METHODS AND MATERIALS IN BUIDDING CONSTRUCTION

V

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COLLEGE	ANRVSA

INDEX

INTRODUCTION TO PLANAR TRUSSES

- A PLANAR TRUSSES IS A FRAME WORK OF SLENDER MEMBER THAT ARE CONNECTED AT JOINTS AND LIE IN A SINGLE TWO - DIMENSIONAL PLANE.
- THE MEMBERS OF A PLANAR TRUSS RESISTS LOADS APPLIED IN THAT PLANE. THE BASIC ELEMENTS OF A PLANAR TRUSS IS A TRIANGLE, WHERE THREE MEMBERS ARE JOINED 1) TOP AND BOTTOM CHORDS 2) WEBS AND PANNELS 3) ZERO FORCE MEMBERS.
- IT CAN ALSO BE DEFINED AS, A PLANAR TRUSS IS ONE WHERE ALL MEMBERS AND NODES LIE WITHIN A TWO-DIMENSIONAL PLANE.

ADVANTAGES

1. AWARE OF MEMBERS BEHAVIOUR - DIAGONAL MEMBERS ARE IN TENSION. VERTICAL MEMBERS ARE IN COMPRESSION.
2. CAN BE USED TO A DESIGN A COST-EFFECTIVE STRUCTURE.
3. USED FOR SPAN LARGE DISTANCES WITH A STRONG LIGHT WEIGHT STRUCTURE.
4. PLANAR TRUSS ARE TWO DIMENSIONAL TRUSS BUILT OUT OF A TRIANGULAR SUBUNITS.

DISADVANTAGES

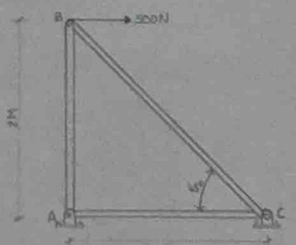
1. REQUIRED SPECIALIZED EQUIPMENT FOR HANDLING AND FOR INSTALLATION.
2. INCLUDES POSSIBILITY OF POOR CONNECTIONS WITH POOR WELDING QUALITY.
3. VERY HARD TO MODIFY IF SOMETHING NEEDS TO BE CHANGED.
4. DUE TO PRE-FABRICATED NATURE, SINCE OFFER LESS FLEXIBILITY IN TERMS OF DESIGN CUSTOMIZATION.

APPLICATIONS

- CONSTRUCTION : STEEL TRUSSES ARE USED IN MANY TYPES OF BUILDINGS, INCLUDING AIRPORT TERMINALS, AIRCRAFT HANGERS, SPORTS STADIA, AUDITORIUM AND WAREHOUSE. THEY ARE ALSO USED BRIDGES AS WELL AS IN THE CONSTRUCTION OF SCAFFOLDINGS AND CRANES.
- INTERNAL LOAD SUPPORT : STEEL TRUSSES CAN BE USED TO SUPPORT SUSPENDED CEILINGS AND OTHER SERVICES.
- INDUSTRIAL APPLICATIONS : FLAT TRUSSES CAN BE USED AS ROOF GIRDENS, FRAME RAFTERS, AND BEAMS. SPATIAL TRUSSES CAN BE USED AS HIGH VOLTAGE POLES, RADIO AND TV TOWERS, AND MASTS. ARTICULATED TRUSSES ARE USED IN THE POWER INDUSTRY AS CONVEYOR BELT FLYOVERS.

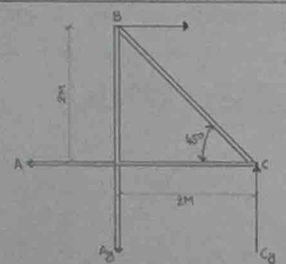
STEEL TRUSSES ARE POPULAR IN CONSTRUCTION BECAUSE THEY ARE RELATIVELY LIGHT BUT CAN SUPPORT LARGE LOADS. THEY ALSO HELP MAKE STRUCTURE MORE STABLE.

