Outlines of the Presentation

1. What is Engineering Geology?
2. Role of Geology in Civil Engineering
3. Building Stones
4. Characteristics of Building Stones
5. Use of Building Stones
6. Types of Building Stones
7. Stone Finish

What is Engineering Geology

Engineering geology is the application of geological data, techniques and principles to the study of rock and soil surficial materials, and ground water. This is essential for the proper location, planning, design, construction, operation and maintenance of engineering structures. Engineering geology complements environmental geology, or hydrogeology.

Civil engineers design structures that are built on or in the ground. As such an understanding of how the ground behaves is fundamental to civil engineering design. Earth materials can pose significant problems that need to be predicted, planned and designed for.

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Role of Geology in Civil Engineering

Geology is applicable in:

- Foundation engineering - assessment of soil conditions
- Construction materials engineering - quality of stones, lime, cement etc.
- Infrastructure engineering - location of bridges, tunnels, river meandering zones
- Disaster mitigation - seismic resistant structural design, flood control, river training, waterway of bridges
- Land-use engineering - soil erosion control, natural drainage
- Water Resources engineering - hydrogeology (reservoir capacity for e.g.), source and quality of aquifer and water, desilting of reservoirs and navigation channels
- Environmental engineering - ecological balance, solid waste management by landfill
- Economical design in advanced

Role of Geology in Civil Engineering

A Civil Engineer should be able to address the following issues.

1. Where to site a civil engineering facility or industrial plant being geological secure and economically feasible.
2. How to avoid unfavourable geological conditions.
3. How to design foundations under acceptable geological and geotechnical conditions.
4. How to excavate a slope to be stable and economically feasible.
5. How to excavate a tunnel or underground facility to be stable.
6. Availability of geological materials to built dams, embankments, roads, etc.
7. Ground treatments to prevent or correct seepages, subsidence, settlements, landslides.
8. Under what geological conditions and materials can be stored toxic, urban or radioactive wastes.
9. How to control, prevent or mitigate geological hazards (earthquakes, landslides, etc.)
10. What geologic and geotechnical criteria must be taken into account in land use and urban planning and to mitigate environmental impacts.

Building Stones

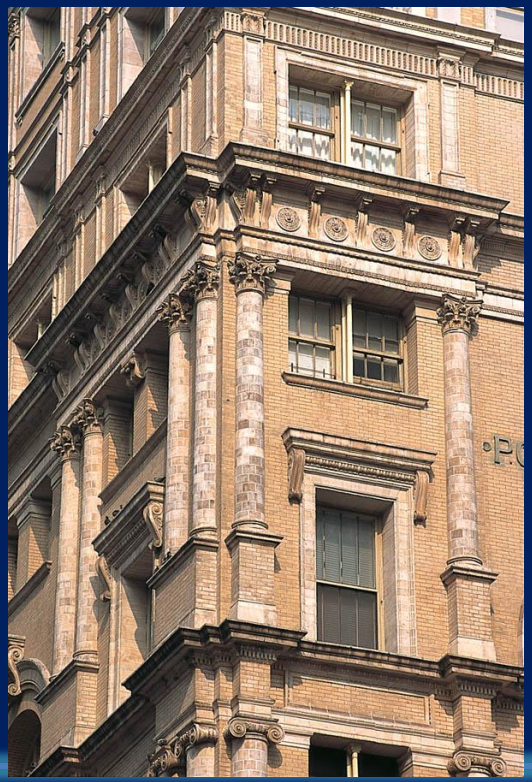
Building stone is rock that is used in the construction of buildings, retaining walls, bridges, and other structures and includes building components such as walls, foundations, sills, chimneys, and steps. The most desirable building stones have a combination of strength; durability; beauty; and ease of quarrying, cutting, and carving.

Characteristics of Building Stones

To qualify as a construction material, stone should have the following qualities:

Strength

Most types of stone have more than adequate compressive strength. The shear strength of stone, however, is usually about 1/10 of its compressive strength.



Characteristics of Building Stones

Hardness

Hardness is important when stone is used for flooring, paving, and stair treads.

