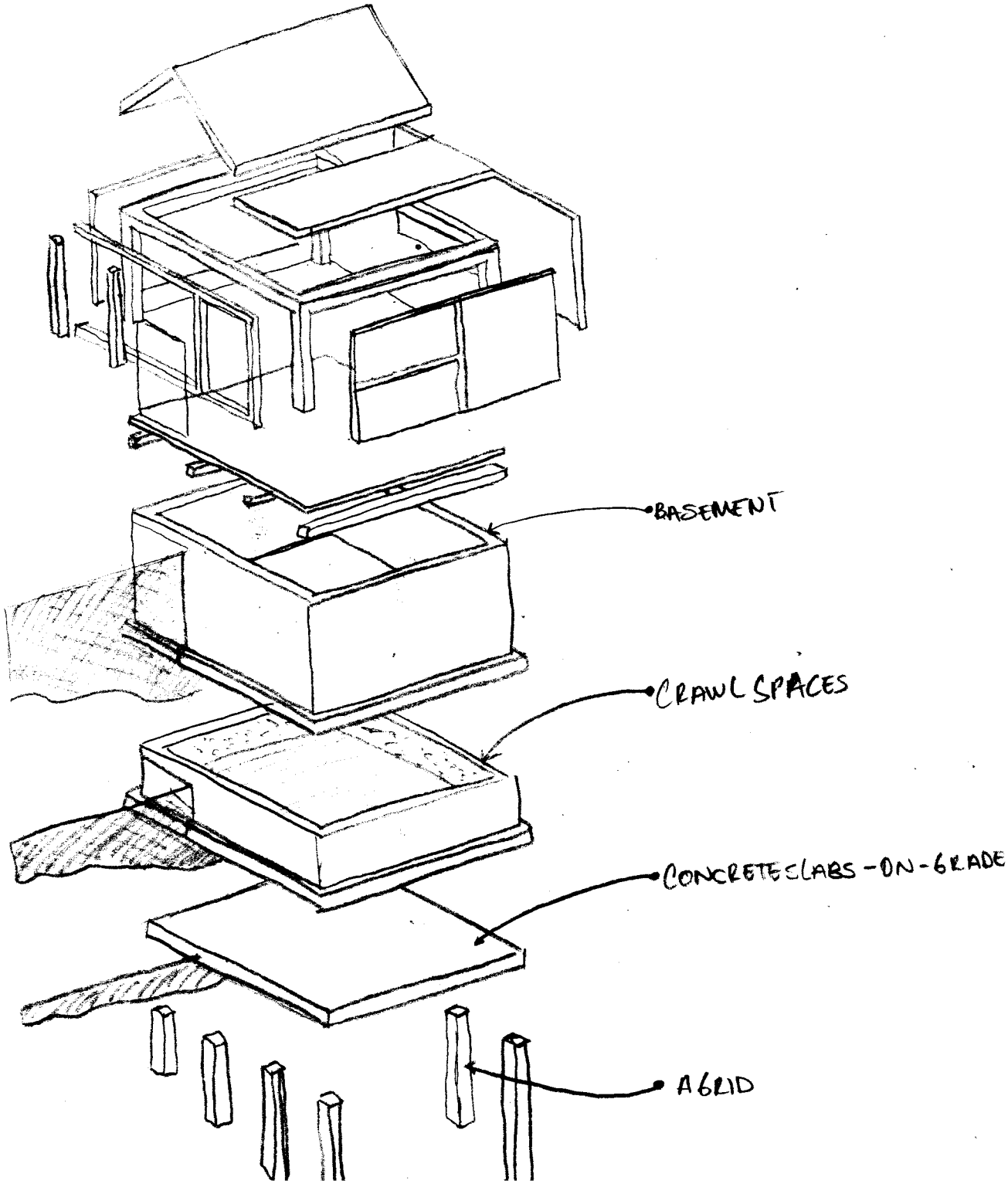
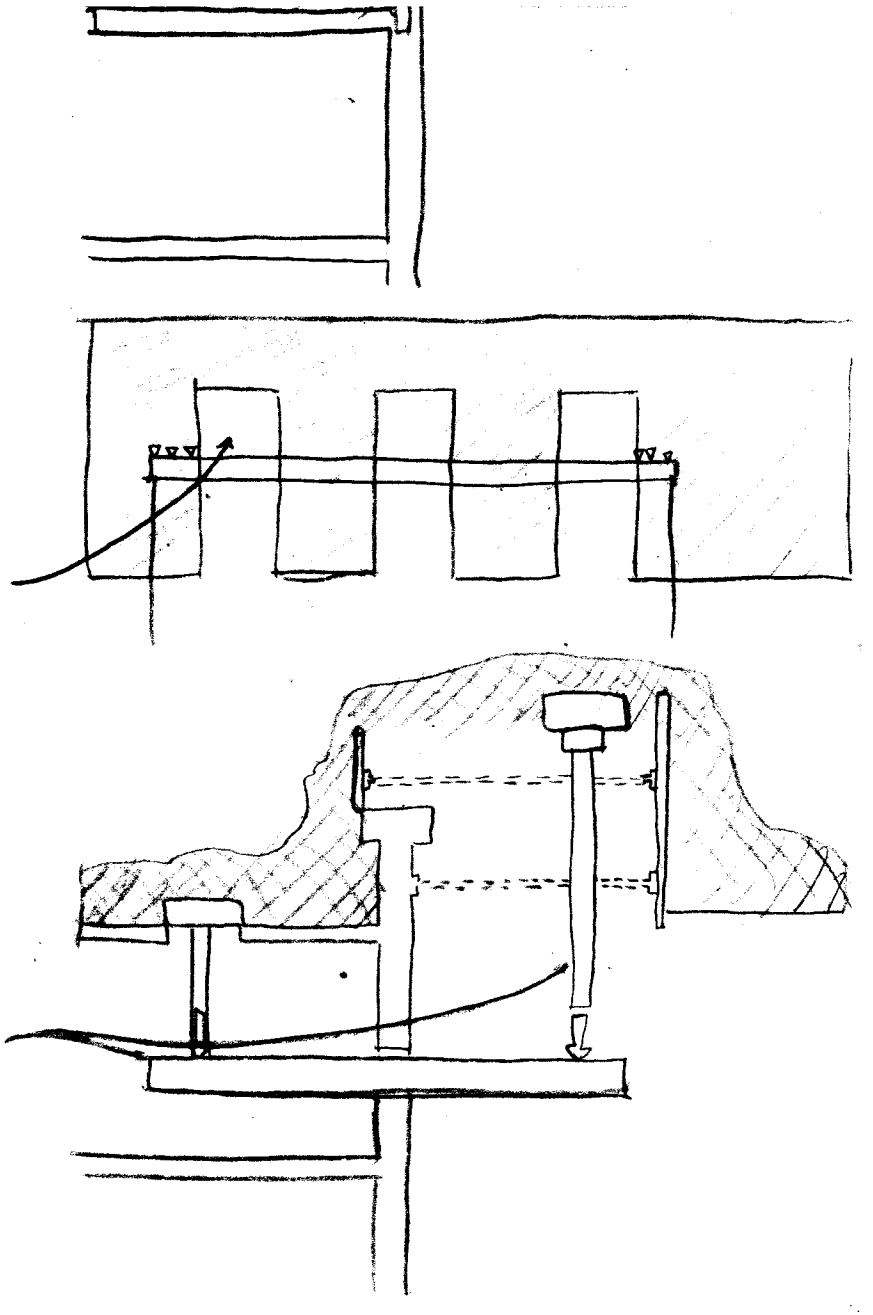

