MATERIALS & METHODS IN BUILDING CONSTRUCTION

~21ARC82

NAME : HARSHITA
USN : 1AA21AT018
SEM : 8
COLLEGE : ANRVSA

INDEX

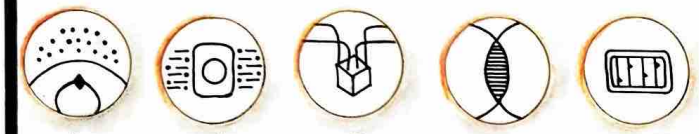
ACHARYA'S NRV SCHOOL OF ARCHITECTURE

EXTERNAL EXAMINER | INTERNAL EXAMINER

AUTOMATION

THE USE OR INTRODUCTION OF AUTOMATIC EQUIPMENT'S OR OTHER PROCESS OR FACILITIES IN CONSTRUCTION IS CALLED AS AUTOMATION IN CONSTRUCTION INDUSTRY.

COMPONENTS



(i) (ii) (iii) (iv) (v)

i. SENSORS - DEVICES THAT MEASURE VALUES SUCH AS CO_2 OUTPUT, TEMPERATURE, HUMIDITY, DAYLIGHT OR EVEN ROOM OCCUPANCY.

ii. CONTROLLERS - THESE ARE BRAINS OF SYSTEMS. CONTROLLERS TAKE DATA FROM COLLECTORS AND DECIDE HOW SYSTEM WILL RESPOND.

iii. OUTPUT DEVICES - THESE CARRY OUT THE COMMANDS FROM THE CONTROLLER.

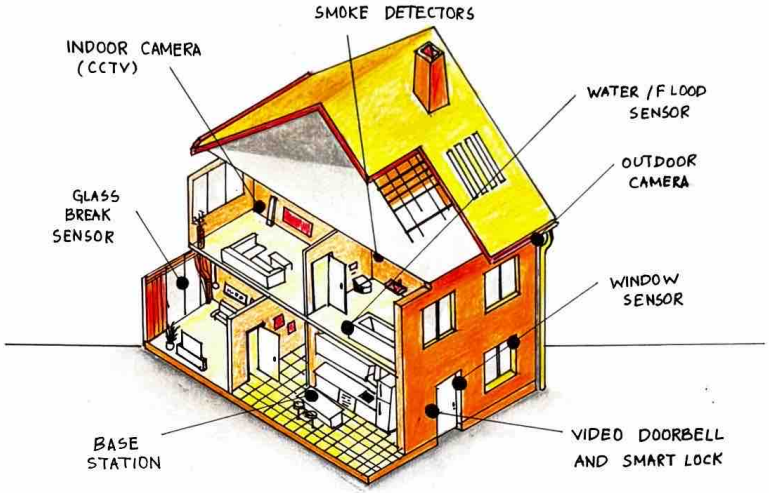
iv. COMMUNICATIONS PROTOCOL - THINK OF THESE AS LANGUAGE SPOKEN AMONG COMPONENTS OF BAS.

v. DASHBOARD OR USER INTERFACE - THESE ARE THE SCREENS OR INTERFACES HUMANS USE TO INTERACT WITH BAS. THE DASHBOARD IS WHERE BUILDING DATA ARE REPORTED.

TYPES OF BUILDING AUTOMATION

- LIGHTING
- CHILLERS AND COLD STORAGE
- HVAC
- ELECTRICAL SYSTEMS.
- OCCUPANCY SENSORS.
- FIRE ALARMS AND FIRE SUPPRESSION.
- CCTV
- SECURITY SYSTEM AND ALARMS.

SECURITY AUTOMATION SYSTEM



ADVANTAGES	DISADVANTAGES
• HELPS IMPROVE EFFICIENCY OF WORK	• LESS VERSATILITY.
• INCREASED PRODUCTIVITY.	• MORE POLLUTION.
• IMPROVED SAFETY	• LARGE INVESTMENT
• ENHANCES WORK ENVIRONMENT	• INCREASE IN UNEMPLOYMENT.
• CONSTRUCTION TIME REDUCES.	• CONTINUOUS POWER SUPPLY.
• UNIFORM QUALITY PRODUCT.	• HIGH MAINTENANCE COST.
	• LEADS TO BRAIN DRAIN FROM COUNTRY.

APPLICATIONS

- ROADS & RUNWAY CONSTRUCTION
- STRUCTURES
- BUILDING CONSTRUCTION
- FACTORIES AND INDUSTRIES.

INFORMATION

- MOBILE DEVICE MANAGEMENT
  MOBILE DEVICES HAVE MADE JOB SITE WORK MORE MANAGEABLE BY ALLOWING ACCESS TO PROJECT INFO.
- CLOUD STORAGE
  ANOTHER ENABLER FOR MODERN TECHNOLOGY IN CONSTRUCTION IS CLOUD STORAGE, OFFERS FASTER DATA PROCESSING SPEEDS.
- ASSET MANAGEMENT
  ASSET MANAGEMENT HAS BEEN MADE EASIER WITH READILY AVAILABLE TECHNOLOGY TO MANAGE LOCATION AND STATUS OF ASSETS.
- WEARABLES - CONSTRUCTION SITES ARE USING WEARABLES AS A METHOD TO IMPROVE SITE SAFETY. WEARABLES CAN BE BUILT INTO PPE, APPAREL, ETC.
- BUILDING INFORMATION MANAGEMENT
  BIM USES DIGITAL DEPICTIONS OF ACTUAL BUILDINGS TO FOSTER COMMUNICATION AND TEAMWORK AT CONSTRUCTION SITE.
- AUGMENTED REALITY (AR)
  USES TECHNOLOGY TO ADD DIGITAL VISUALS TO REAL WORLD PICTURE. WITH SUPPLEMENTED VISUAL, AR USER CAN GIVE VALUABLE INSIGHTS.

AUTOMATION AND INFORMATION

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SHEET NO. 1

PREFABRICATION

- PREFABRICATION IS THE PRACTICE OF ASSEMBLING COMPONENTS OF A STRUCTURE IN A FACTORY OR OTHER MANUFACTURING SITE AND TRANSPORTING COMPLETE ASSEMBLIES OR SUB-ASSEMBLIES TO THE CONSTRUCTION SITE WHERE STRUCTURE IS TO BE LOCATED.
- A PREFABRICATED BUILDING IS MANUFACTURED AND CONSTRUCTED USING PREFABRICATION. IT CONSISTS OF FACTORY-MADE COMPONENTS OR UNITS THAT ARE TRANSPORTED AND ASSEMBLED ON SITE TO FORM COMPLETE BUILDING.
- THE TERM PREFABRICATIONS ALSO APPLIES TO MANUFACTURING OF THINGS OTHER THAN STRUCTURE AT A FIXED SITE.
- IT IS FREQUENTLY USED WHEN FABRICATION OF A SECTION OF A MACHINE OR ANY MOVABLE STRUCTURE IS SHIFTED FROM MANUFACTURING SITE TO ANOTHER LOCATION AND SECTION IS SUPPLIED ASSEMBLED AND READY TO FIT.

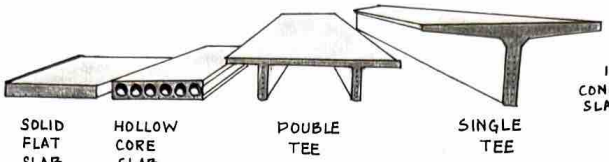
PROCESS

- CASTING : PRECAST COMPONENTS ARE CASTED WITH CONTROLLED CEMENT CONCRETE IN MOULDS OF REQUIRED SHAPE AND SIZE.
- CURING : AFTER 24 HOURS OF CASTING, CASTED COMPONENTS ARE RELEASED FROM MOULD AND TRANSPORTED TO CURING TANKS.
- TRANSPORTATION AND ASSEMBLY : AFTER COMPLETE CURING IS DONE THE COMPONENTS ARE TRANSPORTED TO SITE.

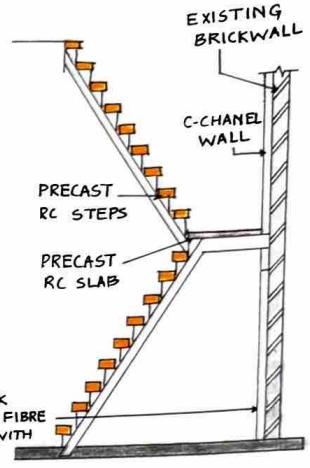
MATERIALS USED

- CONCRETE
- CERAMIC
- TREATED WOOD
- STEEL
- ALUMINIUM

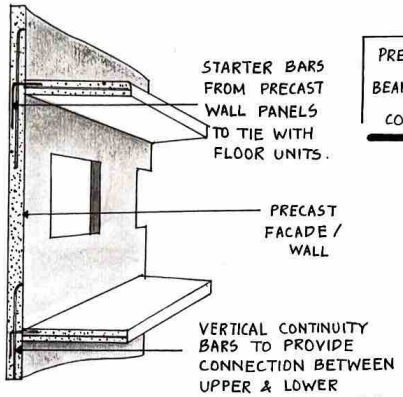
PRECAST SLAB



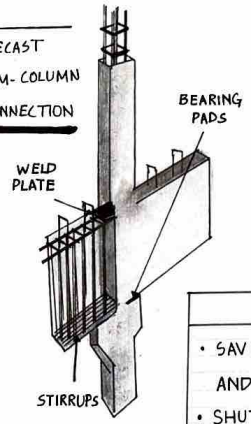
PRECAST FLIGHT



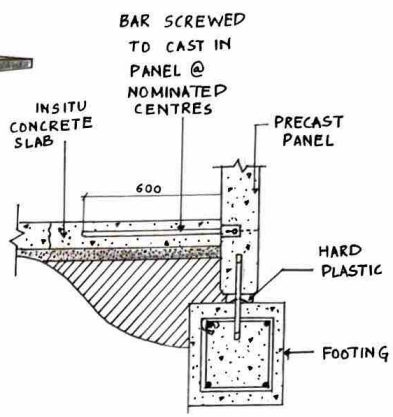
WALL TO SLAB CONNECTION



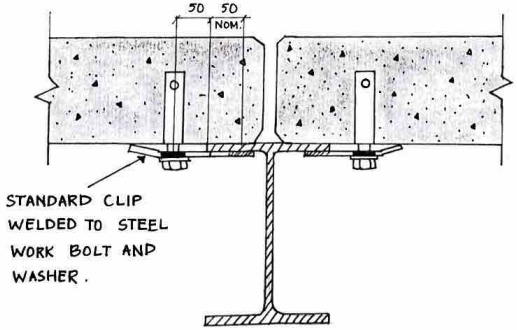
PRECAST BEAM-COLUMN CONNECTION



WALL PANEL CONNECTED TO IN-SITU CONCRETE



CONNECTION OF WALL PANELS TO COLUMNS



ADVANTAGES	DISADVANTAGES
• SAVING IN COST, MATERIAL, TIME AND MANPOWER.	• HANDLING AND TRANSPORTATION MAY CAUSE BREAKAGES OF MEMBERS DURING TRANSIT AND EXTRA PROVISION TO BE MADE.
• SHUTTERING AND SCAFFOLDING IS NOT NECESSARY.	• DIFFICULTY IN CONNECTING PRECAST UNITS SO AS TO PRODUCE SAME EFFECT AS MONOLITHIC.
• INSTALLATION OF BUILD SERVICES AND FINISHES CAN BE DONE IMMEDIATELY.	• THEY ARE TO BE EXACTLY PLACED IN POSITION.
• POSSIBILITY OF ALTERATIONS AND REUSE.	• HIGH TRANSPORT COST
• VERY THIN SECTIONS CAN BE ENTIRELY PRECAST WITH PRECISION.	• SKILLED LABOR IS REQUIRED.
• CORRECT SHAPE AND DIMENSIONS AND SHARP EDGES ARE MAINTAINED.	