Characteristics of Building Stones

Hardness

- ✓ **Talc,** easily scratched with the thumb-nail: **1**
- ✓ **Gypsum,** scratched by the thumb-nail: **2**
- ✓ **Calcite,** not scratched by thumb-nail but easily cut by knife: **3**
- ✓ **Fluorite,** can be cut by knife with greater difficulty than calcite: **4**
- ✓ **Apatite,** can be cut only with difficulty by knife: **5**
- ✓ **Orthoclase,** can be cut w/ knife w/ great difficulty on thin edges: **6**
- ✓ **Quartz,** not scratched by steel, scratches glass: **7**
- ✓ **Topaz:** **8**
- ✓ **Sapphire:** **9**
- ✓ **Diamond:** **10**

Characteristics of Building Stones

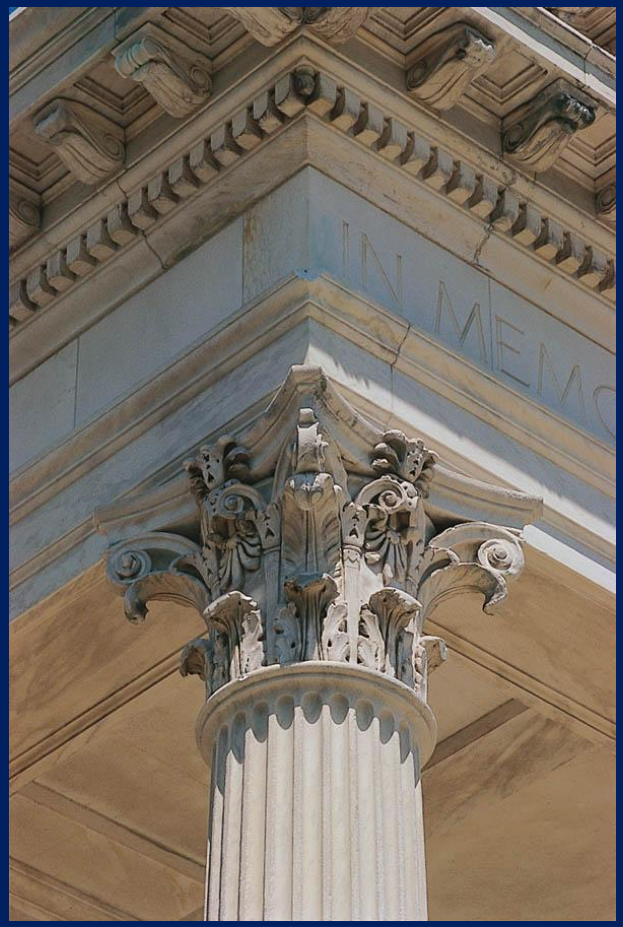
Durability

Exfoliation, hydration, slaking, solution, oxidation & abrasion all lower rock quality. Resistance to the weathering effects of rain, wind, heat, and frost action is necessary for exterior stonework.

