estimates that the annual air temperature of a city with 1 million people or more can be 1.8° to 5.4°F warmer than its surroundings, and in the evening the difference can be as high as 22°F. These conditions lead to increasing air conditioning costs, heat-related illness and mortality, and air pollution.

The good news is that there is a solution to this problem that offers benefits beyond cooling off a city. Earthen or "green" roofs can reduce the urban heat island effect by removing heat from the air. By absorbing heat and increasing insulation, they lower a building's energy use and costs by reducing energy needed for heating and cooling. They also alleviate the strain on drain and sewer systems by reducing immediate water runoff, and clean the air by removing pollution and sequestering carbon. Not to mention they offer green space for city dwellers and many species, as well as a place to grow local produce.

A green roof is essentially a vegetative layer grown on a rooftop. The two most common types of green roofs, extensive and intensive, have to do with the amount of soil installed on the roof.

"Extensive" green roofs are more suitable for residential buildings and typically cost anywhere from $8 to $20 per square foot to install. They often have one to six inches of soil. These roofs require very little maintenance (intermittent watering and weeding), cost less, and can withstand most types of weather because the plants are small, hardy, and drought-resistant.

"Intensive" green roofs are more likely to be found on large, flat-roofed buildings that can support the intense weight. They typically have a soil depth of six inches to two feet (or more), which increases the roof's weight. This style can support a wider variety of plants, including shrubs, flowers, and even trees. They will typically cost anywhere from $15 to $25 per square foot to install, but require more maintenance due to the required care of a wider variety of plants.

Green roofs are growing in popularity and are found in all shapes and sizes around the world. The spectrum ranges from farmhouses with goats grazing on rooftop grass to fertile gardens set atop urban skyscrapers. Given their adaptability to several different kinds of roofs, schools, businesses, and even governments are able to install them.

The Calhoun School in New York City, for example, created a semi-intensive green roof which reduces storm water runoff by up to 40 percent throughout the year. It also provides a space for students to learn about gardening, astronomy, geometry, poetry, and meteorology. The school has effectively turned unused space into a learning centre that enriches the entire school curriculum.

The City of Chicago turned its City Hall into a green roof space in 2001, which now hosts 100 species of plants. It provides habitat for insects and birds, as well as an eye-pleasing view to the buildings that surround it. So far, studies have concluded that the new green roof has decreased

ambient air temperature by 78°F when compared to the previous black tar roof.

Installing a green roof is one more solution to climate problems that has a long list of great benefits. It can save money, make homes and cities more beautiful, and provide a habitat for wildlife while simultaneously transforming our urban landscapes and cleaning up our shared environment for future generations. Green roof installation, along with retrofitting buildings, is also an industry that could create jobs as part of a green recovery program focused on moving toward a low-carbon economy. [12]

Smart Buildings for Future Skylines

Hiding within the halls of homes and office buildings around the United States exists the largest opportunity for energy savings to date. Commercial and industrial buildings account for as much as 50 percent of U.S. energy use, and residential buildings account for another 20 percent, meaning that there are countless ways for them to be more efficient. Many Americans have taken steps to go green in their homes, but office buildings still have a long way to go.

Office buildings, particularly in cities that have passed laws that mandate energy savings goals, have made great strides in using green building technologies such as lighting, roofing, and insulation. While these buildings have made vast improvements in how they're built, they haven't improved in how they communicate with other buildings or the power grid that supplies energy to the region.

By coordinating efforts, buildings can become more efficient by automating energy saving techniques. "The sad truth is that many green buildings today are neither highly efficient nor particularly intelligent, and this is a missed opportunity," wrote Paul Ehrlich of the Building Intelligence Group in an article discussing the results of an energy conference held in early 2008.

Many offices in the United States have made progress. They've added improvements like bicycle racks, more efficient lighting, and water-saving plumbing equipment. But the next step, according to Ehrlich, is making sure that these innovations connect with one another. Green buildings not only employ physical innovations such as green roofs, but also, Ehrlich notes, "[…] the systems, controls, and automation needed to provide improved scheduling, coordination, optimization and usability."