BASEMENT
CRAWL SPACES
CONCRETE SLABS-ON-GRADE
A GRID

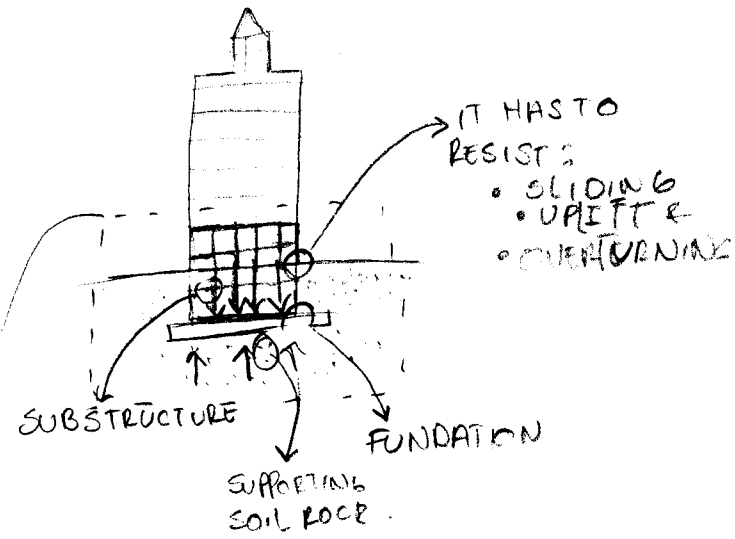


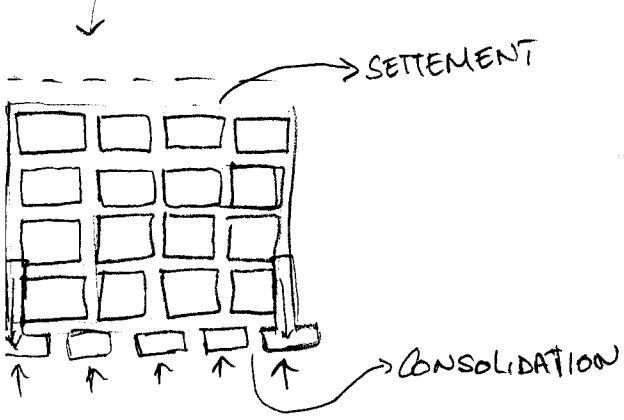
FUNDATION SYSTEMS #1.

THE FUNDATION IS THE LOWEST DIVISION OF A BUILDING.

↓

BECAUSE IS A VERY IMPORTANT LINK OF CONSTRUCTION → THE CONSTRUCTION OF IT HAS TO BE DESIGN TO ACCOMODATE THE FORM & THE LAYOUT OF THE STRUCTURE





A PROPERLY DESIGN & FUNDATION SYSTEM. SHOULD DISTRIBUTE LOADS UNDER ALL PORTIONS OF THE STRUCTURE, BECAUSE IT WILL GIVE A EQUAL LOAD PER UNIT AREA TO THE SUPPORTING SOIL OR ROCK WITHOUT EXITING ITS BEARING CAPASITY

FUNDATIONS UTILIZE A COMBINATION OF BERING WALLS, COLUMS, & PIERS CAN FORM VARIOUS TYPES OF SUBSTRUCTURES.

BASEMENTS: WHOLY OR PARTLY BELLOW GRADE REQUIRE A CONTINUOUS FOUNDATION WALL IT SUPPORTS THE EXTERIOR WALLS & THE STRUCTURE ABOVE.

CRAWL SPACES: ENCLOSED BY A CONTINOUS FUNDATION WALL OR PIERS FOR THE INTEGRATION OF THE ACCESS TO THE MECHANICAL, ELECTRICAL, & PLUMING INTALLATIONS.

CONCRETE SLABS-ON-GRADE: SUPPORTED DIRECTLY BY THE EARTH & THICKENED TO CARRY WALL & COLUMN LOADS TO A FUNDATION & FLOOR SYTEM FOR ONE & TWO STORY STRUCTURES IN CLIMATES WHERE LITTLE GROUND FROST OCCURS.

A GRID: OF INDEPENDENT PIERS

FUNDATION SYSTEMS ARE CLASSIFY INTO TWO CATEGORIES

- SHALLOW FUNDATIONS
- DEEP FUNDATIONS

SHALLOW FUNDATIONS → THEY ARE EMPLOYED WHE THERE IS A STABLE SOIL & OCCOURS RELATIVELY TO THE GROUND SURFACE

DEEP FUNDATIONS → THEY ARE EMPLOYED WHEN THE SOIL UNDERLAYING A FUNDATION IS INSTABLE FOR THE BEARRING CAPASITY.