THE METHODS OF JOINTS



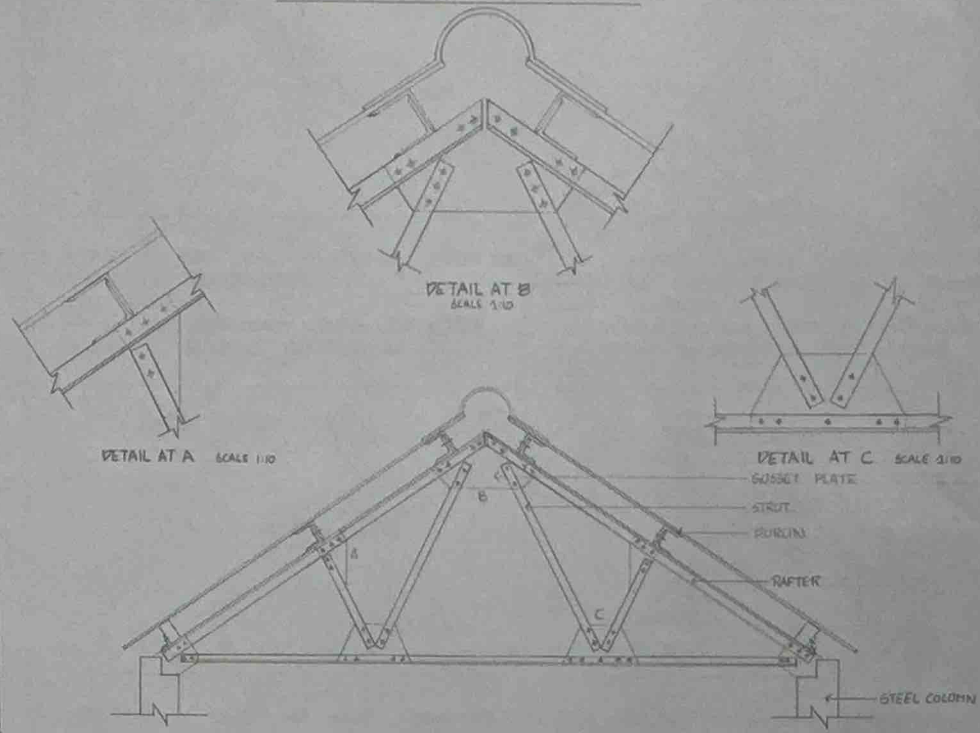
- THIS METHOD IS BASED ON THE PRINCIPLE THAT IF A STRUCTRAL SYSTEM CONSTITUTES A BODY IN A EQUILIBRUM, THEN ANY JOINT IN THAT SYSTEM IS EQUILIBRIUM.
- THUS, CAN BE ISOLATED FROM THE ENTIRE SYSTEM AND ANALYZED USING CONDITIONS OF EQUILIBRIUM.

THE METHOD OF SECTIONS



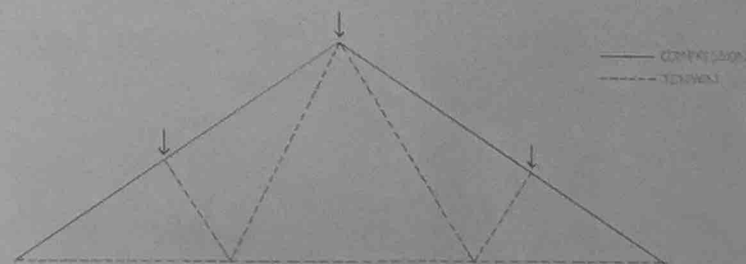
- THE METHOD OF SECTION IS A PROCESS USED TO SOLVE FOR THE UNKNOWN FORCES ACTING ON MEMBERS OF A TRUSS.
- IT INVOLVES BREAKING THE TRUSS DOWN THE INDIVIDUAL SECTIONS AND ANALYZING EACH SECTION AS A SEPARATE RIGID BODY.