Green building, up to this point, has been primarily about materials. While using eco-friendly building supplies helps improve the overall energy footprint for the building, these efforts can prove inadequate if not matched with efficiency management equipment. To combat this pitfall, the Energy Independence and Security Act of 2007 provides a framework for "net zero" energy buildings. These buildings, according to Jack McGowan at the U.S. Department of Energy, enshrine the idea that "buildings can give and take energy - that's where the opportunity presents itself." His vision, McGowan states, "is having the smart building meet the smart grid."

Smart grids, or digitally redesigned power grids, are being implemented in cities and rural communities across the United States. Smart girds use new efficiency methods that prioritize the needs of different buildings in order to decrease the overall demand on the energy

delivery system. By coordinating energy use throughout a region, they also have the ability to decrease strain on the system that often leads to devastating blackouts. According to a 2008 report by the Department of Energy, had a smart grid system been in place during the Northeast blackout of 2003, it could have saved almost $6 billion in economic loss to the region. That same report notes that if the smart gird made the United States grid system just 5 percent more efficient, it would mean decreases in greenhouse gasses equivalent to taking 53 million cars off the road.

While green building in the United States is making progress, innovation and automation are lacking. Smart buildings have the capacity to automate power-saving methods throughout an entire region by connecting with the smart grid. By automating lights and temperature controls, for example during the warmer months of summer, the smart grid can shift air conditioning to buildings that need it more than others, allowing not only lower energy consumption and cost for individual buildings, but also less strain on the entire system. By implementing regional control of energy use through the use of smart buildings - and the smart grid - the United States can take the lead in managing one of the most efficient and secure power systems of the 21st century. [13]

Vision of South Koreans urban future (11)

Designing homes with Feng Shui

Feng Shui is a topic that rarely enters contemporary architectural discourse although many Architects have Clients who consider the principles of Feng Shui as important to their project in one way or another.

So what is Feng Shui after all? To put it simply, it aims to align earth and life with the cosmos in order to receive positive energy. The Feng Shui method of organisation covers all aspects of living and working spaces, from interiors, bedrooms, bathrooms and kitchens, to gardens and outdoor living spaces. The fundamental aspects of Feng Shui are simple and rational, and can be applied very easily to planning a home or workspace. In the most part they are common sense principles most Architects would adhere to in a general sense, particularly the principles relating to cross ventilation, light and generosity of space.

Feng Shui Principles
The basic principles of Feng Shui are to design spaces which permit the clear, unobstructed flow of warm and harmonious energy. High ceilings and generous spaces that are well-lit with good air flow and lighting are great foundations for a Feng Shui home.

Entrance to the Home
The main pedestrian entrance into a home should be easily accessible from the road and be the most prominent entrance to the home in order to welcome the most positive energy.
A sensitive design approach to entry paths, gates, intercoms, property numbers, letterboxes, planting and lighting can provide a sense of priority over the vehicular entry to the site. Unfortunately, these elements are mostly neglected in the average home where an architect is not involved.

Kitchen
The kitchen is central to nourishment and sustenance. It is important not to have the kitchen too close to the entrance or the back door as it allows energy to easily escape. Position water elements (sinks, dishwashers) separate to fire elements (stove/oven).
In addition to these principles the kitchen should be the command centre of the social spaces of the home (living, dining, and outdoor living) allowing families to interact during meal preparation time.

Bedroom
Getting good quality sleep is crucial to your wellbeing. The principles of Feng Shui suggest good access to natural light and cross ventilation as well as a solid timber bed as opposed to a metal bed are important. Avoid televisions, visible exercise equipment and loud colours in the bedroom to ensure that sleeping spaces are harmonious and relaxing
Brightly painted walls in children's bedrooms are quite patronising. Letting children explore their senses and experience sunlight, breezes, shrubs and trees, bugs and birds outside their bedroom windows without the distraction of bright patterns and wall colours allows your child to experience the world more deeply when they are in that calm (yet very short) moment when they wake, fall asleep or daydream during playtime in these spaces. [14]

Living Room

The living room should be a sanctuary that retains the most energy, and thus is best located centrally to the home. Feng Shui principles suggest orientation of furniture in south and west corners, and avoidance of furniture at the north and east sectors.

Obviously these principles are a little rigid but they do make sense in terms of having furniture face the direction of the sun. Most Living spaces will connect with outdoor gardens, lawns and courtyards to ensure this most utilised space of the home enjoys great sunlight all year round so it makes sense that furniture also connects with these indoor outdoor spaces by facing the direction of the sun.