FUNDATION SYSTEMS ⟶ UNDERPINNING

- **UNDERPINNING:** IS THE PROCCESS OF REBUILDING OR STRENGTHENING THE FUNDATION OF AN EXISTING BUILDING

- IN ANOTHER METHOD OF PROVIDING SUPPORT IS TO DIG INTERMITENT PITS UNDER THE EXISTING FUNDATION DOWN TO THE LEVEL OF THE NEW FOOTINGS

- AN ALTERNATIVE TO EXTENDING A NEW FUNDATION WALL & PLACING NEW FUTINGS IS TO CONSTRUCT PILES ON EITHER SIDE OF THE EXISTING FUNDATION

CHAPTER 13

ROMANS → ACCIDENT BY MIXING → SILICA, ALUMINIA BEARRING, LIMESTONE

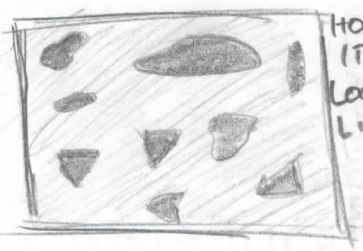
CEMENT
↓
THEN TO MAKE IT SOLID YOU HAVE TO MIX WITH → SAND & WATER → IT DRYS IN → WATER & AIR → STRONGER → MUCH STRONGER

THE USE OF CEMENT WAS LOST UNTIL THE ~~LATE~~ 19 CENTURY
↓
AFTER THAT
↓
PORLAND CEMENT (PATENTED IN 1824 BY JOSEPH ASPDIN) ARTIFICIAL CEMENT

CONCRETE: AFER THE PORLAND CEMENT WAS MADE WITH NATURAL & ARTIFICIAL PRODUCED CEMENTS.

THEN IS JUST THE PORLAND CEMENT & WATER.
↓
GRAY FINE POWDER.

THAT IS MADE OF
↓
RAW MATERIALS COMBINE WITH LIME, IRON, SILICA, & ALUMINEA



HOW IT LOOKS LIKE!

THERE ARE DIFERENT TYPES OF CEMENT

TYPE I → NORMAL

TYPE IA → NORMAL, AIR ENTRAING

TYPE II → MODERATE RESISTANCE TO SULFATE ATTACK.

TYPE IIA → MODERATE SULFATE RESISTANCE & AIR ENTERING

TYPE III → HIGH EARLY STRENGTH

TYPE IIIA → HIGH EARLY STRENGTH & AIR ENTRAINING

TYPE IV → LOW HEAT OF HIDRATION

TYPE V → HIGH RESISTANCE TO SULFATE ATTACK

EACH TYPE OF CEMENT WOR FOR DIFERENT CASES
↓

SUPPLEMENTARY CEMENTOS MATERIALS → MATERIALS

↓

THIS IS ADDED TO THE CONCRETE MIXTURES AS A SUBSTITUTES FOR SOME PORTION OF THE CEMENT TO ACHIVE SOME BENETITS

POZZOLANS

↓

ARE MATERIAS THAT REACT WITH THE CALCIUM TO FORM CEMENTING CONCRETTE

↓

INCLUDING

- FLY ASH
  - ↓
  - A POWDER THAT INCREASES
  - -CONCRETTE STRENGTH
  - - SULFATE RESISTANCE REDUCES
  - - CONCRETE SHRINKAGE
- MICROSILICA
  - ↓
  - A POWDER
  - - IT PRODUCES HIGH STRENGTH CONCRETE & LOW PERMIABILITY
- OTHERS
  - REACTIVITY METAKAOLIN
    - -ENHANCES THE COLORED CONCRETE
    - -IT IMPROVES THE WORKABILITY STRENGTH & DESITY
  - BLAST FURNACE SLAG
    - ↓
    - IS PART OF THE IRON MANUFACTURE

ADMIXTURES

- WATER REDUCING ADMIXTURES
  - • DUCTION THE AMOUNT OF WATER USED
- SUPERPLASTICIZERS
  - • FACILITATES THE CONCRETE UNDER DIFICOULD SIRCUNSTANCES.
- ACCELERATING ADMIXTURES
  - • CAUSE CONCRETE TO CURE FASTER.
- WORKABILITY
  - • IMPROOF THE PLASTICITY OF WET CONCRETE
- SHRINKAGE - REDUCING ADMIXTURES
  - • REDUCE DRYING SHRINKAGE
- CORROSION INHIBITORS
  - • USED TO REDUCED REINFORCING STEEL
- FREEZE PROTECTION ADMIXTURES
  - • USED TO DELAY THE CURING REACTION IN CONCRETE
- COLORING AGENTS
  - • DYES & PIGMENTS USED TO ALTER & CONTROL THE COLOR OF THE CONCRETE

TYPES

I → MOST PURPOSES OF CONSTRUCTION.

IA →

II → CONTACT WITH WATER.

IIA →

III → HARDS FASTER AND IS MEANT FOR SHORT PERIODS.

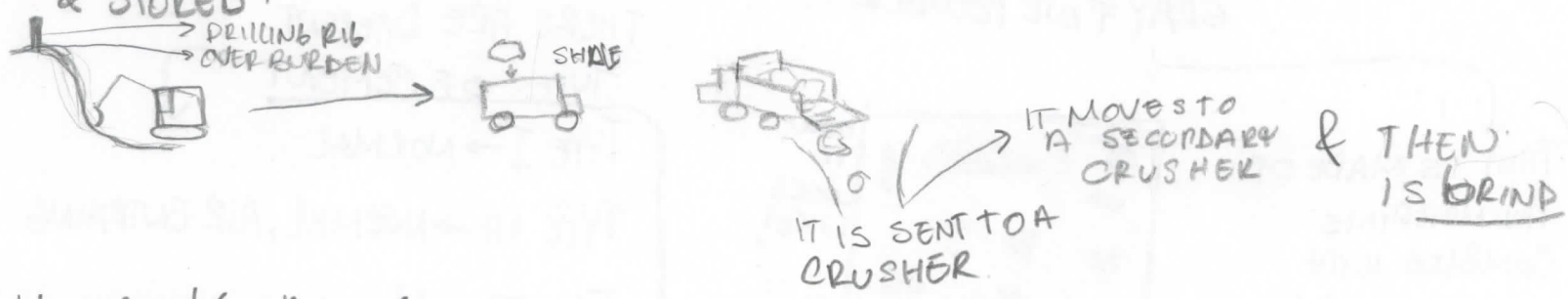
IIIA →

IV → MASIVE STRUCTURES (DAMS)