PARTS OF ROOF TRUSS



FORCES ACTING ON A TRUSS

SCALE 1:200



→ BOTTOM CHORD IS ALWAYS IN TENSION.
→ TOP CHORDS ARE IN COMPRESSION.
→ WEB IS IN ALTERNATE ARRANGEMENT OF MEMBER IN COMPRESSION AND TENSION.

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INTRODUCTION TO PLANAR TRUSSES

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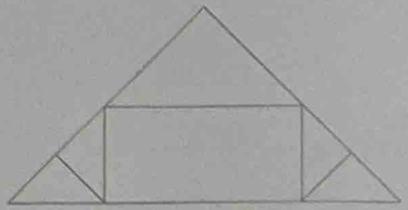
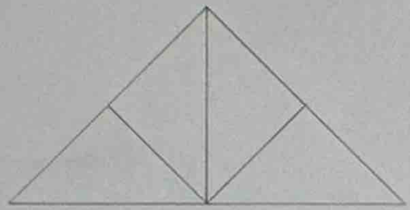
QUEEN POST TRUSS



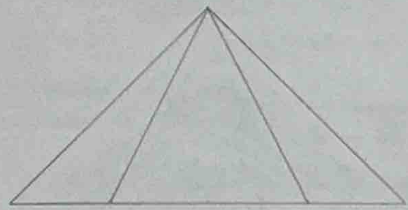
- A POST IS A TENSION MEMBER IN A TRUSS THAT CAN SPAN LONGER OPENINGS THAN KING TRUSS.
- SPAN - 4.9 - 18.2M
- APPLICATIONS - RESIDENTIAL, COMMERICALS SUCH AS SHED, BARNS, SMALL CHRUCHES

KING POST TRUSS



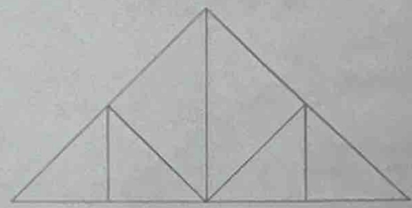
- A POST EXTENDS VERTICALLY FROM A CROSS BEAM TO THE APEX OF A TRIANGULAR TRUSS
- SPAN - 4.9 - 7.9M
- APPLICATIONS - SIMPLE ROOF TRUSS AND AN SHORT SPAN BRIDGES

FINK POST TRUSS



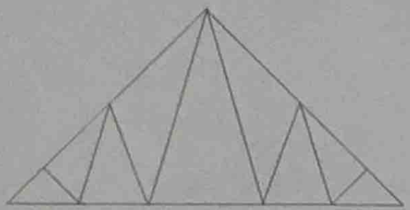
- A TYPE OF ROOF THAT IS COMMONLY USED IN COMMERICAL CONSTRUCTION.
- SPAN - 4.9 - 14M
- APPLICATIONS - PEDESTRIAN BRIDGES AND A ROOF TRUSSES IN BUILDING CONSTRUCTION.

HOWE TRUSS



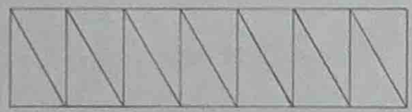
- TRUSS BRIDGE CONSISING CHORDS VERTICALS, DIAGONALS WHOSE MEMBERS ARE IN TENSIONS.
- SPAN - 7.3 - 18.3M
- APPLICATIONS - WIDELY USED IN WOOD BUILDS. PARTICULARY IN PROVIDING ROOF SUPPORT.

DOUBLE FINK TRUSS



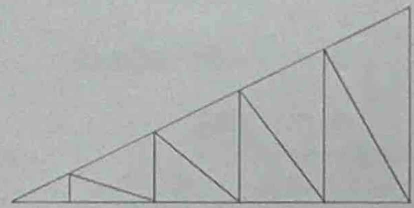
- A TYPE OF ROOF TRUSS THAT IS MADE UP OF A TWO SETS OF PARALLEL CHORDS CONNECTED.
- SPAN - 6.7 - 18.3M
- APPLICATIONS - ROOF TRUSS, PEDESTRIAN BRIDGES.