Bathroom

The bathroom should be located away from central areas like the kitchen and living areas, as the energies of these spaces are incompatible.

Feng Shui specialists claim that following these basic principles can have a significant impact on your everyday life. Principles such as avoiding cramped rooms with little light, awkward unused spaces and lengthy corridors (which rush energy through your home according to Feng Shui) are common sense to most good Architects. What these principles are really based on is not so different to the thought process a good Architect has in terms of seeking positive outcomes for their Client when a project is on their drawing board – listening to your instincts, connecting both material and space with the landscape and nature, designing spaces that will make your Clients feel the most comfortable…these are perhaps the most universal principles of good architecture. [13]

Feng Shui House in Singapore by ONG & ONG (12)

Iconic Legends: The 10 Greatest Modern Architects of Our Time

Frank Gehry (1929)

There is no mistaking Gehry's works, as they are the most distinctive, and innovative architectural phenomena around. His deconstructive forms are iconic as tourists flock to all of his buildings worldwide to marvel at the architectural forms he creates. Named by Vanity Fair as "the most important architect of our age", he has set the precedence for contemporary architecture. His ability to create spaces that manipulate forms and surfaces is his most notable feats and we all love his unique uses of materials that almost defy all logic in how they work together. His most notable projects include: The Walt Disney Concert Hall in Los Angeles, The Guggenheim Museum in Bilbao, Der Neue Zollhof in Düsseldorf and the Marqués de Riscal Vineyard Hotel in Elciego.

Frank Lloyd Wright (1867 - 1959)

Some consider Frank Lloyd Wright to be the greatest architect of all time. For he thought of interior & exterior spaces as one and was ahead of his time in building forms, construction methods, and never went to a formal architecture school. His humble American upbringing led him to learning under Louis Sullivan – another legend in architecture and to this day Wright is noted for his prairie-style buildings and organic influences. His organic and natural forms that seemed to become one with nature and his innovative detailing are still considered to be the best building and design concepts, even after nearly 150 years. His most notable projects include: The Guggenheim Museum in New York City, New York, Fallingwater Residence in Mill Run, Pennsylvania, Arizona State University Gammage Auditorium & Taliesin West – Wright's home and studio in Scottsdale, Arizona.

Ieoh Ming Pei (1917 - 2014)

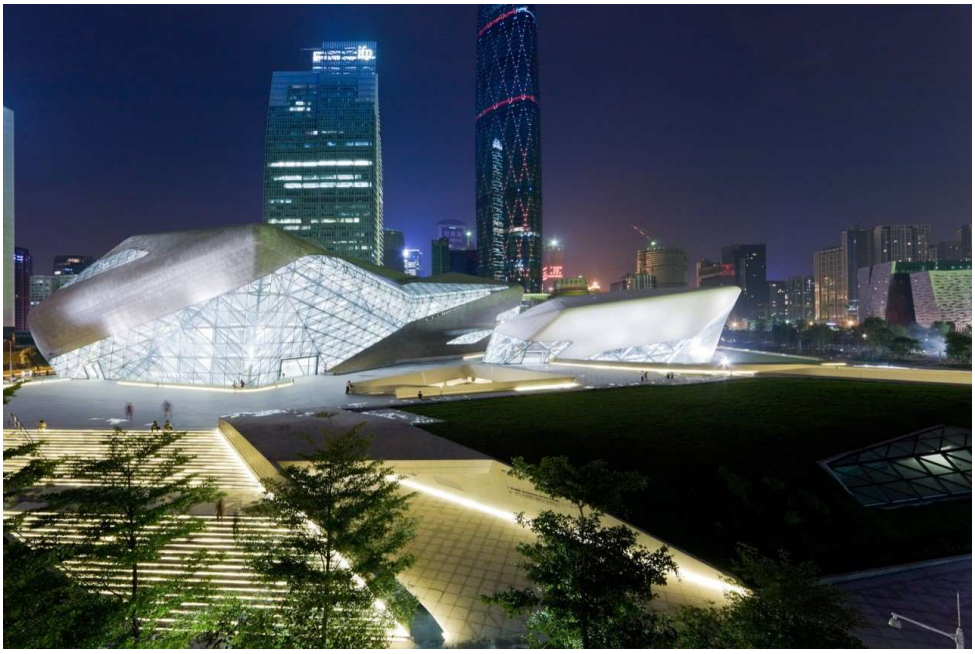
The Chinese born architect came to study architecture in the United States as a teenager and later became one of the greatest architects of modern architecture. Almost 80 years later I.M. Pei's work can be seen worldwide and are noted for their unique use of geometric forms and incorporating Chinese influences into his work. His National Center for Atmospheric Research in Colorado embodies Pei's iconic geometric forms and unity with natural elements in their surroundings. Pei's work graces some of the most prestigious government and acclaimed sites throughout the world. His most profound projects include: John F. Kennedy Presidential Library and Museum in Boston, The National Gallery of Art in Washington D.C., Le Grand Louvre (The Pyramid) in Paris, The Bank of China Tower in Hong Kong and the Museum of Islamic Art in Doha.