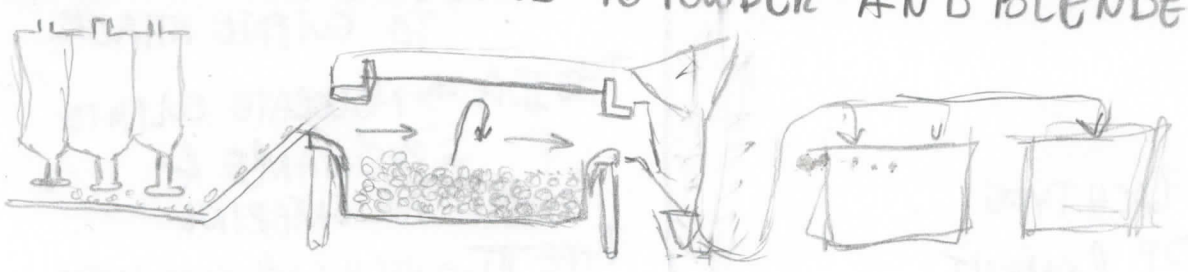
V → CONTACT WITH WATER

PROCES OF PORTLAND CEMENT

1 STONE IS FIRST REDUCED INTO A 5 IN. SIZE, THEN 3/4 IN. & STORED.



2 MATERIALS ARE GROUND TO POWDER AND BLENDED.



REINFORCING → STEEL

STEEL & CONCRETE BOUND TOGUETHER SO WELL BECAUSE OF ITS SIMILARITY IN EXPANTION & PROTECTION TOGUETHER.

→ WHEN IT COMES TO STEEL CONCRETE HELPS WITH THE CORROSSION BY COVERING THE STEEL ARROUND

MATERIAL	STRENGTH IN TENTION	STRENGTH IN COMPRESSION
WOOD	300 – 1 000 PSI	600 — 1700 PSI.
BRICK MASONRY	0 PSI	250 – 1 300 PSI
STEEL	24,000-43,000 PSI	24,000 — 43,000 PSI
CONCRETE	0 PSI	1,000 — 4,000 PSI

STEEL BARS FOR CONCRETE REINFORCEMENT → STANDAR SIZES

- THEY ARE ROUND IN CROSS SECTION & DEFORMED WITH SUFACE RIBS FOR BETER BOUNDING TO CONCRETE

THE STANDAR SIZE OF IT CORRESPONDS TO A NUMBER OF EIGHS OF AN INCH

FABRICATION & ELECTION OF REINFORCING BARS

- THE FABRICATION OF STEEL FOR A CONCRETE CONSTRUCTION PROJECT IS THE BENDING STIFFNESS OF THE REINFORCING BARS THENSELVES BUT IT ONLY HAS A TEMPORARY JOB OF HOLDING THE CONCRETE IN PLACE

REINFORCING SIMPLE CONCRETE BEAM

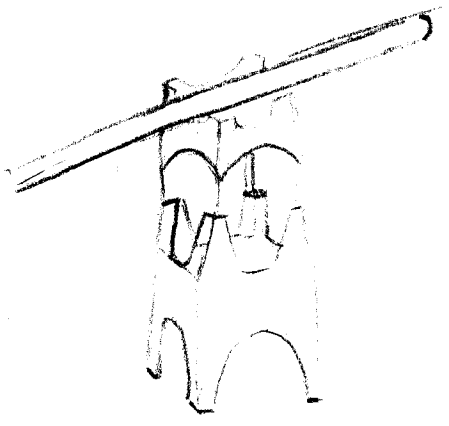
- IS A SUPPORTED BEAM UNDER UNIFORM LOADING COMPRESIVE FORCES THAT CREATE AN ARCHLIKE CURVE WITH COMPRESIVE STRESS AT MIDSPAN WITH A LOWER COMPRESIVE STRESS AT EITHER END.

- STIRRUPS
THEY ARE FULL RECTANGULAR LOOPS OF STEEL THAT WRAP ALL THE WAY ARROUND THE LOGITUDINAL BARS.

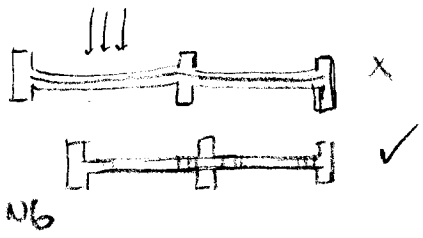
- BOLSTERS,
THEY ARE CHAIRS IN THE CONCRETE AND THEN THE PLACE IS FILLIDED OUT WITH CONCRETE (THEY LONT HAVE TO BE TOOKEN OF

- PRICTOR BARS ARE PLACED HORIZONTALLY NEAR THE BOTTOM BEAM LEAVING AN SPECIFIED AMMOUNT OF CONCRETE BELOW & TO THE SIDES OF THE ROAD. AS COVER IT PROVIDES A FULL EMBEDMENT FOR THE REINFORCING BARS & PROTECS THEM AGAINST THE CORROSION

- BOND: THE ADJESIVE FORCES BETWEEN THE CONCRETE & THE STEEL AIDED BY THE RIBS OF THE SURFACE OF THE BARS



REINFORCING WITH THE CONCRETE BEAM → THE BEAM IS IN TENTION AT MIDSPAN AT THE TOP OF THE BEAM IS IN TENSION AT SUPPORTING GIRDERS, COLUMS, OR WALL



[illegible] STRUCTURAL CONCRETE SLABS

A CONCRETE SLAB THAT SPANS ACROSS PARALLEL BEAMS CONE WAY [illegible] IS A VERY WIDE BEAM.

A [illegible] BEAM IS RELATIVELY WEAK DIAGONAL TENTION FORCES NEAR ITS SUPPORTS WITHOUT THE AID OF STIRRUPS.

[illegible] IS A SET OF SMALL-DIAMETER REINFORCING BAR SET AT RIGHT ANGLES TO & ON TOP OF THE PRIMARY REINFORCING IN THE SLAB

[illegible] CONCRETE COLUMNS

THERE IS 2 TYPES!