Characteristics of Building Stones

Workability

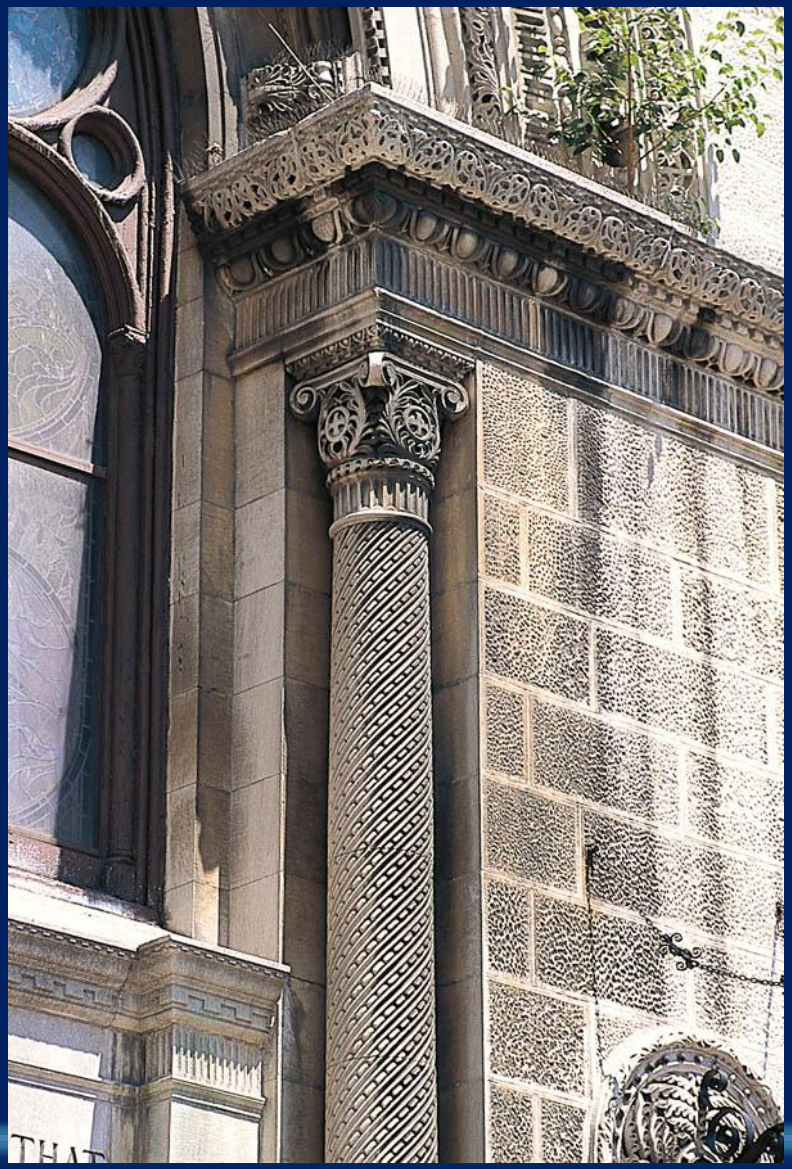
A stone's hardness and grain texture must allow it to be quarried, cut and shaped.



Characteristics of Building Stones

Density

Rocks exhibit a greater range in density than soils. Knowledge of the rock density is important to engineering practice. A concrete aggregate with higher than average density can mean a smaller volume of concrete required for a gravity retaining wall or dam. It is expressed as weight per unit volume.



Characteristics of Building Stones

Porosity

A stone's porosity affects its ability to withstand frost action and staining. Porosity is expressed in percentage as the ratio of volume of voids to the total volume. Typical values for sandstones are around 15%. In Igneous and Metamorphic rocks, a large proportion of the pore space (usually < 1-2%) occurs as planar "fissures".

Characteristics of Building Stones

Permeability

As well as the degree of interconnection between pores / fissures, its variation with change in normal stress assesses the degree of fissuring of a rock. Dense rocks like granite, basalt, schist and crystalline limestone possess very low permeability as lab specimens, but field tests can show significant permeability due to open joints and fractures.

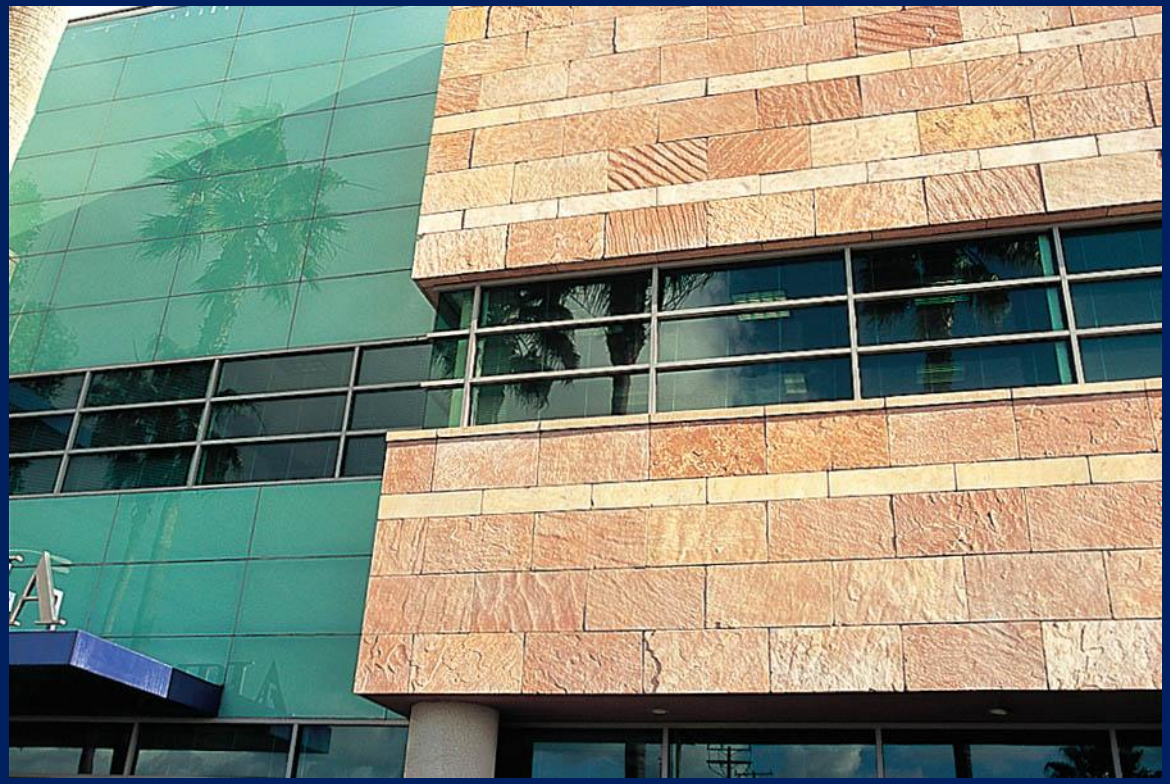
24-hours Water Absorption of Stones by Volume