PREFABRICATION

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MODULAR CONSTRUCTION

MODULAR CONSTRUCTION IS A PRE-ENGINEERED PROCESS OF MAKING ANY STRUCTURE OR ELEMENTS IN A FACTORY THAT IS OFF-SITE AND ARE DELIVERED TO SITE AND ASSEMBLED AS LARGE VOLUMETRIC COMPONENTS OR AS SUBSTANTIAL ELEMENTS OF ANY STRUCTURE.

IMPROVES PRODUCTIVITY
↓
STANDARDIZATION
↓
PROMOTE INDUSTRIALIZATION
↓

LESS WET WORK SITE
• NO DEPENDENCE ON UNSKILLED LABOR. • LESS MODIFICATION ON SITE.

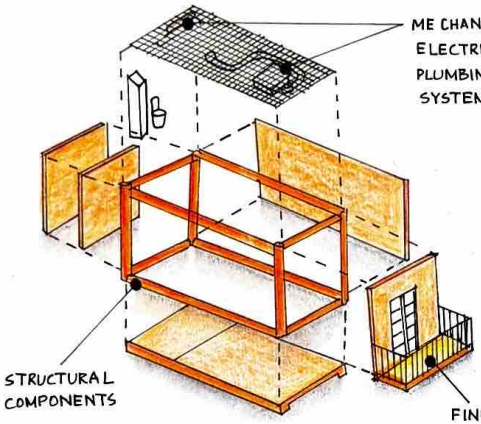
WITH INCREASING INDUSTRIALIZATION TO THE BUILDING INDUSTRY, STEADILY LARGER PARTS OF BUILDINGS ARE MADE UP OF PREFABRICATED COMPONENTS, DELIVERED TO THE BUILDING SITE FROM FACTORIES. SUSTAINABILITY CAN BE ACHIEVED IN MODULAR CONSTRUCTION.

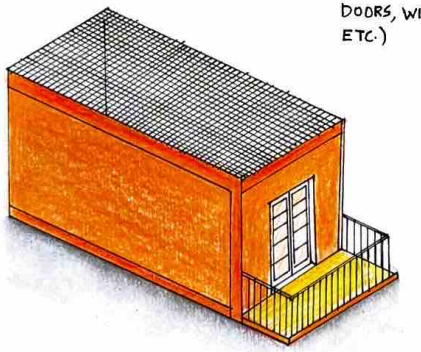
ADVANTAGES

- REDUCED COST - ONE KEY ADVANTAGE OF MODULAR CONSTRUCTION IS THAT ITS MORE COST EFFECTIVE, THEY WORK ON SMALLER PIECES.
- THE NEED FOR SPEED.
- QUALITY
- NEW CONSTRUCTION - BUILT TO MODERN STANDARDS.

DISADVANTAGES

- LIMITED CUSTOMIZATION.
- LIMITED SERVICE AREA - AFTER FABRICATION, MODULES MUST BE SHIPPED TO BUILDING LOCATION WHICH CAN BE EXTREMELY FAR AWAY.
- PAYMENT PLANS - TYPICALLY NEED TO BE PAID FOR UPFRONT OR FINANCED ON AS-YOU-GO BASIS.





ALL THE ELEMENTS ASSEMBLED TOGETHER

NEW / ADVANCED MATERIALS

NEW ADVANCED MATERIALS OFFER OPPORTUNITIES TO CHANGE THE WAY IN WHICH WE CONSTRUCT AND RETROFIT BUILDINGS. THEY GIVE ADDED VALUE IN TERMS OF INCREASED PERFORMANCE AND FUNCTIONALITY. NEW MATERIALS CAN ALSO HELP ADDRESS NEW CHALLENGES OF DURABILITY IN CHANGING CLIMATE.

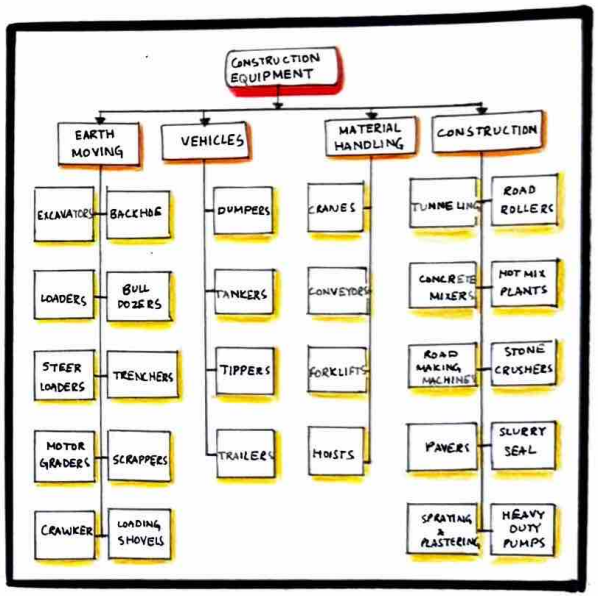
SMART OR INTELLIGENT MATERIALS ARE MATERIALS THAT HAVE TO RESPOND TO STIMULI AND ENVIRONMENTAL CHANGES TO ACTIVATE THEIR FUNCTIONS ACCORDING TO THESE CHANGES, THE STIMULI LIKE TEMPERATURE, PRESSURE, ELECTRIC FLOW, MAGNETIC FLOW, LIGHT, MECHANICAL, ETC CAN ORIGINATE INTERNALLY OR EXTERNALLY. IN ADVANCED SMART MATERIALS.

ADVANTAGES

- INCREASE IN RATE OF OUTPUT
- REDUCE OVERALL CONSTRUCTION COST.
- ELIMINATES HEAVY MANUAL WORK BY HUMANS.
- MAINTAIN PLANNED RATE OF PRODUCTION.
- MAINTAIN HIGH QUALITY STANDARDS.

DISADVANTAGES

- IF MACHINE BREAKS DOWN, IT CAN CAUSE DELAY IN CONSTRUCTION.
- ELECTRIC TOOLS CAN CAUSE SHORT CIRCUIT.
- ONLY SKILLED LABORS CAN OPERATE THE EQUIPMENTS.
- CONTRACTORS IN SMALL PROJECTS MAY CHARGE HIGH.



MODULAR CONSTRUCTION

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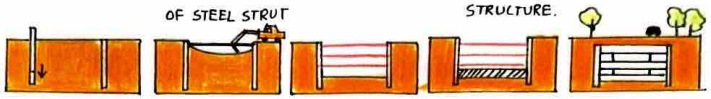
UNDERWATER CONSTRUCTION

DURING CONSTRUCTION OF BRIDGE, DAMS AND OTHER STRUCTURE WHERE FOUNDATION PART IS LAID UNDER WATER, WE OPT FOR UNDER WATER CONSTRUCTION. MAIN OBJECTIVE IS TO CREATE A DRY SURROUNDING FOR WORKING SUCH THAT THERE IS STRUCTURAL ABILITY DURING DRY PROCESS.

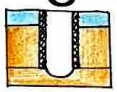
1. INSTALLATION OF RETAINING WALL.
2. EXCAVATION & INSTALLATION OF STEEL STRUT
3. EXCAVATION & INSTALLATION
4. CONSTRUCTION OF UG STRUCTURE.
5. BACKFILLING & REINSTATEMENT



TECHNIQUES USED FOR UNDERWATER CONSTRUCTION

- STRUCTURES CREATING A DRY ENVIRONMENT FOR WORK -
  - CAISSONS & COFFERDAM.
- UNDER WATER CONCRETING TECHNIQUES -
  - TREMIE
  - BUCKET PLACING
  - BAGWORK
  - PUMPING
  - TOGGLE BAGS
  - TWO STAGE CONCRETING.

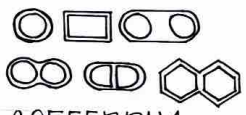
CAISSONS



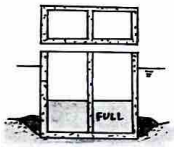
- PERMANENT STRUCTURE
- LARGE HOLLOW STRUCTURE THAT IS SUNK DOWN VIA EARTH.
- WATER TIGHT RETAINING STRUCTURE.

TYPES OF CAISSONS

OPEN CAISSONS
- BOX WITHOUT TOP OR BOTTOM, MADE OF TIMBER, METAL, CONCRETE

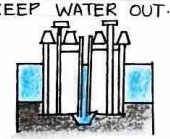


BOX CAISSONS
- BOXES WITH 4 SIDES AND BOTTOM.



PNEUMATIC CAISSONS

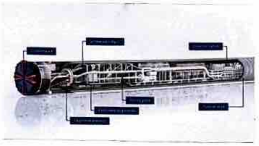
LARGE, WATERTIGHT CHAMBERS THAT USE COMPRESSED AIR TO KEEP WATER OUT.