VERTICAL BARS

↓

ARGE DIAMETER
EINFORCING BARS
HAT SHARE THE
OMPRESSING LOADS
WITH THE CONCRETE
& RESIST THE TENSILE
STRESSES THA OCCUR
WITH COLUMS WHEN
A BUILDING FRAME IS
SUBJECTED TO WIND OR
EARTHQUAKE FORCES

[illegible]
TIES

↓

A SMALL-DIAMETER STEEL BARS WRAPED ARROUND THE VERTICAL BARS HELPING THE PREVENTION TO VENT FROM BUCKLING UNDER LOAD

THERE ARE TWO TYPES OF SHAPING

Colum TIES

↓

HELP BETER TO KEEP IN POSITION

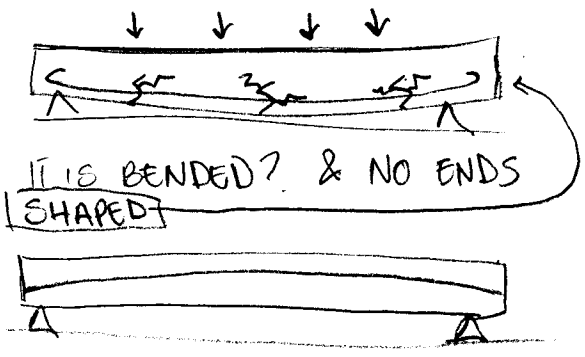
RECTANGULAR TIES

[illegible] IS A STRUCTURAL ELGNOMY UNIQUE CONCRETE FRAMES.

~~PRETENTIONING~~

PRETRESSING → INITIAL TENSION

- WHEN A BEAM SUPPORTS A LOAD, THE COMPRESSION SIDE OF THE BEAM IS SQUEEZED SLIGHTLY & THE TENTION SIDE IS STRECHED.



IT IS BENDED? & NO ENDS SHAPED

SO IT LEADS TO BENDING THE STEEL ITSELF TO THE OPPOSITE DIRECTION & DOESN'T HAS BENDED ENDS

METALS IN ARCH

STEEL → 24,00 – 43,000 PSI

METAL → CONDUCT OF METAL & ELECTRICITY
→ CAN BE LIQUEFIED WHEN HOT & SOLID WHEN COOL

ORIGEN → NATURE → OXIDE ORES

IS AN ABUNDANT MINERAL O EARTH & EASY TO REFINE

→ THERE ARE: FERROUS & NON-FERROUS METALS

FERROUS → NO CHEAP → STONG

NON-FERROUS → CHEAP →

ALLOYS

IS A MODIFICATION OF THE METAL THAT ARE MADE FOR A SPESIFIC PURPOSE

COPPER + TIN = BRONZE
CARBON MIX + IRON = STEEL

} LIKE THIS EXAMPLES THE ALLOY IS STRONGER THAN THE ELEMENTAL METAL (PRIMARY ELEMTS)

STEEL = THERE ARE VARIOUS PROSSES TO CHANGE STEEL.

→ HEAT + COLD WATER = BREAK!
→ HEAT + SLOW CODING = SOFTER & EASY TO WORK & LESS BRITTLE (ANNEALING)
→ COLD WORKING = THEY ARE STRONGER SO IS USED TO REINFORCE

NOTED → MANY ALUMINIUM ALLOYS GET THE SAME EFECT TO.

MOLDING METALS.

METALS CAN BE SHAPE IN DIFFERENT WAYS WHICH ARE:

CASTING: IS PUTTING THE METAL INTHE MOLD.

ROLLING: IT CAN BE DONE COLD OR HOT → IT USED FOR SHAPED ROLLERS.

EXTRUSION: IS A WAY TO MAKE LONG PIECES OF METAL BY SQUIZING IT HOT ~~(MOLDING)~~

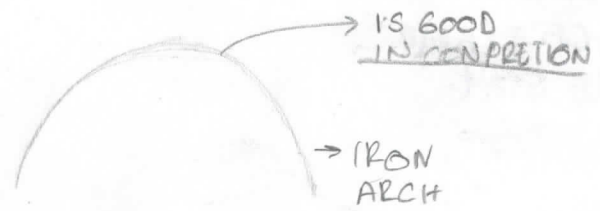
FORGING: THE METAL GETS HEAT UNTIL IT GETS SOFT THEN BIT IT INTO SHAPE

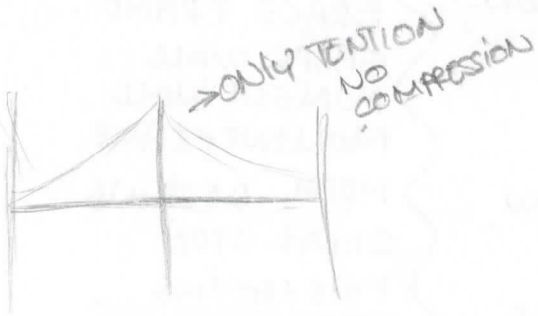
STAMPING: THE METAL GETS SQUEEZ BETWEEN 2 SHEETS. GIVING A DESIRE SHAPE OR TEXTURE

DRAWING: IT MAKES WIRES TROUGH HOLES.

STEEL → IRON IS A ALLOY METAL

WHEN IT COMES TO STEEL IT OPPENS TO A HIGH LEVEL OF TRANSPARECY



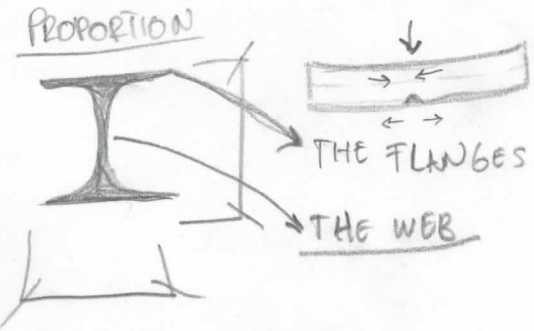


60% RECYCLE MATERIAL

WROUGHT_IRON
VERY LOW CARBON
↓
MALEABLE / WEAKER

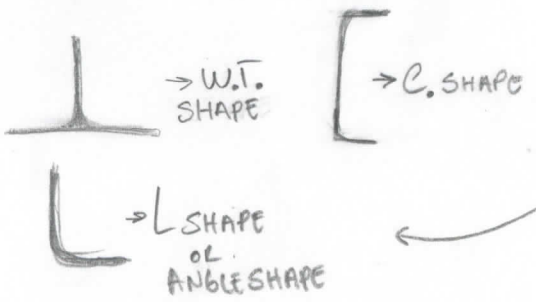
CASTIRON
↓
WROUGHTIRON
↓
PUDDLE IRON/STEEL.
↓
BESSEMER PROCESS → BIRH MODEL STILL PRODUCTION.
↓
OPEN HEARTH METHOD → MAKING STEEL PRODUCTION EFFITIENT