FLAT TRUSS OR PARALLEL CHORD TRUSS



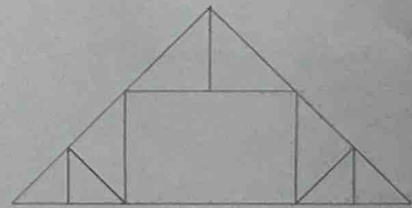
- A TRUSS WHICH HAS THE TOP CHORD PARALLEL TO THE BOTTOM CHORD OVER ENTIRE LENGTH
- SPAN - 7.3 - 21.M
- APPLICATON - ENGINEERING PROJECTS, LIKE BRIDGES, BRIDGES, BUILDING STRUCTURES.

NORHT LIGHT TRUSS



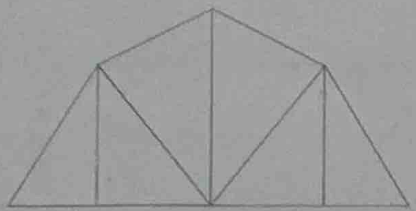
- TRADITIONALLY USED FOR SHORT SPANS IN A INDUSTRIAL WORKSHOP - TYPE BUILDINGS.
- SPAN 20-30M
- APPLICATIONS - OFFICE SPACES HOME THEATRE, AND READING ROOM.

ATTIC TRUSS



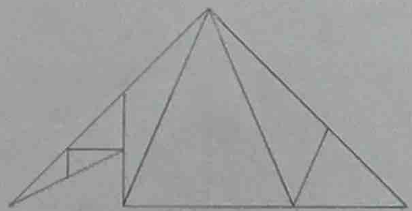
- TYPE OF ROOF TRUSS WITH AN OPEN SPACE AT ITS BOTTOM CENTER TO ACCOMODATE LIVING SPACE.
- SPAN - UPTO 15M.
- APPLICATIONS - RESIDENTIAL HOMES, GARAGE, AGRICULTURAL BUILDINGS.

GAMBREL TRUSS



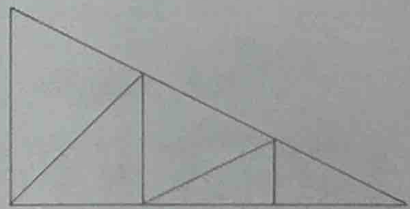
- A TYPE OF ROOF TRUSS THAT HAS TWO SLOPING SIDES ON EACH OF ITS TWO HALVES.
- SPAN - 7.3 - 14.6M
- APPLICATIONS - TO BUILD ROOFS FOR BARNS, SHEDS, ENERGY - EFFICIENT HOUSES.

STUDIO VAULT



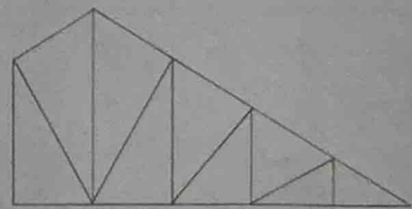
- OCCURS WHEN BOTTOM CHORD IS PITCHED IN ONE DIRECTION WITHOUT PEAK, TERMINATED BY WEP
- SPAN - 7.3 - 14.6M
- APPLICATIONS - TO SUPPORT LIGHTNING, AUDIO AND EQUIPMENT

MONO PITCH



- A SHED ROOF, KNOWN VARIOUSLY PENT ROOF LEAN - TO - ROOF.
- SPAN - HORIZONTAL DISTANCE OF ROOF COVERS
- APPLICATIONS - MODERN ARCHITECTURE, HOMES.