METHODS

- **TUNNEL BORING MACHINES**

LARGE ROTATING MACHINES THAT EXCAVATE TUNNELS WITH MINIMAL SURFACE DISRUPTION



- **PIPE JACKING**

HYDRAULIC JACKING PUSHES PREFABRICATED PIPES THROUGH GROUND FOR TUNNEL CONSTRUCTION.

- **BOX JACKING**

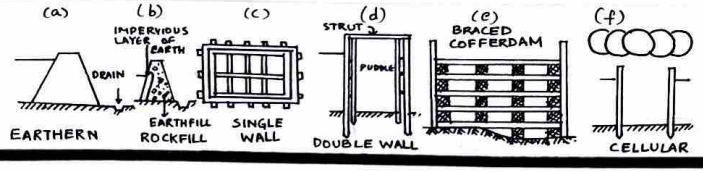
PRECAST CONCRETE BOX SECTIONS ARE PUSHED INTO PLACE USING HYDRAULIC JACK WHILE SOIL IS EXCAVATED.

- **IMMERSED TUNNEL CONSTRUCTION**

PREFABRICATED TUNNEL SECTIONS ARE FLOATED, POSITIONED AND SUNK INTO DREDGED TRENCH UNDERWATER.

COFFERDAM

A TEMPORARY BARRIER IN OR AROUND A BODY OF WATER WHICH ALLOWS PROCESS OF DEWATERING, DIVERSION, DAMMING OF WATER WITHIN AN ENCLOSED AREA.



TYPES OF COFFERDAM

(a) EARTHEN
MADE OF COMPACTED SOIL AND HT OF WATER IS LESS THAN 3M.

(b) ROCKFILL
USES OF ROCK AND GRAVEL, HT OF DAM IS TO BE UP. TO 3M.

(c) SINGLE-WALLED
ONE SHEET PILE BARRIER, AREA TO BE ENCLOSED IS SMALL, DEPTH OF WATER 6M.

(d) DOUBLE-WALLED
TWO SHEET PILE WITH FILLING. SUPPORT WATER UPTO 12M.

(e) BRACED
TIMBER OR STEEL SUPPORTS

(f) CELLULAR
INTERLOCKING SHEET PILES. WATER LAYER MORE THAN 20M. USED IN DAMS WEIRS, ETC.

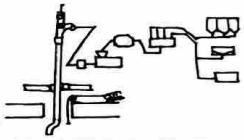
CONCRETING TECHNIQUES

UNDERWATER CONCRETING TECHNIQUES ARE SPECIALIZED METHODS USED TO PLACE CONCRETE BELOW WATER WHILE MAINTAINING ITS STRENGTH AND DURABILITY; HERE ARE THE MAIN TECHNIQUES -

1. **TREMIE METHOD**

USES VERTICAL PIPE TO POUR CONCRETE, PREVENTING SEGREGATION.

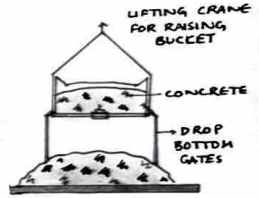
2. **PUMP METHOD**



CONCRETE IS PUMPED DIRECTLY TO PLACEMENT AREA THROUGH PIPELINE.

3. **BUCKET PLACING**

CONCRETE IS PLACED USING LARGE, WATERTIGHT BUCKETS LOWERED INTO POSITION.



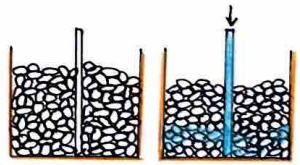
4. **BAGWORK**

BAGS ARE FILLED WITH CONCRETE, THE BAGS ARE LOWERED INTO WATER AND PLACED IN HEADER & STRETCHER COURSES.

5. **TOGGLE BAGS**

IDEAL FOR SMALL AMOUNT OF CONCRETE PLACEMENT. THEY ARE FILLED WITH WET CONCRETE, MOSTLY USED FOR REPAIR WORKS.

6. **TWO STAGE CONCRETE METHOD**



AGGREGATES ARE PLACED FIRST, THEN GROUT IS INJECTED TO FILL VOIDS.

UNDERWATER CONSTRUCTION

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SHEET 4

KINETIC ARCHITECTURE

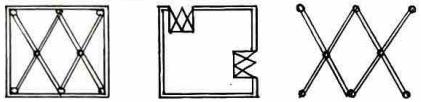
KINETIC ARCHITECTURE CONCEPT IS THE DESIGN OF BUILDINGS WITH TRANSFORMATIVE AND AUTOMATIC ELEMENTS. THE BUILDINGS SHAPE IS CHANGED TO MATCH THE PEOPLE REQUIREMENTS AND ADAPT TO ENVIRONMENTAL CONDITIONS.

KINETIC STRUCTURE SYSTEMS

KINETIC STRUCTURE SYSTEMS ARE DEFINED AS BUILDINGS AND / OR BUILDING COMPONENTS WITH VARIABLE MOBILITY, LOCATION, GEOMETRY. THE PERFORMANCE WAYS OF A KINETIC STRUCTURAL SOLUTION CAN BE FOLDING, SLIDING, EXPANDING, AND TRANSFORMING IN BOTH SIZE AND SHAPE.

KINETIC STRUCTURES CAN BE CATEGORIES INTO THREE GROUPS:

1. EMBEDDED KINETIC STRUCTURES
2. DEPLOYABLE KINETIC STRUCTURES
3. DYNAMIC KINETIC STRUCTURES.

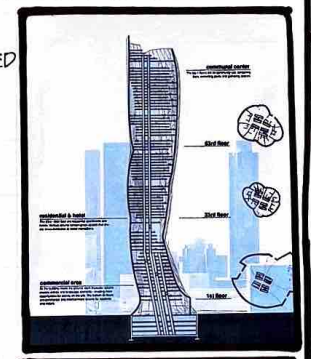


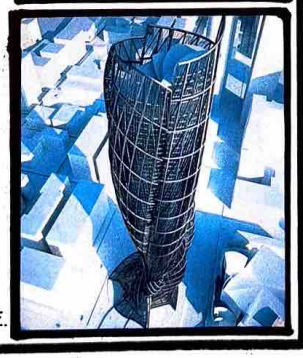
THEY ARE PART OF A LARGER ARCHITECTURAL SYSTEM IN A FIXED LOCATION. IT AIMS TO CONTROL THE MAIN ARCHITECTURAL SYSTEM OR BUILDING, IN RESPONSE TO VARYING FACTORS LIKE STRUCTURES THAT DAMPENING EARTHQUAKES.

EXAMPLE: THE MUSCLES TOWER IS A 35 FEET SKYSCRAPER CONSISTING OF AN ARTICULATED SPINE CONTROLLED BY A SERIES OF PNEUMATIC MUSCLES THAT ALLOW THE STRUCTURE TO BEND IN DIFFERENT DIRECTIONS. WHEN THE MUSCLES ARE NOT ACTIVE, TOWER'S RIGID CORE KEEPS THE ENTIRE STRUCTURE STRAIGHT.

BY ACTIVATING SEVERAL MUSCLES ONE COULD CAUSE THE TOWER TO CURVE MAKING IT APPEAR TO BOW. HELP STABILIZE THE STRUCTURE AGAINST CHANGING FORCES SUCH AS WIND AND EARTHQUAKES.

- REAL-TIME SENSORS EMBEDDED WITHIN THE STRUCTURE CONSTANTLY MONITOR EXTERNAL PRESSURES AND INTERNAL STRESSES.
- A CENTRAL CONTROL SYSTEM ADJUSTS THE PNEUMATIC PRESSURE WITHIN EACH MUSCLE TO COUNTERACT DESTABILIZING FORCES, ACTIVILY SHIFTING TOWER'S POSTURE TO MAINTAIN BALANCE.



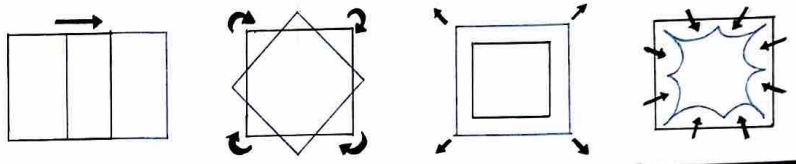


CONCEPT

THE CONCEPT OF KINETIC FACADES IS ABOUT USING GEOMETRIC TRANSFORMATION TO CREATE MOVEMENT IN SPACE. THIS MOVEMENT AFFECTS THE PHYSICAL STRUCTURE OR MATERIAL PROPERTIES OF THE BUILDING FACADES WITHOUT IMPAIRING THE BUILDING STRUCTURE.

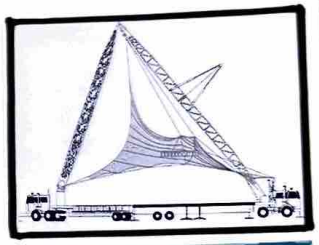
CLASSIFICATIONS OF KINETIC FACADES BASED ON FACADE TRANSFORMATION.

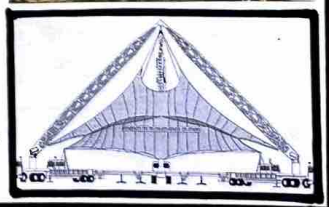
1. TRANSLATION : THE MOVEMENT OCCURS IN SINGLE DIRECTION.
2. ROTATION : THE OBJECT IS MOVED AROUND ALL AXIS.
3. SCALING : EXPANSION OR CONTRACTION IN SIZE.
4. MATERIAL DEFORMATION : DEPENDS ON CHANGEABLE MATERIAL PROPERTIES, LIKE MASS OR ELASTICITY.



EXAMPLE : THE CARLOS MOSELEY MUSIC PAVILION IS A STATE OF ART PERFORMANCE FACILITY. THE DESIGN OF PAVILION ALLOWS STRUCTURE TO BE EASILY CONSTRUCTED AND DECONSTRUCTED, THEN MOVED TO NEXT PERFORMANCE LOCATION. THE PAVILION CONSISTS OF SEVEN SEMI-TRUCKS THAT CARRY ENTIRE FACILITY TO ANY OPEN SITE. THE CENTRE TRAILER CONTAINS FOLDING BEAMS WHEN OPENED; IT PROVIDES STRUCTURE FOR THE STAGE. ON THE SAME TRAILER, HYDRAULIC PISTONS UNFOLD HINGED PANELS THAT SERVE AS STAGE SURFACE. IN ITS FINAL POSITION, THE STAGE RESTS UPON THE TWO FRONT CORNER TRAILERS AND TWO REAR CORNER CABS, AND THE ENTIRE ASSEMBLY IS JOINED TOGETHER TO FORM ONE CONTINUOUS RIGID STRUCTURE.