PROPORTION



THE TENTION IS ALWAYS AT THE BOTTOM

WBEAM → WIDE FLAME OF STEEL
→ THE ABILITY TO CONTROL THE FLAGES & THE WEB INDIVIDUALLY



W21 x83
21 → NOMINAL DEPTH
83 → LBs / FOOT OF LENGTH → RESISTANCE

LA x 3 x 3/8
LENGHT SIDE
4x3 → NOMINAL DEPTH OF EACH LEG
3/8 → THICKNESS OF THE LEGS

RIVETS
IT HEATS.
ADDEIDES DOWN.
WITH VIBRATION

STEEL PROTECTION TO CONCRETE FOR IN CASE OF FIRE

- BRICK & CONCRETE → VERY HEAVY
- FOAM ANTY FIRE → VERY DELICATE

KEY WORDS

RIVET
SLIP CRITICAL - CONECTION.
FRICTION CONECTION
WELD
" SIMBOLS
SHEAR CONNECTION
MOMEN CONECTION
HIGH STRENGTH BOLT

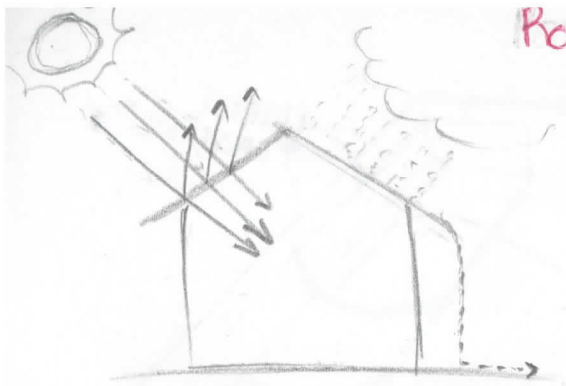
FABRICATION

FABRICATION
SHOP DRAWING
IRON WORKER / ERECTOR
PLUMBING UP VERY VERTICAL HORIZONTAL
DRIFT PIN.

FRAME

BRACE FRAME
SHEAR WALL
MOMENT WALL
MOMENT FRAME
METAL DECKING
SHEAR STUD
FIRE PROOFING
SPRAY APPLIED FIRE-RESISTING MATERIALS
PAINT / INTUMECENT MASTIC

GRINDER.
TRUSS
CHORD
SPACE FRAME
CABLE STAY



ROOF SYSTEMS

ROOF SYSTEMS FUNTIONS AS A PRYMARY SHETER FROM SUN & WATER. → THE ROOF HAS TO BE SELF SOSTEINABLE

SLOPING ROOFS MATERIALS

- WOOD OR STEEL RAFTERS & SHEATHING
- TIMBER OR STEEL BEAMS, PURLINS & DECKING
- TIMBER OR STILL TRUSSES

ROOF SLOPE

A SLOPE IN A ROOF IS INPORTANT IN ORDER TO GET READY OF RAIN WATER & SNOW WHEN IS MELTING.

IT ALSO MANAGE THE HEAT ACCESS &

↓

THERE ARE DIFERENT TYPES OF ROOFS:

FLAT ROOFS

↓

IS A CONTINUOS MEMBRANE OF ROOFTING MATERIAL (SLOPE 1/4 PER FOOT)

↓

THIS SLOPE LEADS TO INTERIOR DRAINS

↓

IS FLAT BECAUSE IS EASY TO USED IT AS A OUTDOOR SPACE

↓

STRUCTURE OF A FLAT SURFACE CONSIST OF

- REINFORCED CONCRETE SLABS
- FLAT TIMBER
- STEEL BEAMS & DECKING
- STEEL JOISTS & SHEATING

SLOPING ROOFS

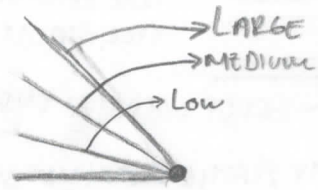
↓

THE ROOF SLOPE AFFECTS THE CHOICE OF ROOFTING MATERIAL

↓

THERE ARE

- LOW SLOPE
- MEDIUM SLOPE
- HIGH SLOPE

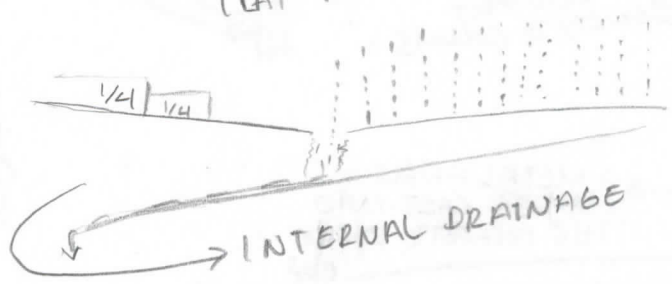


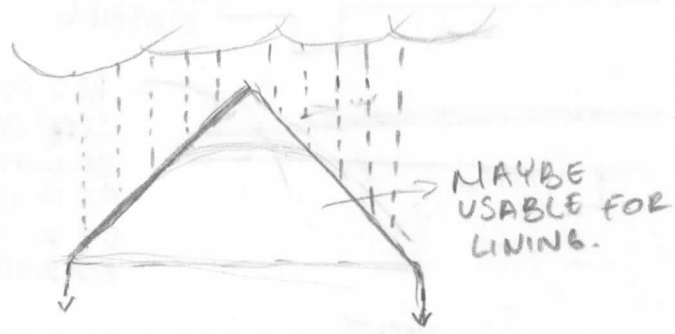
THE HIGHER THE ROOF SLOPE THE EASIER THE WATER DRAINS

↓

THE SPACE THA THE ROOF CREATES IS MAYBE USABLE.