S.No.	Types of Stone	Water absorption (% not greater than)
1.	Sandstone	10
2.	Limestone	10
3.	Granite	1
4.	Trap	6
5.	Shale	10
6.	Gneiss	1
7.	Slate	1
8.	Quartzite	3

Characteristics of Building Stones

Appearance

Appearance factors include color, grain, and texture.



Use of Building Stones

Stone is used in construction in the following forms:

- ✓ Rubble
- ✓ Dimension stone
- ✓ Flagstone
- ✓ Crushed stone

Use of Building Stones

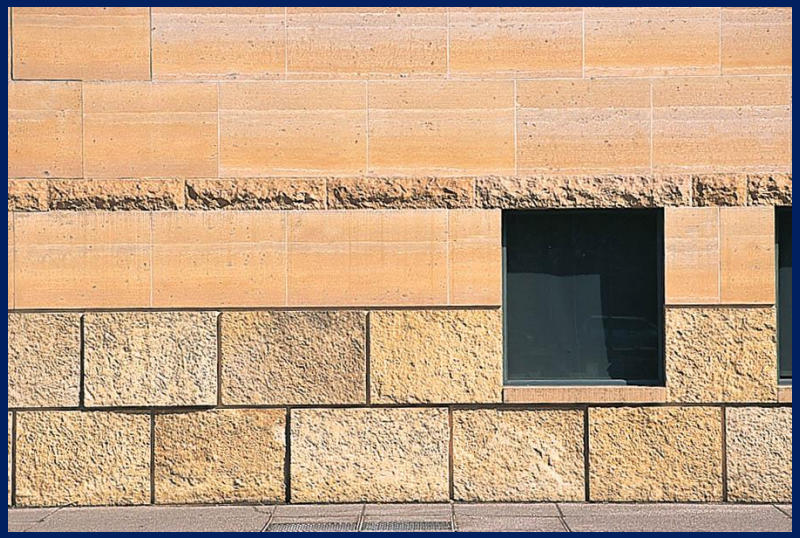
- ✓ Rubble

  Rubble consists of rough fragments of broken stone that have at least one good face for exposure in a wall. It can also be used for a variety of purposes, including rubble stone walls, fill, and stepping stones.

Use of Building Stones

- ✓ Dimension Stone

  Dimension Stone is natural stone or rock that has been selected and fabricated (i.e., trimmed, cut, drilled, ground, or other) to specific sizes or shapes, used commonly for wall panels, cornices, copings, lintels and flooring.



Use of Building Stones

- ✓ Flagstone

  Flagstone refers to flat stone slabs used for flooring and horizontal surfacing.

Use of Building Stones

- ✓ Crushed Stone

  Crushed stone is used as aggregate in concrete products, typically produced by mining a suitable rock deposit and breaking the removed rock down to the desired size using crushers.