Zaha Hadid (1950 - 2016)

The first woman architect who ever won the Pritzker Architecture prize went to the legendary Zaha Hadid. Born in Iraq Hadid went on to win this iconic award which is often termed the 'Nobel peace prize of architecture'.Hadid's forms are characterized as futuristic, unconventional, daring and artistic. Many of her projects were never built and she still was

ranked on Forbes list at 69th most powerful women in 2008. Her beautiful buildings always leave us with our mouths open, as if to say, "How did she design that?"

Her most noted projects are: MAXXI - the National Museum of the 21st Century Arts the Bridge Pavilion in Zaragoza, Bergisel Ski Jump in Innsbruck, Phaeno Science Center and the Opera House in Guangzhou.



Opera House in Guangzhou by Zaha Hadid (13)

Philip Johnson (1906 - 2005)

Noted as the American architect who founded the Department of Architecture and Design at the Museum of Modern Art in New York City, Johnson's architectural works are easily identifiable. His Glass house in Connecticut is one of the most familiar residences with its minimal interiors and expansive glass vistas were just one example of his use of the material. His amazing use of glass, steel and later crystal became his world-renowned fame. The Crystal Cathedral in California looks as though it should be in a child's fairytale book it is the epitome of forward-thinking architecture that characterized Johnson's Minimalism and Pop-Art styles. His most notable works are the Seagram Building in New York City, in collaboration with architect, Mies van der Rohe, Philip-Johnson-House in Berlin, Germany, The Museum of Television of Radio & The Crystal Cathedral in California.

Tom Wright (1957)

Is it possible to become one of the greatest modern architects of our time if you are only noted for one building? When the building is the most recognizable hotel in Dubai, yes. British architect, Tom Wright is responsible for the Burj Al Arab in Dubai. Acclaimed for its luxurious amenities as a hotel and also one of the most recognizable buildings in modern architecture. Noted with the world's tallest atrium, and equipped with its own helicopter landing pad and tallest tennis court at the top, Tom Wright definitely deserves to join the list of great modern architects.

Burj al Arab, by Tom Wright (14)

Renzo Piano (1937)

The Italian born architect was named one of Time magazine's top 100 most influential people in 2008. Piano who is an Italian Pritzker prize-winning architect has been instrumental in shaping modern architecture that stands on its own in recognition. The Shard – Europe's tallest skyscraper in London has faced much controversy in its construction, but many feel it has given London a way to join the 21st century. In his younger years he worked with the world-renowned architect Louis Kahn and soon become known for his unique applications of materials and details. Piano's most notable projects include: The newly opened Shard in London, England, NEMO Science Center in Amsterdam, The New York Times building in New York, and Kansai International Airport in Osaka, Japan.