THEY ARE EASILY TRANSPORTABLE AND USUALLY EXIST IN TEMPORARY LOCATION.



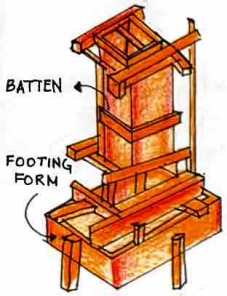


KINETIC ARCHITECTURE

SIGNATURE	NAME : HARSHITA	SHEET
	USN : 1AA21AT018	5
	SEM : 8	
	SUB : MMBC	
	COLLEGE : ANRVSA	

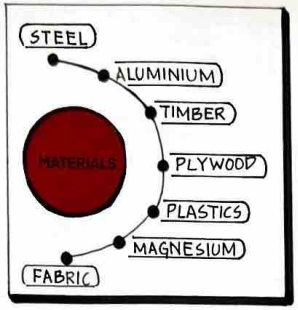
FORMWORKS

FORMWORK IS ONE TYPE OF TEMPORARY MOLD IN WHICH CONCRETE IS POURED TO CAST THE REQUIRED SHAPE OF CONCRETE.



IMPORTANCE

- PROVIDES SHAPE AND SUPPORT
- ENSURES STRUCTURAL STABILITY
- IMPROVES CONSTRUCTION SPEED.
- ENHANCES SURFACE FINISH
- ENSURES SAFETY
- INCREASE EFFICIENCY
- IMPROVES DURABILITY



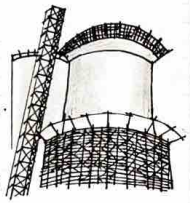
ADVANTAGES	DISADVANTAGES
• SPEEDS UP CONSTRUCTION.	• HIGH INITIAL COST.
• ENHANCES STRUCTURAL STRENGTH.	• SOME MATERIALS HAVE LIMITED REUSE.
• CAN BE REUSED.	• MAINTENANCE AND STORAGE CHALLENGE.
• ALLOWS COMPLEX AND VERSATILE DESIGNS.	• ENVIRONMENTAL CONCERNS.
• PROVIDES SAFETY AND STABILITY.	• TIME CONSUMING SETUP AND REMOVAL.

DOKA : DOKA IS A LEADING GLOBAL COMPANY THAT PROVIDES INNOVATIVE FORMWORK SOLUTIONS FOR CONCRETE CONSTRUCTION. IT SPECIALIZES IN HIGH QUALITY, REUSABLE, AND EFFICIENT FORMWORK SYSTEMS.

PERI : PERI IS ONE OF WORLD'S LEADING MANUFACTURERS OF FORMWORK AND SCAFFOLDING SYSTEMS. KNOWN FOR ITS INNOVATION, DURABILITY, AND EFFICIENCY. PERI FORMWORK IS WIDELY USED IN RESIDENTIAL.

DIFFERENT SYSTEMS OF FORMWORK IN CONSTRUCTION

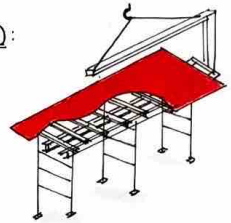
▸ **SLIPFORM FORMWORK** : IT IS A CONTINUOUS CONSTRUCTION METHOD WHERE FORMWORK MOVES VERTICALLY OR HORIZONTALLY AS CONCRETE IS POURED, USED FOR TALL STRUCTURES LIKE CHIMNEYS & HIGH-RISE BUILDINGS.



TYPES : VERTICAL - TOWERS & BUILDING CORE
HORIZONTAL - ROADS & TUNNELS, BRIDGES
CONICAL - FOR TAPERING STRUCTURES.

ADVANTAGES : FAST, REDUCES LABOR AND SCAFFOLDING.

▸ **TABLE FORMWORK (FLYING FORMWORK)** : A LARGE, REUSABLE SLAB FORMWORK SYSTEM THAT CAN BE MOVED AS A UNIT USING CRANES, USED FOR HIGH-RISE BUILDINGS. AND LARGE FLOOR SLABS.



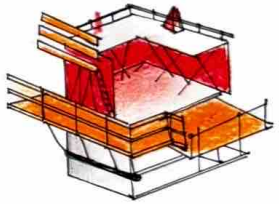
ADVANTAGES : FAST ASSEMBLY, REUSABLE, REDUCES LABOR COSTS.

LIMITATIONS : REQUIRES CRANES, NOT FLEXIBLE FOR COMPLEX.

▸ **TUNNEL FORMWORK** : A LARGE, REUSABLE FORMWORK SYSTEM THAT ALLOWS SIMULTANEOUS CASTING OF WALLS & SLABS, COMMONLY USED IN MASS HOUSING & INFRASTRUCTURE.

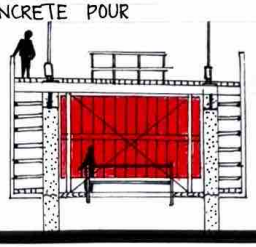
USES : HIGH-RISE, MASS HOUSING PROJECTS, TUNNELS, AND MILITARY BUNKERS.

ADVANTAGES : FAST, STRONG, UNIFORM AND DURABLE.



▸ **JUMP FORM (CLIMBING FORMWORK)**

A MODULAR, MOVABLE FORMWORK SYSTEM, IT "JUMPS" OR CLIMBS IN STAGES AFTER EACH CONCRETE POUR



TYPES : SELF CLIMBING FORMWORK
CRANE LIFTED JUMP-FORM.

ADVANTAGES : FASTER THAN TRADITIONAL FORMWORK, REDUCES SCAFFOLDING AND LABOR COSTS.

USES : HIGH-RISE BUILDINGS, BRIDGE PYLONS & SILOS, LIFT SHAFTS, CORE WALLS.

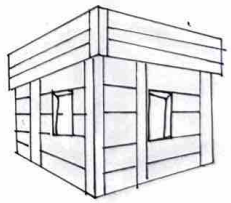
▸ **COLUMN FORMWORK** : A TEMPORARY MOLD USED TO SHAPE AND SUPPORT CONCRETE COLUMNS UNTIL THEY GAIN STRENGTH.

TYPES : TIMBER, STEEL, ALUMINIUM AND PLASTIC.

ADVANTAGES : PROVIDES ACCURATE SHAPE & SUPPORT, CAN BE REUSED.

USES : SKYSCRAPERS, INDUSTRIAL BUILDING, BRIDGES AND REINFORCED CONCRETE STRUCTURES.

▸ **MIVAN FORMWORK** : HIGH-SPEED ALUMINIUM FORMWORK SYSTEM USED FOR MASS HOUSING AND HIGH-RISE BUILDINGS, ENSURING MONOLITHIC CONCRETE STRUCTURE WITH WALLS AND SLABS CAST SIMULTANEOUSLY.



ADVANTAGES : HIGH PRECISION, DURABLE, REUSABLE AND SMOOTH FINISH.

USES : MASS HOUSING PROJECTS, HIGH RISE RESIDENTIAL & COMMERCIAL.

FORMWORK

SIGNATURE	NAME - HARSHITA	SHEET
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	SEM - 8	
	SUB - MMBC	
	COLLEGE - ANRVSA	

SMART MATERIALS AND SUPPY CHAIN OPTIMIZATION

BIG DATA IS TRANSFORMING THE WAY MATERIALS ARE SOURCED, MANAGED, AND USED IN CONSTRUCTION. BY LEVERAGING DATA ANALYTICS, CONSTRUCTION FIRMS CAN REDUCE COSTS, MINIMIZE WASTE, AND IMPROVE EFFICIENCY IN PROCUREMENT AND LOGISTICS.

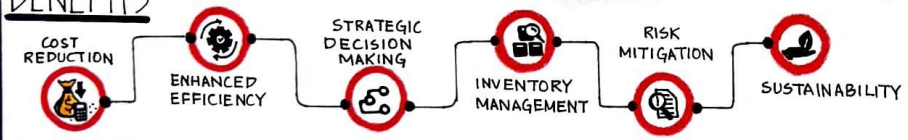
ROLE OF BIG DATA IN SMART MATERIAL MANAGEMENT

- **TRACKING MATERIAL USAGE AND REDUCING WASTE:**
  - SENSORS AND RFID TAGS ARE USED TO MONITOR MATERIAL CONSUMPTION ON-SITE.
  - DATA ANALYTICS HELPS IN REDUCING SURPLUS ORDERS, PREVENTING EXCESS INVENTORY.

- **AUTOMATED INVENTORY MANAGEMENT:**

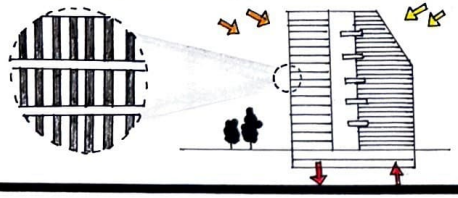
  - CLOUD-BASED SYSTEMS PROVIDE ALERTS FOR LOW STOCK, PREVENTING SHORTAGES.
  - AUTOMATED ORDERING SYSTEMS STREAMLINE PROCUREMENT BASED ON DEMAND FORECASTS.
- **REAL-TIME SUPPLY CHAIN ANALYTICS:**
  - CONSTRUCTION COMPANIES CAN TRACK SUPPLIER RELIABILITY AND DELIVERY TIMELINES.
  - AI CAN IDENTIFY INEFFICIENCIES IN LOGISTICS, REDUCING TRANSPORT DELAYS.

BENEFITS



CASE STUDY: THE EDGE AMSTERDAM, NETHERLANDS

- WORLD'S SMARTEST BUILDING, USING 28000 IOT SENSORS TO OPTIMIZE ON-SITE MATERIAL USAGE BY 30%.



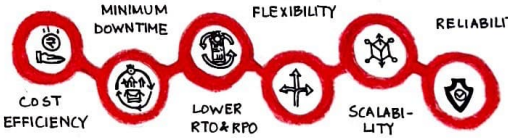
- ACHIEVED 70% ENERGY SAVINGS, MAKING IT ONE OF THE GREENEST OFFICE BUILDINGS.