Types of Building Stones

Granite

Its of igneous origin, hard, strong, durable and capable of taking high pressure. They can be polished to red, pink, yellow, green, blue, white and brown.

Used for:

- ✓ flooring
- ✓ wall paneling
- ✓ column
- ✓ facing
- ✓ stair treads
- ✓ flagstone

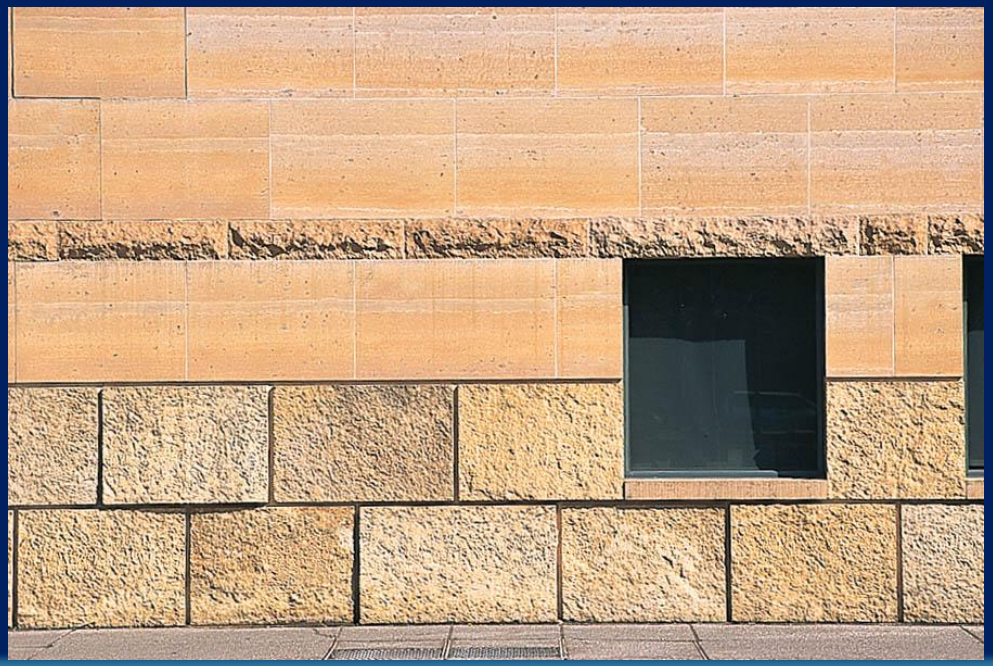
Types of Building Stones

Sandstone

It's a class of rock of cemented silica grains with texture ranging from very fine to very coarse. Colors vary from buff, red and light brown. They are porous, 30% of volume is composed of pores.

Used for:

- ✓ paneling
- ✓ rubblework
- ✓ copings
- ✓ cornices
- ✓ lintels
- ✓ arch stone



Types of Building Stones

Slate

Slate Rock comes from the metamorphosis of clays and shale's deposited in layers. May be separated into thin, tough sheets called slates. Colors are black, green red, grey, or purple.

Used for:

- ✓ flooring
- ✓ window sills
- ✓ stools
- ✓ stair treads & facing

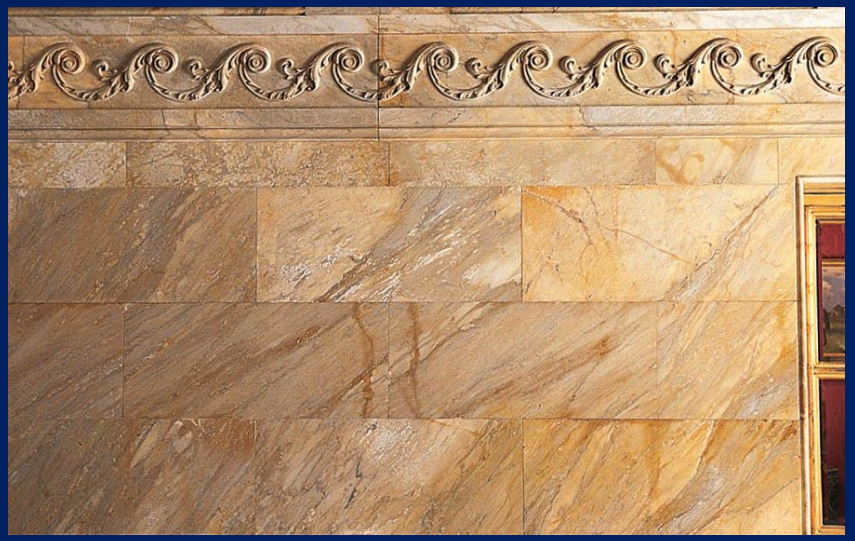
Types of Building Stones

Marble

Marble is a non-foliated metamorphic rock composed of recrystallized carbonate minerals, most commonly calcite or dolomite.