SHED TRUSS



- DESIGNED FRAMEWORK, DISTRIBUTE THE WEIGHT OF ROOF PROPERLY TO SUPPORT WALLS.
- SPAN - 4.8M
- APPLICATIONS - AIRPORT TERMINALS, HANGERS

TYPES OF STEEL TRUSSES

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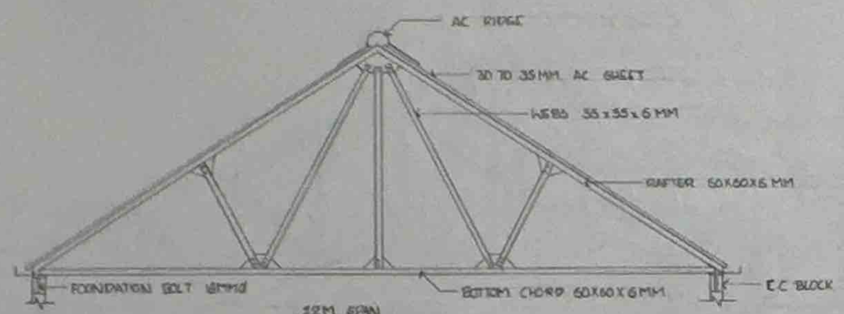
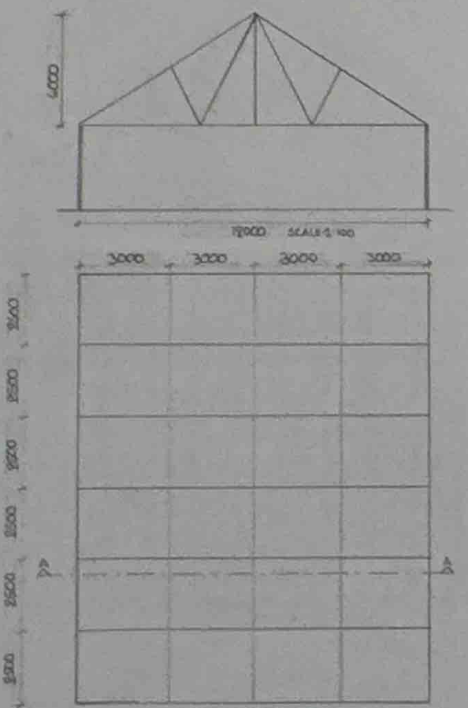
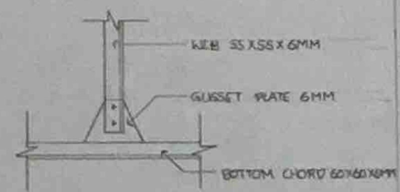