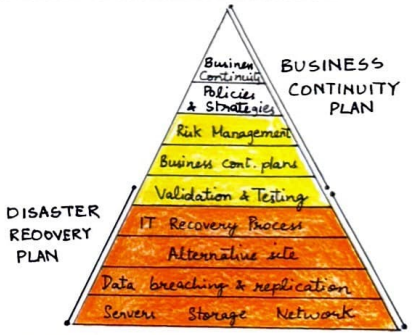
DISASTER RECOVERY & BUSINESS CONTINUITY IN CLOUD COLLABORATION

THIS CONSTRUCTION INDUSTRY RELIES HEAVILY ON DATA, DOCUMENTS AND PROJECT MANAGEMENT SYSTEMS. CLOUD-BASED DISASTER RECOVERY AND BUSINESS CONTINUITY STRATEGIES ENSURE THAT CONSTRUCTION COMPANIES CAN RECOVER QUICKLY AND MAINTAIN PROJECT PROGRESS DESPITE UNEXPECTED DISRUPTIONS.

ROLE OF CLOUD COLLABORATION IN DISASTER RECOVERY AND BUSINESS CONTINUITY

- **OFF-SITE STORAGE**: CLOUD SERVERS STORE DATA IN MULTIPLE LOCATIONS, PREVENTING PERMANENT LOSS.
- **DISASTER RECOVERY PLANS (DRP)**: CLOUD SYSTEMS PROVIDE STEP-BY-STEP RECOVERY PROCESSES TO RESTORE NORMAL OPERATIONS QUICKLY.
- **DATA ENCRYPTION AND MULTI-FACTOR AUTHENTICATION**: PREVENTS UNAUTHORIZED ACCESS AND PROTECTS SENSITIVE CONSTRUCTION DOCUMENT.
- **SCALABILITY**: CLOUD SYSTEMS ADJUST TO PROJECT NEEDS, ENSURING ALL DATA REMAINS ACCESSIBLE REGARDLESS OF PROJECT SIZE.





CASE STUDY: DUBAI'S SMART CONSTRUCTION PROJECTS

- DUBAI'S MAJOR CONSTRUCTION PROJECTS USE CLOUD-BASED COLLABORATIONS FOR DISASTER RECOVERY PLANNING.

- IN CASE OF CYBERATTACKS, SYSTEM FAILURE, DATA IS RESTORED INSTANTLY FROM BACKUP SERVERS.

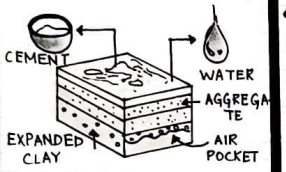
INFLUENCE OF INFORMATICS

Good work

SIGNATURE	NAME - HARSHITA	SHEET
	USN - 1AA21AT018	7
	SEM - 8	
	SUB - MMBC	
	COLLEGE - ANRVSA	

CONCRETE

- CONCRETE IS A COMPOSITE CONSTRUCTION MATERIAL MADE FROM MIXTURE OF CEMENT, WATER, AGGREGATES. IT HARDENS OVER TIME THROUGH A CHEMICAL PROCESS CALLED HYDRATION.
- LIGHT WEIGHT CONCRETE (LWC) IS A SPECIAL CONCRETE WHICH WEIGHS LIGHTER THAN CONVENTIONAL CONCRETE.
- DENSITY OF THIS CONCRETE IS LOW WHEN COMPARED TO NORMAL CONCRETE, UPTO 13% TO 71% DENSITY CAN BE DECREASED.



TYPES OF LIGHT WEIGHT CONCRETE

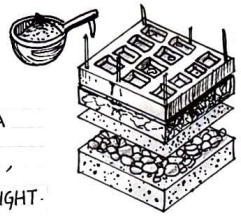
PUMICE | FOAMED SLAG | EXPANDED CLAY AND SHALES | FUEL ASH AGGREGATE

LIGHT WEIGHT AGGREGATE CONCRETE

THE LIGHT WEIGHT AGGREGATE IS A KIND OF COARSE AGGREGATE WHICH IS USED IN THE PRODUCTION OF LIGHTWEIGHT CONCRETE PRODUCTS LIKE CONCRETE BLOCKS, STRUCTURAL CONCRETE AND PAVEMENT.

AERATED CONCRETE

AERATED CONCRETE IS MADE BY ADDING A FOAMING AGENT TO CREATE AIR POCKETS, IMPROVING INSULATION AND REDUCING WEIGHT.



NO FINE CONCRETE

NO FINE CONCRETE IS A LIGHTWEIGHT CONCRETE MADE UP OF ONLY COARSE AGGREGATE, CEMENT AND WATER BY OMITTING FINES FROM CONCRETE.

ADVANTAGES	DISADVANTAGES
▸ REDUCES STRUCTURAL LOAD	▸ LOWER STRENGTH
▸ BETTER THERMAL INSULATION	▸ HIGHER WATER ABSORPTION
▸ FIRE RESISTANCE	▸ LOWER DURABILITY.

PLASTIC

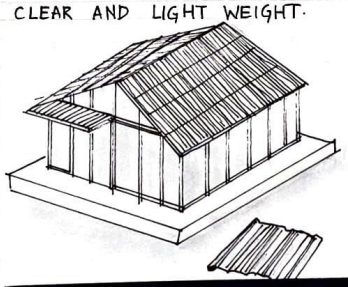
- PLASTIC IS A SYNTHETIC MATERIAL MADE FROM A WIDE RANGE OF ORGANIC POLYMERS SUCH AS PVC, POLYTHENE, NYLON ETC.

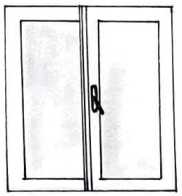
BUILDING PROPERTIES

- ▸ DURABILITY
- ▸ COST EFFECTIVENESS
- ▸ ENERGY SAVING
- ▸ SAFETY
- ▸ EASY TO INSTALL
- ▸ INSULATION
- ▸ SUSTAINABILITY.

APPLICATION

- ▸ PLASTIC FOR ROOFING : CORRUGATED PLASTIC BEEN USED FOR SHEETING HAS ROOFING IN CONSERVATORIES AND BUILDINGS WHERE TRANSPARENT PANELS ARE REQUIRED.
- ▸ PLASTIC FOR WALL : TWIN OR TRIPLE WALLED POLY-CARBONATE : PROVIDES NUMBER OF ADVANTAGES DURING INSTALLATION, SINCE IT CAN BE CUT WITH CONVENTION TOOLS.
- ▸ PLASTIC FOR WINDOW : POLYCARBOCATE IS USED TO MANUFACTURE WINDOWS, THIS PLASTIC IS STRONG, CLEAR AND LIGHT WEIGHT.





ADVANTAGES	DISADVANTAGES
▸ LIGHTWEIGHT	▸ LOW HEAT RESISTANCE
▸ COST-EFFECTIVE	▸ RECYCLING CHALLENGES.
▸ WATER PROOF	▸ ENVIRONMENT IMPACT.

GLASS-ALLUMINIUM CURTAIN WALL

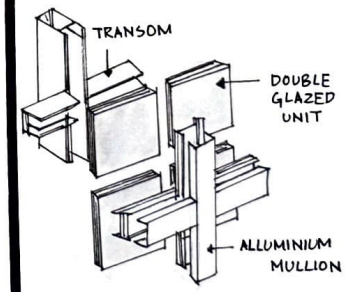
- THE ALLUMINIUM WALL PANEL IS MADE OF HIGH-QUALITY ALLUMINIUM ALLOY SHEET. ALLUMINIUM CLADDING FACADE DOESNT TAKE DEAD LOAD OF MAIN BUILDING, THERE IS A GAP BETWEEN CLADDING FACADE AND MAIN BUILDING, THIS WILL PREVENT MAIN BUILDING AGAINST WIND LOAD, AVOID DISTORTION AND STABILIZE TEMPERATURE OF INDOOR.

PROPERTIES

- ▸ LIGHTWEIGHT
- ▸ HIGH DURABILITY
- ▸ FIRE RESISTANT
- ▸ SOUND-PROOFING
- ▸ THERMAL INSULATION
- ▸ LOW MAINTENANCE

APPLICATION

- ▸ HIGH-RISE BUILDINGS - USED FOR MODERN SKYSCRAPERS.
- ▸ COMMERCIAL BUILDINGS - MALLS, HOTELS AND OFFICES.
- ▸ AIRPORTS AND TRANSPORTATION HUB - ENHANCES NATURAL LIGHTING AND SLEEK DESIGN.
- ▸ INSTITUTIONAL BUILDINGS - SCHOOLS, HOSPITALS.
- ▸ RESIDENTIAL TOWERS.
- ▸ SHOWROOMS AND RETAIL SPACES.



ADVANTAGES	DISADVANTAGES
▸ MODERN & SLEEK DESIGN	▸ HIGH INITIAL COST
▸ PROVIDES NATURAL LIGHTING	▸ GLARE ISSUES
▸ ENERGY EFFICIENCY	▸ REGULAR MAINTENANCE.

LIGHT WEIGHT MATERIALS

good.

SIGNATURE	NAME : I. HARSHITA
	USN : 1AA21AT018
	SEM : 8
	SUB : MMBC
	COLLEGE : ANRVSA

SHEET NO. 8

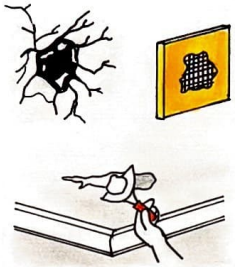
BUILDING LIFE CYCLE ASSESSMENT (LCA)

BUILDING LIFE CYCLE ASSESSMENT (LCA) IS A METHOD USED TO EVALUATE THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH ALL STAGES OF BUILDING'S LIFE - FROM RAW MATERIAL EXTRACTION THROUGH CONSTRUCTION, USE, AND EVENTUAL DEMOLITION OR RECYCLING.

MAIN STAGES

1. PRODUCT STAGE - RAW MATERIAL, EXTRACTION
2. CONSTRUCTION STAGE - TRANSPORT TO SITE
3. USE STAGE - USE, MAINTENANCE, REPAIR, REPLACEMENT, ENERGY, WATER USE.
4. END OF LIFE STAGE - DEMOLITION, DISPOSAL
5. BEYOND BUILDING LIFE - REUSE, RECYCLING.

NON-STRUCTURAL FAILURE



1. CRACKING IN WALLS OR CEILINGS

CAUSE : SHRINKAGE OF MATERIALS, POOR WORKMANSHIP, THERMAL EXPANSION / CONTRACTION OR FOUNDATION SETTLEMENT.