Used for:

- ✓ flooring
- ✓ wall & column facing



Stone Finish

Rusticated

A term describing stone masonry with a recessed cut margin, so a channel is formed when the blocks are aligned.

Stone Finish

Sand Finish

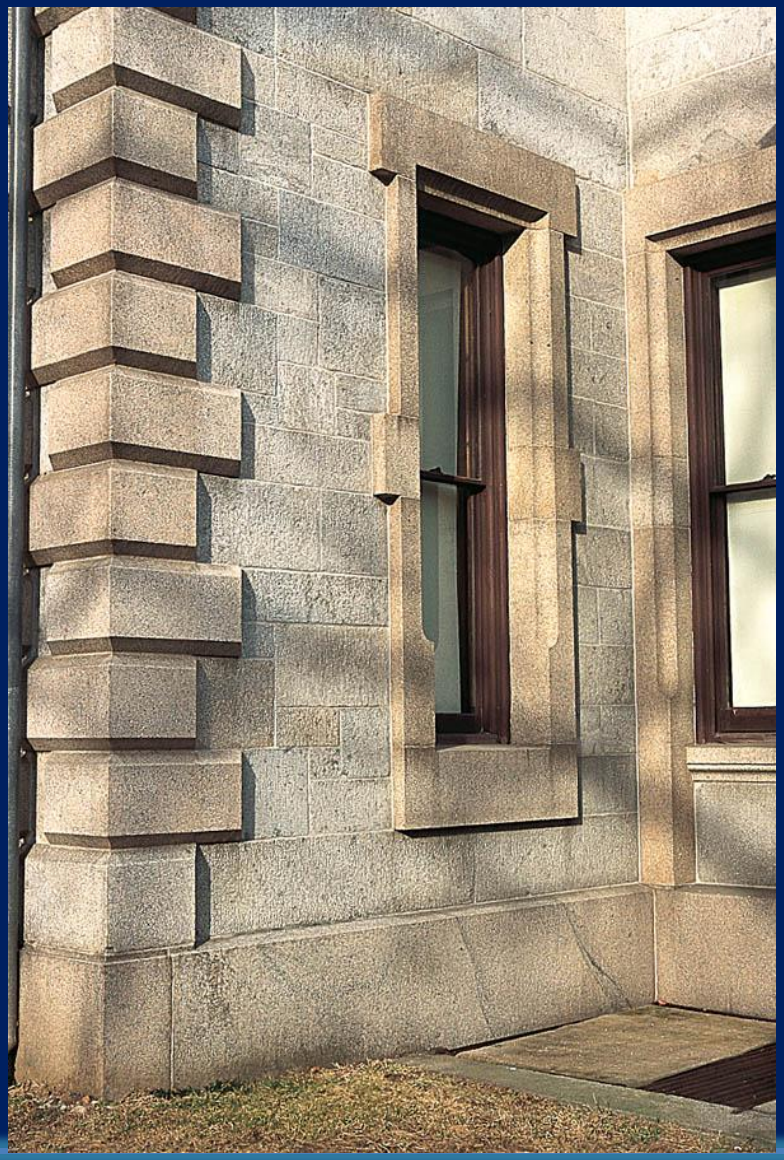
A stone finish that is granular and moderately smooth, varying with the characteristics of the specific stone.

Stone Finish

Saw Face

A stone finish that is granular and moderately smooth, varying with the characteristics of the specific stone.

A term describing stone exhibiting the marks left by the saw used to cut it.



Stone Finish

Rock Face

A stone finish with emphasized face-plane shifts and rough corners, exaggerating the natural look of the stone.

Stone Finish

Split Face

A stone finish exhibiting the natural quarry texture resulting from splitting the stone.