MORTARS

Building mortars are workable pastes made of mixtures of binders, aggregates and water, used to bind different building pieces together in a whole, fill and seal the gaps between them and cover their surface. The mortar composition is designed by the weight of binding material in 1 m^3 of mortar, which is defined as dosage. For mortars composed of one kind of binding material, the composition is expressed as 1:4 = one part (by weight) of binding material and four parts of aggregate.

Mortars can be classified according to their bulk density, kind of binding material, applications and properties.

bulk density:

type	**bulk density (kg/m³)**	**aggregate**
heavy	> 1500	sand
light	< 1500	grounded pumice, slag, etc.

binding material: The governing factors in deciding a particular type of mortar depends on the desired strength, resistance to water, appearance, hardening conditions, cost, etc.

cement mortar is prepared with Portland cement or its varieties, sand and water. Portland cement and blast furnace slag cement form excellent mortars for masonry. Puzzolana cement and sulfate resisting cement form mortar for surfaces exposed to aggressive and waste water.

lime mortar is mixture of fat or hydraulic lime, sand and water. Fat lime has high calcium oxide content. Its hardening depends on loss of water and absorption of carbon dioxide from the atmosphere. Lime mortar is not suitable for water-logged areas and damp situations.

gypsum mortar is prepared with plaster of Paris or anhydrite.

mud mortar is prepared with clay. This is the cheapest type of mortar prepared with locally available ingredients. To improve resistance to rain water, the surface of placed mortar can be sprayed with bituminous materials.

composite mortar may contain surkhi-lime-water, lime-surkhi-sand-water, cement-lime-water or cement-clay-water. Lime-cement mortar has increased water retentivity, workability, better bonding properties and frost resistance.

The main properties of hardened mortar are strength, development of good bond with other products, porosity, resistance to weathering, cost, durability, appearance and for green mortar mixes, mobility, placability and setting.

Strength: Strength of hardened mortar depends on the activity of binding material, the amount of water and the quality of aggregate. Strong cement mortars are most likely to lead to shrinkage cracks, on the other hand, the use of much ben her hafta ders notlarının arasına saklanmış weaker mortar (e.g. 1:10 cement mortar) is not satisfactory since reduction in cement content leads to less workability, less cohesion and will produce porous joints of low frost resistance.

- The density and strength of mortars decrease as the proportion of fine aggregate is increased.
- It requires about twice as much cement to produce a mortar of given strength when fine sand is used as it does with coarse sand.
- When the percentage of mixing water is increased beyond that required to form a placeable mix, the density and strength of mortar reduces.

Functions of Ingredients:

Binding materials (cement, lime, gypsum and clay) are used to impart adhesive power and strength.

Sand increases the compressive strength of mortar and reduces shrinkage. When used in lime mortar, it assists the hardening of fat lime by allowing air to penetrate providing carbon dioxide for carbonization. **Surkhi** is used for economy and for furnishing hydraulic properties to lime mortar. **Flyash** is used as fine aggregate.

Water in mortar lubricates the surface of aggregate, spreads the binding material uniformly so that it can fill the pores in the fine aggregate and cause hydration.

sand (m^3)	cement (kg)	water (l)	where to use
1	200 250	110 120	masonry exposed to light weights
1	300 350 400	130 140 150	masonry exposed to air or fresh water
1	450 500	160 170	masonry exposed to severe conditions
1	600 1200	200 400	floors

Grout: Cement mortar of fluid consistency used to fill the voids and joints in masonry and to repair the cracks is known as grout. Grout differs from mortar in its fluidity as it is to be poured. It is essentially composed of cement, fine and coarse sand, water and a small amount of grouting admixture.

STONES

Rock is a natural substance, a solid aggregate of one or more minerals or mineraloids with a definite chemical composition, forming a portion of earth's crust. Being aggregations of minerals, the properties of rocks are dependent upon the character of these constituents, identified by their physical properties. Stone has been defined as the natural, hard substance formed from minerals and earth material which are present in rocks.

A mineral is a naturally occurring chemical compound, usually of crystalline form. A mineral has one specific chemical composition, whereas a rock can be an aggregate of different minerals. There are over 5300 known mineral species. Some of the most important minerals are given in the third, fourth and fifth pages.

Some minerals feature great strength, hardness and resistance to chemical attack (quartz); others have poor strength and readily soak in water (gypsum); some minerals display a great tendency to cleavage and split readily along one or several directions (mica), thus decreasing the strength of the rock they make up. Some of the important properties of minerals are as follows:

hardness is probably the most important property for rapid determination of minerals. It is measured by scratching the mineral with a series of substances of known variation in hardness using the following scale of Mohs:

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 with knife with great difficulty on thin edges	6
quartz	not scratched by steel, scratches glass	7
topaz		8
sapphire		9
diamond		10