EFFECT : AESTHETIC DEGRADATION, WATER SEEPAGE AND LOSS OF SURFACE FINISH DURABILITY.

SOLUTION : FILL CRACKS WITH FLEXIBLE SEALANT / CRACK FILLER. USE MESH OR FIBER REINFORCEMENT IN PLASTER & CRACK STITCHING.

2. WATER LEAKAGE OR DAMPNESS

CAUSE : FAULTY WATERPROOFING, POOR DRAINAGE, CRACKS IN WALLS / ROOF.

EFFECT : MOLD GROWTH, PAINT PEELING, CORROSION OF EMBEDDED PARTS.

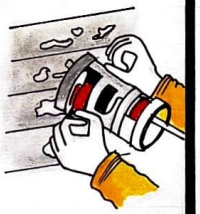
SOLUTION : APPLY WATERPROOF COATINGS OR MEMBRANES, SEAL VISIBLE CRACKS WITH WATERPROOFING COMPOUNDS, USE DAMP-PROOF COURSES

3. BLISTERING OF PAINT

CAUSE : MOISTURE TRAPPED BENEATH PAINT LAYER, PAINTING ON DAMP OR DIRTY SURFACE OR USING INCOMPATIBLE PAINT TYPES.

EFFECT : BUBBLES OR BLISTERS FROM UNDER PAINT, LEADING TO PEELING.

SOLUTION : SCRAP OFF BLISTERED AREAS & LET SURFACE DRY, APPLY A PRIMER OR SEALER BEFORE REPAINTING & IMPROVE VENTILATION.



4. HONEYCOMBING IN CONCRETE

CAUSE : POOR COMPACTION DURING CONCRETE POURING, INADEQUATE VIBRATION OR IMPROPER FRAMEWORK.

EFFECT : VOIDS OR CAVITIES ON CONCRETE SURFACES, EXPOSED AGGREGATES, REDUCED STRENGTH AND DURABILITY.

SOLUTION : CHIP OUT LOOSE MATERIAL AND PATCH USING HIGH STRENGTH REPAIR MORTAR, FOR SHALLOW HONEYCOMB, CLEAN SURFACE AND APPLY A BONDING AGENT FOLLOWED BY CEMENTITIOUS MORTAR; ENSURE FORMWORK SEALING & PROPER VIBRATION.

STRUCTURAL FAILURE - FOUNDATION FAILURE

FOUNDATION FAILURE OCCURS WHEN SOIL OR STRUCTURE SUPPORTING A BUILDING IS UNABLE TO ADEQUATELY SUPPORT LOAD, LEADING TO CRACKS, SINKING OR SHIFTING.

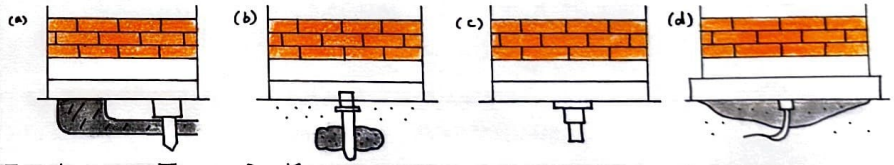
CAUSES : POOR SOIL BEARING CAPACITY, INADEQUATE DRAINAGE, CHANGES IN WATER TABLE, CONSTRUCTION ERRORS AND WEATHER CONDITIONS.

SIGNS : CRACKS IN WALLS OR FLOORS, UNEVEN FLOORS / WALLS, SAGGING OR LEANING STRUCTURES.

CONSEQUENCES : STRUCTURAL DAMAGE, SAFETY HAZARDS, COSTLY REPAIRS AND POTENTIAL LOSS OF PROPERTY.

REPAIRING FOUNDATION FAILURE : HERE ARE SOME KEY METHODS -

- UNDERPINNING : THIS INVOLVES INSTALLING NEW FOUNDATION ELEMENTS SUCH AS PIERS, PILES OR FOOTINGS.
- COMPACTION GROUTING : THIS INJECTS PRESSURIZED CEMENT GROUT TO DENSIFY AND STRENGTHEN LOOSE GRANULAR SOILS UNDERNEATH FOUNDATIONS.
- PIERING : CONCRETE OR STEEL PIERS ARE DRILLED & INSTALLED TO DEPTHS WITH SUITABLE BEARING CAPACITY & USED TO SUPPORT EXISTING FOUNDATION.
- SLAB JACKING : ALSO CALLED MUD JACKING THIS LEVELS SETTLED SLAB FOUNDATIONS BY PRESSURE INJECTING MUD SLURRY.



THE LEANING TOWER OF PISA

ONE OF THE MOST FAMOUS FOUNDATION FAILURE EXAMPLES WHERE INADEQUATE SOIL TESTING & OVERSIGHTS IN DESIGN LED TO TOWER TILTING ALMOST 5 DEGREES ON WEAK SUBSURFACE SOIL. COMPLEX REMEDIATION EFFORTS WERE UNDERTAKEN TO STABILIZE STRUCTURE.

RETROFIT AND REPAIRS

Crowd to use

SIGNATURE	NAME - HARSHITA	SHEET
	USN - 1AA21AT018	9
	SEM - 8	
	SUB - MMBC	
	COLLEGE - ANRVSA	

SMART MATERIALS

- A SMART MATERIAL IS A NEW CLASS OF NANOMATERIALS WITH THE ABILITY TO SELF-RESPOND TO EXTERNAL STIMULI.
- IT CAN ALTER ONE OR MORE OF THEIR PROPERTIES IN RESPONSE TO EXTERNAL STIMULI.
- EXTERNAL STIMULI CAN INCLUDE STRESS, TEMPERATURE, LIGHT, ELECTRICAL OR MAGNETIC FIELDS, MECHANICAL DEFORMATION, ELECTROCHEMICAL ACTIONS, OR PH VALUE.

FACTORS DRIVING GROWTH OF SM IN CONSTRUCTION:

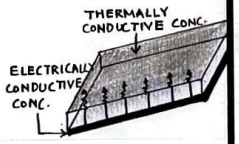
- SUSTAINABILITY
- DURABILITY
- AUTOMATION
- COST EFFICIENCY
- INNOVATION
- REGULATIONS
- SAFETY

TYPES

➤ **SMART CONCRETE** : IT IS A TYPE OF CONCRETE THAT CAN SENSE AND RESPOND TO CHANGES IN THE ENVIRONMENT. IT CONTAINS SENSORS OR OTHER MATERIALS THAT CAN DETECT CRACKS, CHANGES IN TEMPERATURE, HUMIDITY OR STIMULI. WHEN STIMULI IS DETECTED, THE SMART CONCRETE RELEASES A HEALING AGENT OR TAKES OTHER ACTION TO REPAIR ITSELF OR PREVENT FURTHER DAMAGE.

TYPES OF SMART CONCRETE

1. SELF-HEALING CONCRETE : SELF-HEALING CONCRETE IS A SMART MATERIAL DESIGNED TO REPAIR ITS OWN CRACKS AUTOMATICALLY WITH EXTERNAL INTERVENTION. IT TYPICALLY USES BACTERIA (EG: BACILLUS) OR ENCAPSULATED HEALING AGENT (LIKE POLYMERS OR ADHESIVES) THAT ACTIVATE WHEN CRACKS FORM AND WATER / AIR ENTERS.
2. SELF-SENSING CONCRETE : IT CAN DETECT CHANGES IN ITS OWN CONDITION, SUCH AS STRAIN, STRESS OR DAMAGE. THIS IS ACHIEVED BY ADDING CONDUCTIVE MATERIALS LIKE CARBON FIBERS, CARBON BLACK, OR STEEL FIBERS, WHICH ALLOW CONCRETE TO CHANGE ITS ELECTRICAL RESISTANCE WHEN DEFORMED.
3. CONDUCTIVE CONCRETE : IT INCLUDES MATERIALS THAT ALLOW IT TO CONDUCT ELECTRICITY, SUCH AS GRAPHITE POWDER, CARBON NANOTUBES, OR METALLIC PARTICLES. IT COMBINES STRUCTURAL STRENGTH WITH ELECTRICAL FUNCTIONALITY.

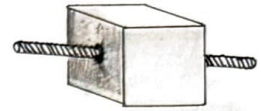


➤ **SHAPE MEMORY ALLOY** : IT IS A METAL THAT CAN RETURN TO ITS ORIGINAL SHAPE AFTER BEING DEFORMED, WHEN HEATED.

TYPES OF SHAPE MEMORY ALLOY

1. ONE-WAY SMA : REMEMBERS ITS SHAPE ONLY WHEN HEATED. AFTER DEFORMATION, IT RETURNS TO ORIGINAL SHAPE ONLY ONCE WHEN HEATED.
2. TWO-WAY SMA : REMEMBERS TWO SHAPES- ONE AT LOW TEMPERATURE AND ANOTHER AT HIGH.

➤ **CARBON CONCRETE**



- CARBON CONCRETE, IS A COMPOSITE MATERIAL THAT COMBINES THE STRENGTH AND DURABILITY OF CONCRETE WITH VERSATILY AND HIGH TENSILE STRENGTH OF CARBON FIBERS.
- IT IS FOUR TIMES STRONGER AND LIGHTER THAN USUAL REINFORCED CONCRETE.

➤ **AEROGEL**

- AEROGEL IS A SYNTHETIC POROUS MATERIAL DERIVED FROM A GEL, IN WHICH THE GEL'S LIQUID COMPONENT IS REPLACED WITH A GAS.
- IT IS A SOLID WITH LOWEST KNOWN DENSITY, MAKING IT INCREDIBLY LIGHTWEIGHT.
- AERODGELS CAN BE CLASSIFIED INTO THREE MAIN TYPES-

1. SILICA AEROGEL : IT IS MADE FROM SILICA GEL. HIGH THERMAL INSULATION PROPERTIES. USED IN VARIETY OF APPLICATIONS, INCLUDING BUILDING INSULATION, FIREPROOFING, SOUND PROOFING.
2. CARBON AEROGEL : IT IS MADE FROM CARBON NANOTUBE OR GRAPHINE. LIGHTER AND STRONGER THAN SILICA AEROGEL. IT HAS BETTER THERMAL INSULATION PROPERTIES.