12M SPAN
SECTION A-A SCALE 1:40

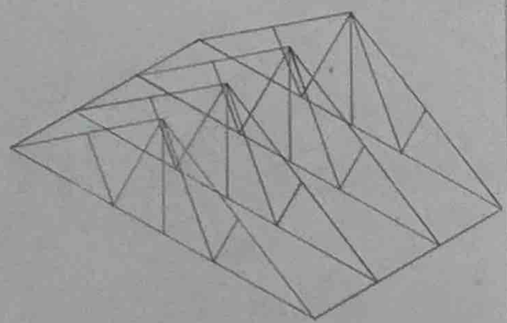


KEY PLAN SCALE 1:100

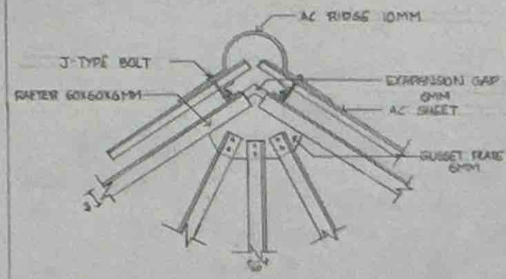
DETAIL AT E SCALE 1:10



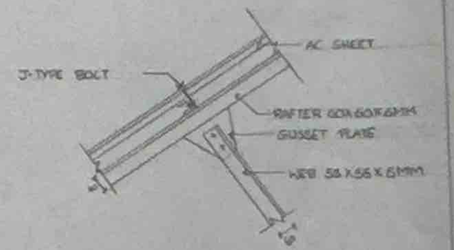
ISOMETRIC VIEW



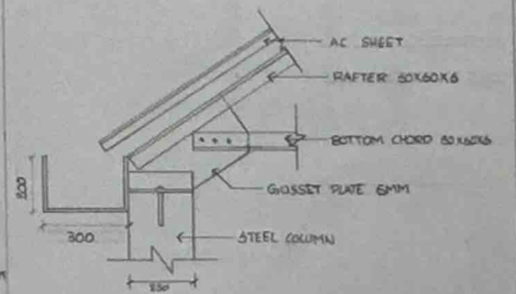
DETAIL AT A SCALE 1:10



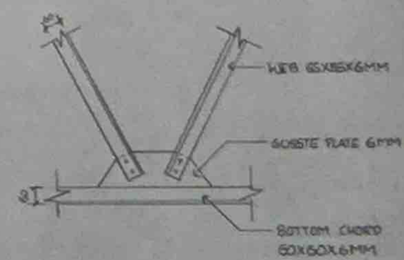
DETAIL AT B SCALE 1:10



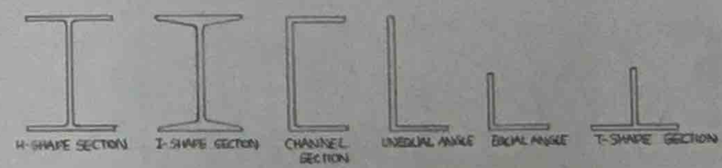
DETAIL AT C SCALE 1:10



DETAIL AT D SCALE 1:10



STEEL SECTIONS USED



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ALL MEASUREMENT ARE IN MM

FINK TRUSS

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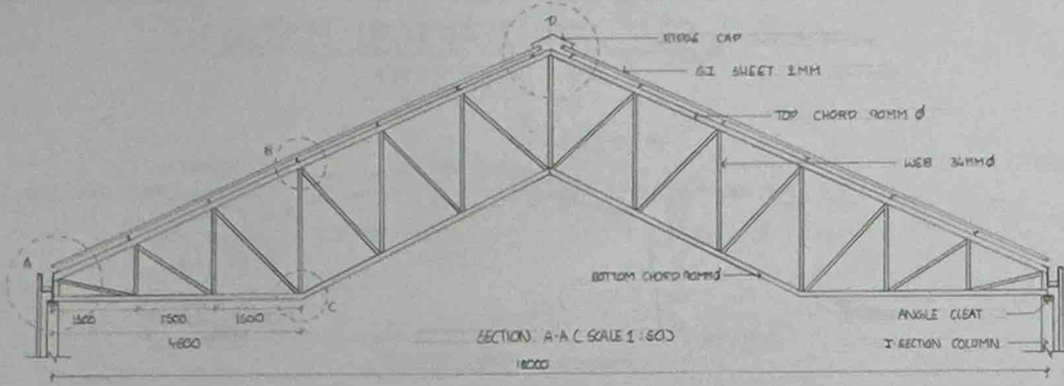
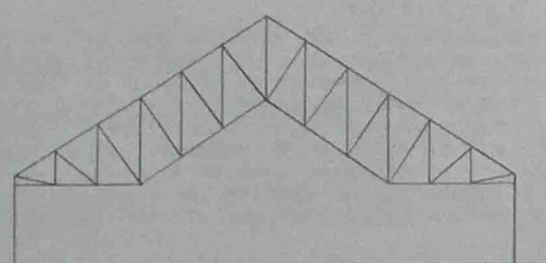
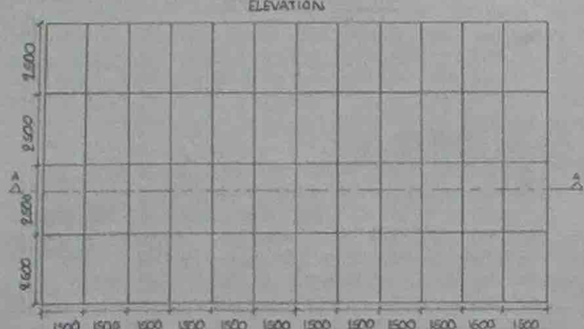
SECTION AND KEY PLAN