Jean Nouvel (1945)

Nouvel is a French born architect who has won numerous prestigious awards and honors over the years for his projects, including the Prtizker Prize in 2008. Nouvel's most acclaimed fame came from winning the design competition for the Arab World Institute in Paris that brought him international fame. Mechanical lenses in the south wall open & shut automatically and are reminiscent of Arabic latticework. The devices control interior lighting automatically from exterior light levels. Nouvel's work is known worldwide and his use of innovative architectural concepts set him apart from many modern architects today. Nouvel's projects of note include: Arab World Institute in Paris, Denstu Building in Tokyo, Ziaty Andel in Prague, and Gasometer A in Vienna and Les Grandes Tables of Seguin Island in Paris. [15]

Do your own research

Nemo Science Museum in Amsterdam, by R. Piano (5)

Millenium redisence, by T. Wright (16)

Chrystal Cathedral, by P. Johnson (17)

Zaragoza Bridge Pavillion, by Z. Hadid (18)

Have fun with Architecture
Quiz Pages

Architecture Quiz I

1. Which English architect is best known for rebuilding the Houses of Parliament?
2. London's Shard was designed by which architect?
3. The three classical orders of classical architecture are Ionic, Corinthian, and which other order?
4. The Cenotaph war memorial on Whitehall was designed by which architect?
5. Which Danish architecture designed Sydney Opera House?
6. Which prize is considered to be the most prestigious architecture award in the United Kingdom?
7. Name the world famous house in rural Pennsylvania designed by architect Frank Lloyd Wright?
8. Which building is regarded by most as the best example of Mughal architecture?
9. Which steel suspension bridge crossing the River Thames was nicknamed the 'Wobbly Bridge' by Londoners?
10. What name is given to the wedge-shaped stone piece at the apex of a masonry arch?
11. The Chrysler Building is a New York skyscraper designed in which style?
12. What's the name of the historic circle of townhouses in the city of Bath, completed in 1768, which are a preeminent example of Georgian architecture?
13. Which world capital city was chosen as a UNESCO World Heritage Site due to its modernist architecture?
14. Archibald Leitch was a Scottish architect most famous for his work in designing which type of buildings?
15. Who was the first architect to introduce the classical architecture of Rome and the Italian Renaissance to Britain?

Answers:

1. Sir Charles Barry
2. Renzo Piano
3. Doric
4. Sir Edwin Landseer Lutyens
5. Jørn Utzon
6. The Stirling Prize
7. Fallingwater
8. Taj Mahal
9. London Millennium Footbridge
10. Keystone
11. Art Déco
12. The Circus
13. Brasilia
14. Football stadiums (he designed Anfield, Highbury, Goodison Park, Ibrox, Cardiff Arms Park, White Hart Lane, and many more iconic grounds)
15. Inigo Jones

Architecture Quiz II

1. Sir Clough Williams-Ellis is chiefly known for the creation of which village in North Wales?
2. Sir Basil Spence was a Scottish architect, most notably associated with which building in England?
3. At the time of its opening in 1933, which Sir Giles Scott designed building did *The Observer* newspaper describe as 'one of the finest sights in London'?
4. By what name is 30 St Mary Axe better known by?

5. Can you name the magnum opus of architect Antoni Gaudi?
6. 'Reader, if you seek his memorial - look around you' is an epitaph to which architect?
7. Frederick Gibberd, was the winner of a worldwide design competition to build Liverpool's Metropolitan Cathedral - what is this building's best known nickname?
8. For which 'no more' London building is Joseph Paxton chiefly noted?
9. What architectural term is given to an anteroom or small foyer leading into a lobby or entrance hall?
10. Which architect was made a Dame by Elizabeth II in 2012, for services to architecture?
11. Wo's best-known works include the Guggenheim Museum in Bilbao, Spain?
12. An extension to which building was once described by Prince Charles as a 'monstrous carbuncle on the face of a much-loved and elegant friend'?
13. Which neoclassical styled building was the most famous design of Irish-born architect James Hoban?
14. Who designed Marble Arch in 1827?
15. Which architect would you associate with London Heathrow Terminal 5, Lloyd's Building, and the Millennium Dome?

Answers:

1. Portmeirion
2. Coventry Cathedral
3. Battersea Power Station
4. The Gherkin (designed by Norman Foster and Arup Group)
5. Sagrada Familia, in Barcelona
6. Sir Christopher Wren (who is burried in St. Paul's Cathedral)
7. Paddy's Wigwam
8. Crystal Palace
9. Vestibule

10. Dame Zaha Hadid
11. Frank Gehry
12. The National Gallery
13. The White House (constructed between 1792 and 1800 using sandstone painted white)
14. John Nash
15. Richard Rogers [16]

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