3. POLYMER AEROGEL: IT IS MADE FROM POLYMERS, SUCH AS POLYIMIDE OR POLYSTYRENE. THE UNIQUE PROPERTY OF THIS AEROGEL IS IT HAS ABILITY TO BE SHAPED INTO DIFFERENT FORMS.

APPLICATIONS

USED IN CONSTRUCTION, MEDICAL DEVICES, AEROSPACE, ELECTRONICS.

BENEFITS

- SELF RESPONSIVE
- LOW MAINTENANCE
- DURABLE
- IMPROVED PERFORMANCE

CHALLENGES AND LIMITATIONS

- COST IMPLICATIONS
- TECHNICAL LIMITATIONS AND COMPATIBILITY ISSUES.
- LACK OF STANDARDIZATION AND REGULATIONS.
- RESISTANCE TO ADOPTION AND IMPLEMENTATION.

SMART MATERIALS

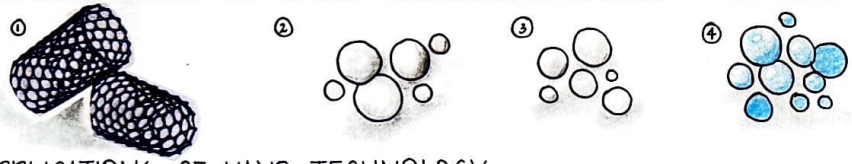
SIGNATURE	NAME - HARSHITA	SHEET
	USN - 1AA21AT018	10
	SEM - 8	
	SUB - MMBC	
	COLLEGE - ANRVSA	

NANO MATERIALS

NANO MATERIALS ARE AN INCREASINGLY IMPORTANT PRODUCT OF NANOTECHNOLOGIES. THEY CONTAIN NANO-PARTICLES, SMALLER THAN 100 NANOMETRES IN ATLEAST ONE DIMENSION.

1. CARBON NANOTUBES
2. TITANIUM DIOXIDE (TiO_2)
3. ZINC OXIDE (ZnO)
4. TUNGSTEN OXIDE (WO_3)

1. CARBON NANOTUBES : CYLINDRICAL NANOSTRUCTURES MADE OF CARBON ATOMS ARRANGED IN HEXAGONAL LATTICE. THEY ARE KNOWN FOR THEIR EXCEPTIONAL TENSILE STRENGTH, LIGHT WEIGHT, AND HIGH ELECTRICAL AND THERMAL CONDUCTIVITY.
2. TITANIUM DIOXIDE : ADDED TO CONCRETE TO IMPROVE ITS PROPERTIES. A WHITE, UV RESISTANT NANOPARTICLE WITH STRONG PHOTOCATALYTIC, ANTIBACTERIAL, AND SELF-CLEANING PROPERTIES.
3. ZINC OXIDE: A WHITE, SEMICONDUCTING NANOPARTICLE WITH UV-BLOCKING, ANTIBACTERIAL, AND ANTIFUNGAL PROPERTIES.
4. TUNGSTEN OXIDE: A THERMALLY STABLE, ELECTROCHROMIC NANOPARTICLE THAT BLOCKS INFRARED RADIATION AND EXHIBITS PHOTOCATALYTIC BEHAVIOR.

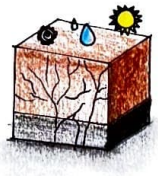


APPLICATIONS OF NANO-TECHNOLOGY

NANOTECHNOLOGY IS WIDELY USED IN CONSTRUCTION MATERIAL AS:
• IN CONCRETE • IN STEEL • IN WOOD • IN GLASS • IN COATING • IN FIRE-RESISTANCE • IN STRUCTURAL MONITORING.

NANOTECHNOLOGY IN CONCRETE

NANOTECHNOLOGY IMPROVES CONCRETE BY ADDING NANO-SIZED MATERIALS THAT ENHANCE STRENGTH, DURABILITY & PERFORMANCE.



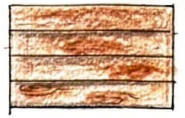
⇒KEY NANO MATERIALS : NANO-SILICA = INCREASED STRENGTH, REDUCES PORES.
CNTs = BOOSTS TENSILE STRENGTH, PREVENTS CRACKS.

NANOTECHNOLOGY IN STEEL

NANOTECHNOLOGY ENHANCES STEEL BY IMPROVING ITS STRENGTH, COROSSION RESISTANCE AND WEAR PROPERTIES.

⇒KEY NANO MATERIALS: CNTs = INCREASE TENSILE STRENGTH AND FATIGUE.
NANO CERAMIC COATING = PREVENTS RUST AND WEAR.

NANOTECHNOLOGY IN WOOD



WOOD IS ALSO COMPOSED OF NANOTUBES WHICH ARE TWICE AS STRONG AS STEEL. NANOTECH IN WOOD IMPROVES FIRE RESISTANCE, DURABILITY, AND MOISTURE CONTROL.

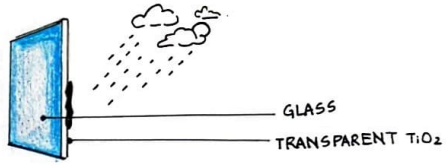
⇒NANO MATERIALS : NANO SILVER = ADDS ANTIMICROBIAL AND UV PROTECTION.
NANO CLAY = ENHANCES FIRE RESISTANCE & DIMENSIONAL STABILITY.

NANOTECHNOLOGY IN GLASS

NANOTECHNOLOGY ENHANCES GLASS BY ADDING SELF-CLEANING, AND THERMAL CONTROL PROPERTIES.

⇒KEY NANO MATERIALS : TITANIUM DIOXIDE, SILICA, TUNGSTEN OXIDE & ZINC OXIDE.
USED IN SMART WINDOWS, FACADES, SOLAR CONTROL GLASS & GREEN BUILDING.

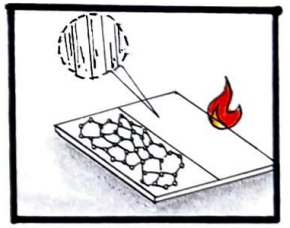
SELF CLEANING OF GLASS
SELF CLEANING GLASS COATED WITH TITANIUMDIOXIDE COATING BREAKS DOWN ORGANIC MATTER; CAN BLOCK UV AND GLARE.



NANOTECHNOLOGY IN COATING

- COATING IS AN AREA OF SIGNIFICANT RESEARCH.
- NANOTECHNOLOGY IS BEING APPLIED TO PAINTS AND INSULATING PROPERTIES BY ADDITION OF NANO-SIZED CELLS, PORES AND PARTICLES, THE TiO_2 WILL BREAK DOWN AND DISINTEGRATE ORGANIC DIRT THROUGH POWERFUL CATALYTIC REACTION.

NANOTECHNOLOGY IN FIRE-RESISTANCE



NANOTECHNOLOGY IMPROVES FIRE-RESISTANCE BY ENHANCING THERMAL STABILITY, FLAME RETARDANCY, AND SMOKE SUPPRESSION IN MATERIALS.

NANOTECHNOLOGY IN STRUCTURAL MONITORING

- NANOTECHNOLOGY ENABLES SENSORS WHICH EXHIBIT 'SELF-SENSING' AND 'SELF ACTUATING' CAPABILITY.
- THEY CAN MONITOR AND CONTROL ENVIRONMENT. CONDITIONS (EG: TEMPERATURE, MOISTURE, SMOKE, NOISE, ETC.)
- THEY CAN ALSO MONITOR THE MATERIALS / STRUCTURE PERFORMANCE.
- IT CAN PROVIDE EARLY INDICATION BEFORE A FAILURE OF THE STRUCTURE.

NANO MATERIALS

SIGNATURE	NAME: HARSHITA	SHEET
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	SEM: 8	
	SUB: MMBC	
	COLLEGE: ANRVSA	

GREEN BUILDING

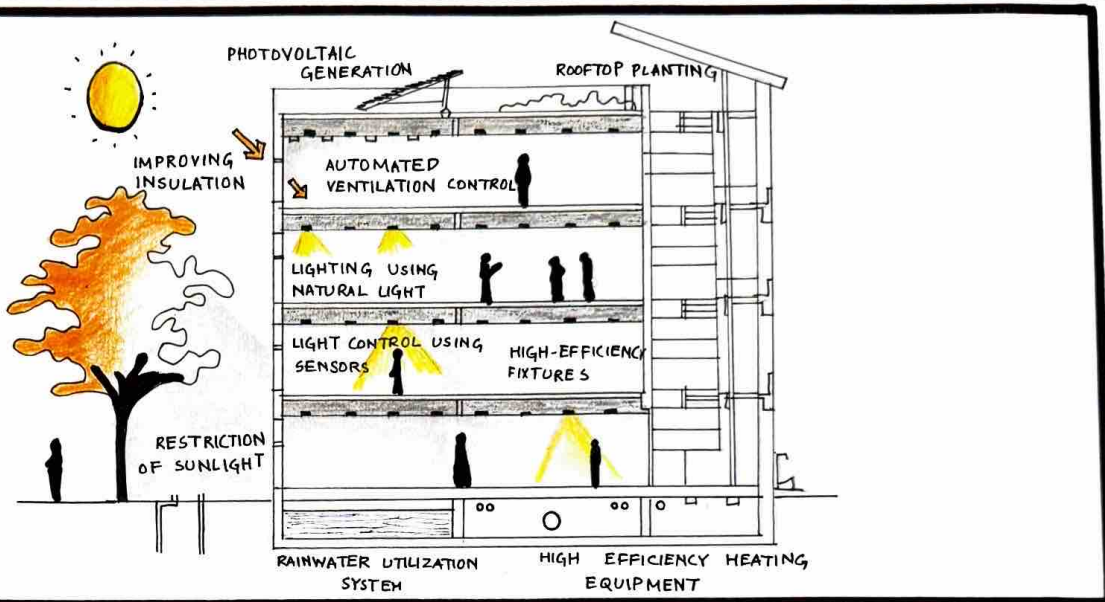
- A GREEN BUILDING IS DESIGNED TO BE ENVIRONMENTALLY RESPONSIBLE AND RESOURCE EFFICIENT.
- IT FOCUSES ON REDUCING ENERGY, WATER AND MATERIAL USAGE DURING CONSTRUCTION AND OPERATION.
- INCORPORATES SUSTAINABLE DESIGN PRINCIPLES LIKE NATURAL LIGHTING, VENTILATION AND INSULATION.
- USES ECO-FRIENDLY MATERIALS, OFTEN RECYCLED OR LOCALLY SOURCED.
- PROMOTES SUSTAINABILITY THROUGH THE ENTIRE BUILDING LIFE CYCLE - FROM DESIGN TO DEMOLITION.