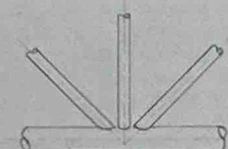
SECTION A-A (SCALE 1 :50)



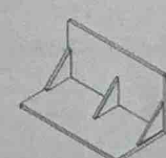
ELEVATION



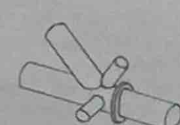
KEY PLAN



WELDED CONNECTION



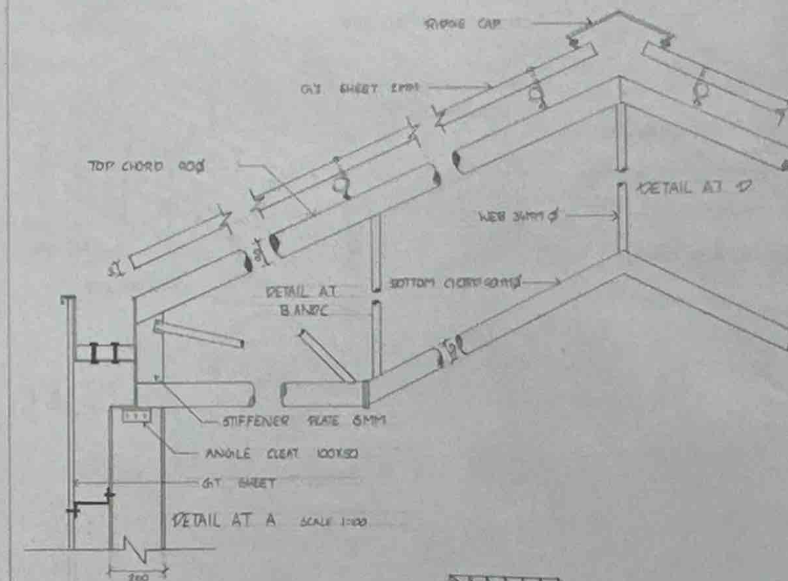
ANGLE CLEAT



FLANGE SPLICE

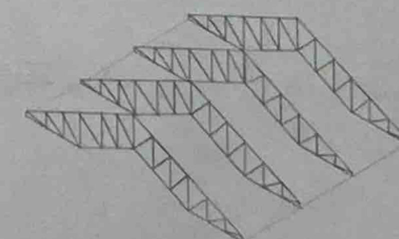
ALL MEASUREMENT ARE IN MM

DETAILS

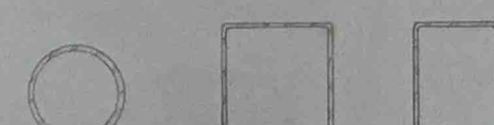


DETAIL AT A SCALE 1:100

ISOMETRIC VIEW
(SCALE 1:200)



SECTIONS USED



HOLLOW CIRCULAR TUBE

HOLLOW SQUARE

HOLLOW RECTANGULAR

TUBULAR TRUSS

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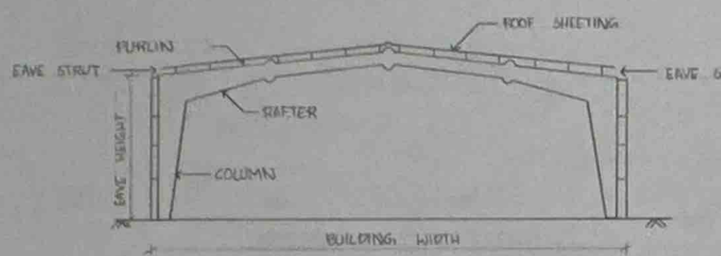
INTRODUCTION

- PRE-ENGINEERED BUILDING (PEB) REFERS TO THE CONSTRUCTION METHOD WHERE THE BUILDING'S STRUCTUR COMPONENTS ARE MANUFACTURED AT A FACTORY AND ASSEMBLED ON-SITE.
- THESE COMPONENTS ARE ENGINEERED TO BE ASSEMBLED ON-SITE, REDUCING CONSTRUCTION TIME COST SIGNIFICANTLY COMPARED TO TRADITIONAL BUILDING METHODS.
- PRE-ENGINEERED BUILDINGS ARE FULLY FABRICATED IN THE FACTORY AFTER DESIGNING, THEN TRANSPORTED TO THE SITE IN COMPLETELY KNOCKED DOWN (CKD) CONDITION AND ALL COMPONENTS ARE ASSEMBLED AND ERECTED WITH NUT-BOLTS, THERE BY REDUCING THE TIME OF COMPLETION.