FLAT ROOF





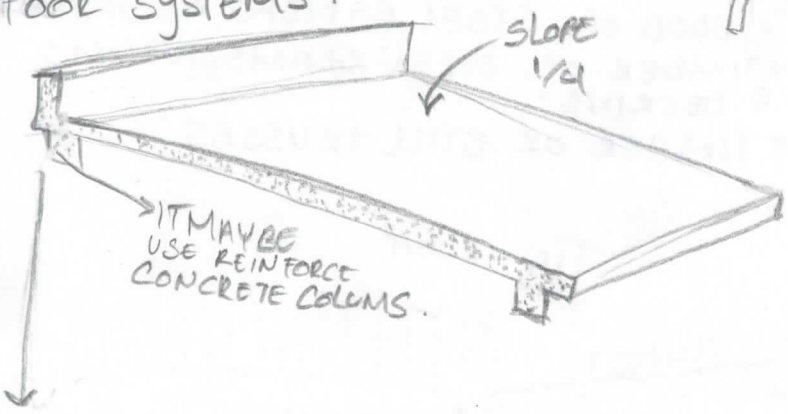
MEMBRANE

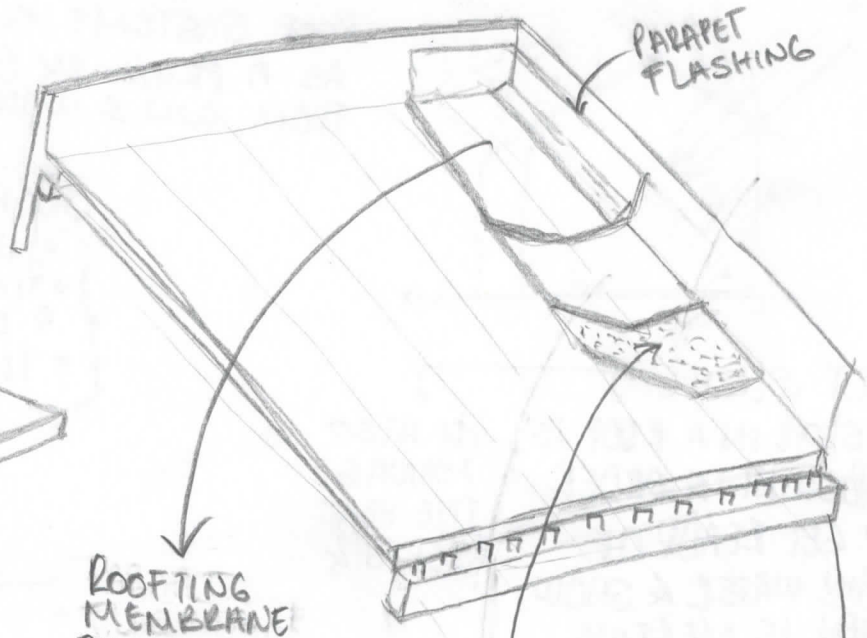
↓

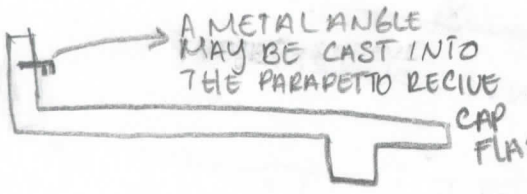
PROTECTS FROM THE WATER.

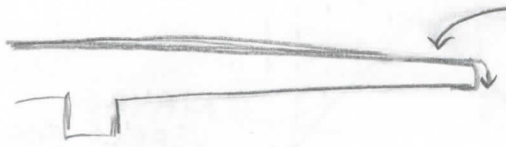
REINFORCE CONCRETE ROOF SLABS

THE CONCRETE ROOF SLABS ARE FORMED ALMOST AT THE SAME MANER AS CONCRETE FOOR SYSTEMS.









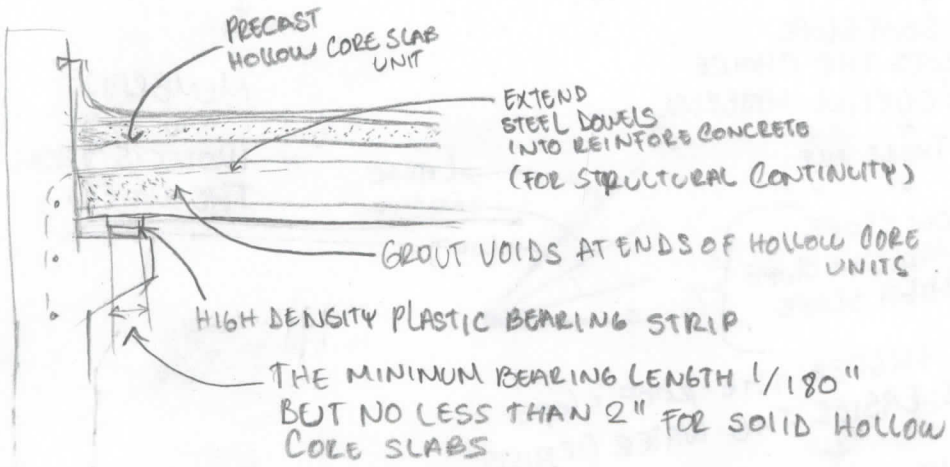
SITECAST CONCRETE TOPING REINFORCE FOR WELDED WIRE FABRIC.

2" MINIMUN

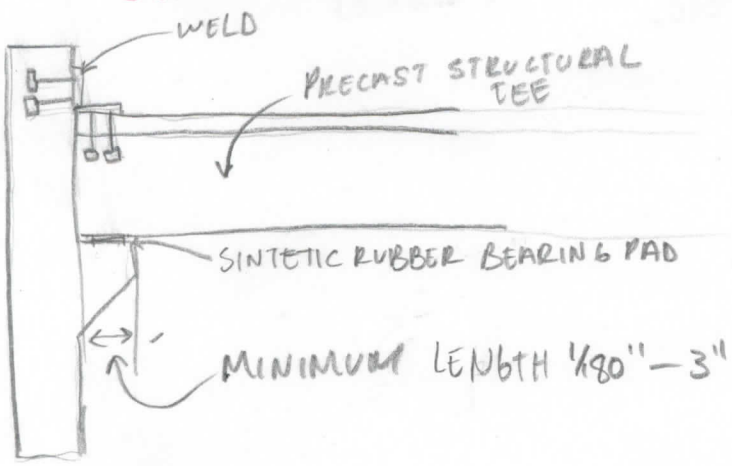
IT CAN BE OMITED IF THE FOAM INSULATION ISLAID OVER SMOOTH-SURFACE PRECAST UNITS

• SLOPE 1/4"