OBJECTIVES OF GREEN BUILDING

- REDUCE ENVIRONMENTAL IMPACT OF BUILDINGS.
- CONSERVE NATURAL RESOURCES LIKE ENERGY, WATER, ETC.
- ENHANCE ENERGY EFFICIENCY THROUGH SMART DESIGN.
- IMPROVE INDOOR AIR QUALITY.
- MINIMIZE WASTE GENERATION DURING CONSTRUCTION.
- LOWER GREENHOUSE GAS EMISSIONS.
- ENSURE ECONOMIC SUSTAINABILITY THROUGH REDUCED OPERATIONAL COST.
- ENCOURAGE SUSTAINABLE SITE PLANNING.
- SUPPORT LONG-TERM RESILIENCE OF BUILDINGS TO CLIMATE AND RESOURCE CHALLENGES.

FEATURES OF GREEN BUILDING

- ENERGY-EFFICIENT SYSTEMS
- USE OF RENEWABLE ENERGY.
- WATER-SAVING FIXTURES
- NATURAL LIGHT & VENTILATION
- ECO-FRIENDLY MATERIALS
- GREEN ROOFS & LANDSCAPING
- WASTE REDUCTION SYSTEMS
- SMART TECHNOLOGY INTEGRATION
- HEALTHY INDOOR ENVIRONMENT
- CLIMATE RESPONSIVE DESIGN.



GREEN BUILDING RATING SYSTEMS

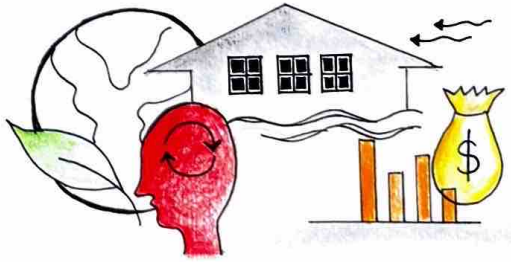
GREEN BUILDING RATING SYSTEMS ARE STANDARDIZED TOOLS OR FRAMEWORKS USED TO ASSESS & CERTIFY ENVIRONMENTAL PERFORMANCE AND SUSTAINABILITY OF BUILDINGS.

GREEN BUILDING RATING SYSTEMS USED AROUND THE WORLD :-

COUNTRY	RATING SYSTEM
INDIA	LEED INDIA / TERI GRIHA
USA	GREEN GLOBES / LEED
AUSTRALIA	NABARS / GREEN STAR
CANADA	LEED CANADA/GREEN GLOBES
UK	MINERGIE / BREEAM
UAE	ESTIDMA
ITALY	PROTOCOLLO ITACA
BRAZIL	AQUA / LEED BRASIL

BENEFITS OF GREEN BUILDING

- ENVIRONMENTAL: LOWER CARBON FOOTPRINT, CONSERVATION OF RESOURCES.
- ECONOMIC: REDUCED OPERATING COSTS, INCREASED PROPERTY VALUE, GOVERNMENT INCENTIVES.
- SOCIAL: IMPROVED INDOOR AIR QUALITY, BETTER OCCUPANT HEALTH AND PRODUCTIVITY.
- RESILIENCE: BETTER ADAPTION TO CLIMATE CHANGE AND EXTREME WEATHER EVENTS.



GREEN BUILDING

SIGNATURE	NAME : HARSHITA	SHEET
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	SEM : 8	
	SUB : MMBC	
	COLLEGE : ANRVSA	

NET ZERO ENERGY BUILDING (NZEB)

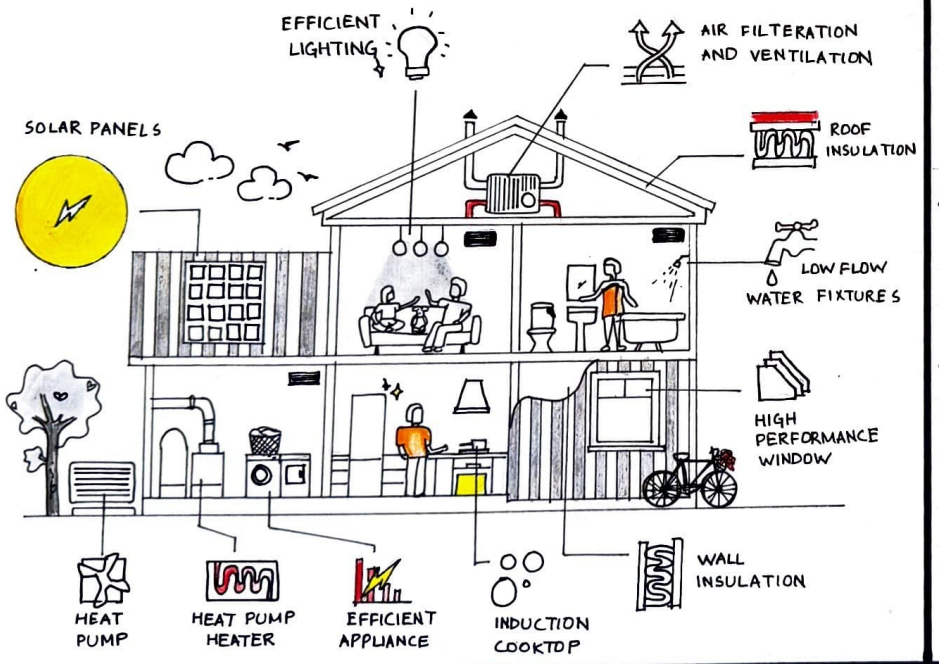
A NET ZERO ENERGY BUILDING IS A BUILDING THAT GENERATES AS MUCH ENERGY AS IT CONSUMES OVER THE COURSE OF THE YEAR. THIS BALANCE IS ACHIEVED THROUGH A COMBINATION OF ENERGY EFFICIENCY AND ON-SITE RENEWABLE ENERGY GENERATION.

CORE PRINCIPLES OF NZEB

- ENERGY EFFICIENCY : BUILDINGS ARE DESIGNED TO USE MINIMAL ENERGY FOR HEATING, COOLING, LIGHTING AND APPLIANCES.
- RENEWABLE ENERGY GENERATION : TO MEET BUILDING'S ENERGY DEMAND, RENEWABLE ENERGY SYSTEMS ARE INSTALLED. (TYPICALLY SOLAR PANELS OR SMALL WIND TURBINES).
- ENERGY MANAGEMENT SYSTEM : SMART TECHNOLOGIES MONITOR AND CONTROL ENERGY USAGE, OPTIMIZING PERFORMANCE AND REDUCING WASTE.

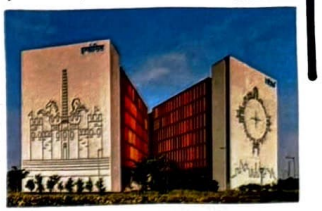
DESIGN STRATEGIES

- PASSIVE DESIGN
- EFFICIENT HVAC SYSTEMS
- LOW ENERGY APPLIANCES/LIGHTING
- HIGH PERFORMANCE BUILDING
- WATER CONSERVATION AND RECYCLING.



CASE STUDY - INFOSYS CAMPUS, NAGPUR.

LOCATION : NAGPUR, MAHARASHTRA
OCCUPANCY TYPE : OFFICE
PROJECT AREA : 29,500 m^2
ENERGY PERFORMANCE INDEX : 25 kWh/m^2/YEAR



KEY SUSTAINABLE FEATURES

1. ENERGY EFFICIENCY : THE BUILDING INCORPORATES HIGH PERFORMANCE INSULATION, ENERGY EFFICIENT LIGHTING, OPTIMIZED HVAC SYSTEMS TO MINIMIZE ENERGY CONSUMPTION.
2. PASSIVE DESIGN ELEMENTS : ORIENTATION - THE BUILDING'S ORIENTATION AND DESIGN MAXIMIZE NATURAL DAYLIGHT AND VENTILATION, REDUCING RELIANCE ON ARTIFICIAL LIGHTING AND MECHANICAL COOLING.
3. RENEWABLE ENERGY INTEGRATION : SOLAR POWER - EQUIPPED WITH ROOFTOP SOLAR PHOTOVOLTAIC SYSTEMS THAT GENERATE SIGNIFICANT ON SITE RENEWABLE ENERGY.

4. WATER CONSERVATION : RAINWATER HARVESTING - SYSTEMS ARE IN PLACE TO COLLECT AND UTILIZE RAINWATER. WASTEWATER TREATMENT - ONE SITE SEWAGE TREATMENT PLANTS RECYCLE WATER FOR LANDSCAPING AND FLUSHING.
5. MATERIAL AND CONSTRUCTION : EMPHASIS ON REDUCING CONSTRUCTION WASTE AND MINIMIZING ENVIRONMENTAL IMPACT DURING BUILDING PROCESS.

PERFORMANCE METRICS

- ENERGY PERFORMANCE INDEX (EPI) : ACHIEVED AN EPI OF 25 kWh/m^2/YEAR, SIGNIFICANTLY LOWER THAN CONVENTIONAL OFFICE BUILDING.
- EPI REDUCTION : A 52% REDUCTION IN EPI COMPARED TO GRIHA BENCHMARKS.

CONCLUSION

THIS CASESTUDY HIGHLIGHTS THE POTENTIAL OF NET ZERO ENERGY BUILDINGS TO ADDRESS ENERGY CHALLENGES, REDUCE CARBON EMISSIONS, AND CREATE HEALTHIER, FUTURE-READY WORKSPACES - SERVING AS AN INSPIRING MODEL FOR LARGE-SCALE GREEN DEVELOPMENT IN INDIA AND BEYOND. THE INFOSYS CAMPUS EXEMPLIFIES HOW THOUGHTFUL DESIGN AND SUSTAINABLE PRACTICES CAN LEAD TO ENERGY EFFICIENT AND ENVIRONMENTALLY FRIENDLY BUILDINGS IN INDIA'S DIVERSE CLIMATE CONDITIONS.

NET ZERO ENERGY BUILDING

SIGNATURE	NAME : HARSHITA	SHEET
	USN : 1AA21AT018	13
	SEM : 8	
	SUB : MMBC	
	COLLEGE : ANRVSA	