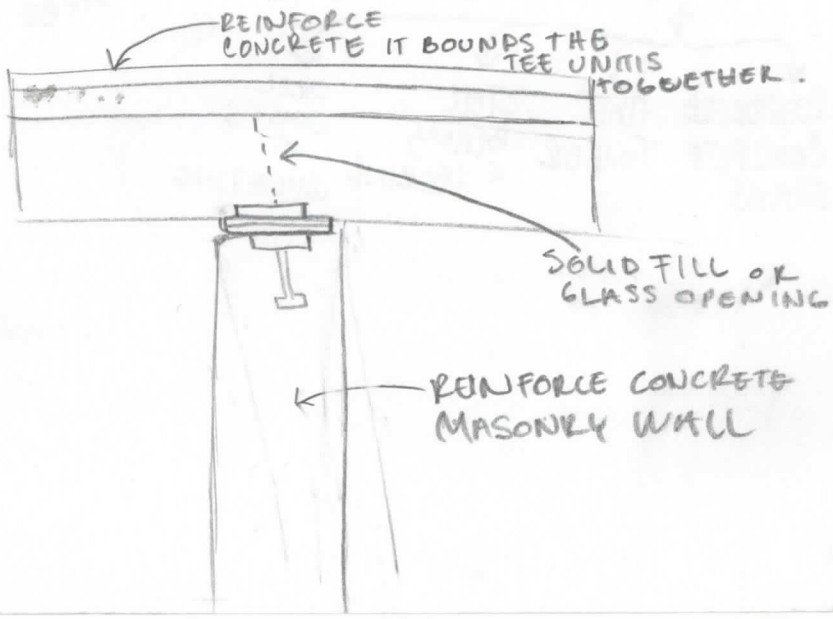
IT IS TO SERVE AS A HORIZONTAL DIAPHRAGM & TRANSFER LATERAL FORCES TO SHEAR WALLS, STEEL REINFORCEMENT MUST TIE THE PRECAST SLAB UNITS.



BEARRING WALL.



END WALL



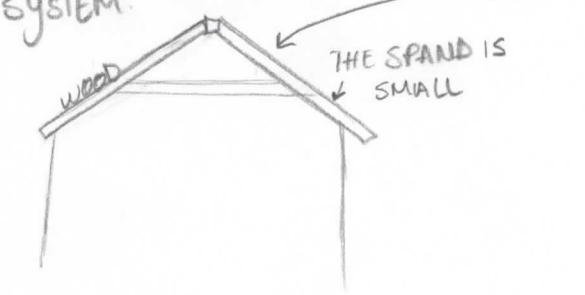
STRUCTURE + ENVELOP
↓
IS A ENCIOSURE TO PROTECT US FROM
↓
WATER, RAIN/SNOW
SUN, HEAT/COLD → RADIATION
& WIND

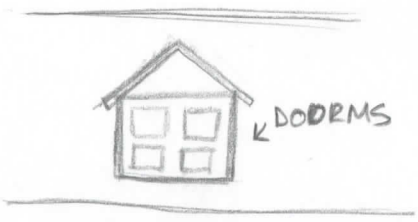
PERMIABLE
↓
WATER PASS TROUGH

IN PERMIABLE
↓
WATER GO TROUGH

HOUSE BUILDING ECOFRIENDLY IS CALLED
PASSIVE

RIDGE → RELATED TO A RAFTER SYSTEM
WHEN THE 2 SLOPES MEET





STRUCTURE → BEAM / JOIST
→ RAFTERS
→ TRUSS
→ SLABS
→ ARCHES/VAULTS
→ SPACE FRAME

DIM CONTONUE

MAKING & PLACING CONCRETE

DEPENDING OF THE USED LIKE

- COLUMS
- BEAMS
- SLABS
- PAVINGS
- FLOOR SLABS
- EXTERIOR CONCRETE WALLS
- DAMS
- WALLS (GENERAL)

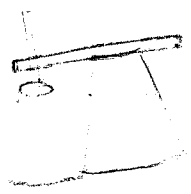
THERE IS ALSO OTHER METHODS THAT ARE NESESARY FOR MAKING & PLACING CONCRETE

PROPORTIONING CONCRETE MIXES

STABLISH THE DESIRED WORKABILITY OF THE CARACTERISTICS ON THE WEB CONCRETE

SLUMP TEST

IS THE DESIRABLE WORKABILITY FOR CONCRETE WITHOUT MAKE IT IN TOO WET & THEY ARE TESTED FOR COMPRESSIVE STRENGTH



HANDLING & PLACING CONCRETE

IS

- SLURRY
  - A SEPARABLE MIXTURE OF CEMENT
- SEGREGATE
  - THE COARCE AGREGATE WORKS ITS WAY FROM THE BOTTOM & THE WATER & CEMENT PASTE RISE TO THE TO.
- DROPCHUTES
  - REDUCE THE FALL OF THE CONCRETE
- SELF CONSOLIDATING CONCRETE (SCC)
  - IT FORMS COMPACTING WITHOUT ANY OTHER METHOD OF CONSOLIDATION

CEMENT MUST NOT BE DROPS A DISTANCE OF MORE THAN 3 TO 5 FEET SO IT CAN FALL FREE SO THAT THE SEGREGATION WILL NOT OCCUR

CURING CONCRETE

IT DOESN'T DRY EASILY

28 DAYS IS THE PERIOD OF CURING

IN COLDER WEATHER THE CURING REACTION IS SLOWER & OPPOSITE IN HOT WEATHER

FORM WORK

IT IS MADE OF BRACED PANELS OF WOOD, METAL OR PLASTIC

IS CONSTRUCTED AS A NEGATIVE OF THE SHAPE INTENDED FOR THE CONCRETE

IS A "TEMPORARY" WORKING SURFACE DURING THE CONSTRUCTION PROCESS (SUPPORTING REINFORCED BARS)

WITH THAT YOU HAVE TO DO

PRECASTING

WHERE CONCRETE IS CAST INTO REUSABLE FORMS AT A INDUSTRIAL PLANT.

CONCRETE: IS A MIX OF CEMENT & VARIOUS MINERALS AGGREGATES WITH WATER.

CEMENT
↓
PORTLAND CEMENT
↓
THERE ARE DIFFERENT TYPES

- TYPE I
- TYPE II
- TYPE III
- TYPE IV
- TYPE V

WATER
↓
WATER CEMENT

AGREGATE
↓
IS VARIOUS MINERAL MATERIALS
↓
ADMIXTURES
↓
IS A MIX THAT IS ADDED TO THE CONCRETE TO HARD THE MIXTURE

STILL REINFORCEMENT:
IS TO REINFORCE VERTICAL & HORIZONTAL ELEMENTS.
↓
DIFFERENT SHAPES
↓

- W SHAPE
- S SHAPE
- C SHAPE
- L SHAPE
- WT SHAPE
- STRUCTURAL TUBING
  - SQUARE
  - CIRCULAR SHAPE

↓
GALVANIC ACTION
↓
IS CONECTED TO THE ELECTRICITY FLOW AND DEPENDS OF HOW APART THE TWO METALS ARE