SECTION OF TYPICAL PEB STEEL STRUCTION



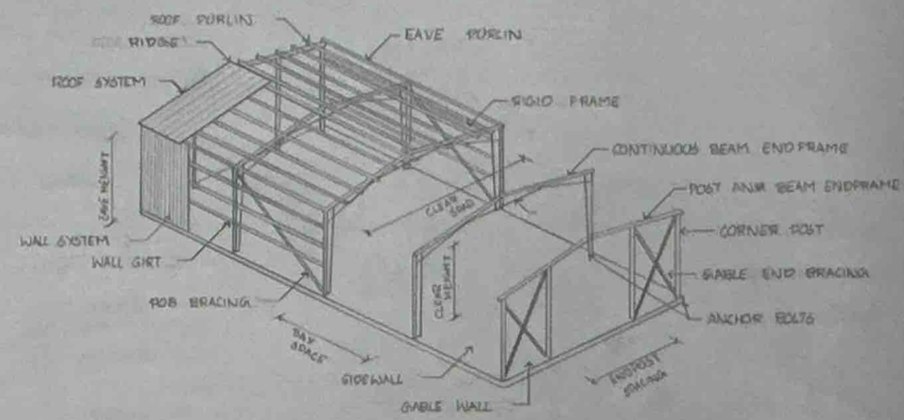
ADVANTAGES

- COST EFFECTIVE : PEB STRUCTURES ARE COST-EFFECTIVE COMPARED TO CONVENTIONAL STRUCTURES.
- SPEED OF CONSTRUCTION : PEB STRUCTURES CAN BE CONSTRUCTED MUCH FASTER THAN TRADITIONAL BUILDINGS DUE TO THE USE OF STANDARDIZED AND PRE-FABRICATED COMPONENTS.
- DESIGN FLEXIBILITY : IT OFFERS A HIGH DEGREE OF FLEXIBILITY IN DESIGN. THEY CAN BE EASILY TAILORED TO MEET SPECIFIC DESIGN REQUIREMENTS, ALLOWING FOR VERSATILE ARCHITECTURAL EXPRESSIONS.
- QUALITY CONTROL : COMPONENTS OF PEB STRUCTURES ARE MANUFACTURED IN A CONTROLLED ENVIRONMENT ENSURING HIGH-QUALITY STANDARDS. THIS RESULTS IN MORE RELIABLE AND DURABLE BUILDINGS.
- ENERGY EFFICIENCY : PEB STRUCTURES CAN BE DESIGNED TO BE DESIGNED TO BE ENERGY-EFFICIENT, INCORPORATING FEATURES SUCH AS INSULATION AND EFFECIENT HVAC SYSTEMS, LEADING TO REDUCED ENERGY CONSUMPTION.
- ENVIRONMENTALLY FRIENDLY : THESE PRODUCE LESS CONSTRUCTION WASTE DUE TO PRECISE MANUFACTURING.
- LOW MAINTENANCE : DUE TO HIGH QUALITY OF MATERIALS AND PRECISION IN MANUFACTURING, PEB STRUCTURES REQUIRES LOWER MAINTENANCE, REDUCING LONG-TERM COSTS.
- SPACE EFFICIENCY : PEB STRUCTURES MAXIMIZE INTERIOR SPACE WITHOUT THE NEED FOR INTERNAL COLUMNS, PROVIDING MORE USABLE SPACE FOR VARIOUS PURPOSES.

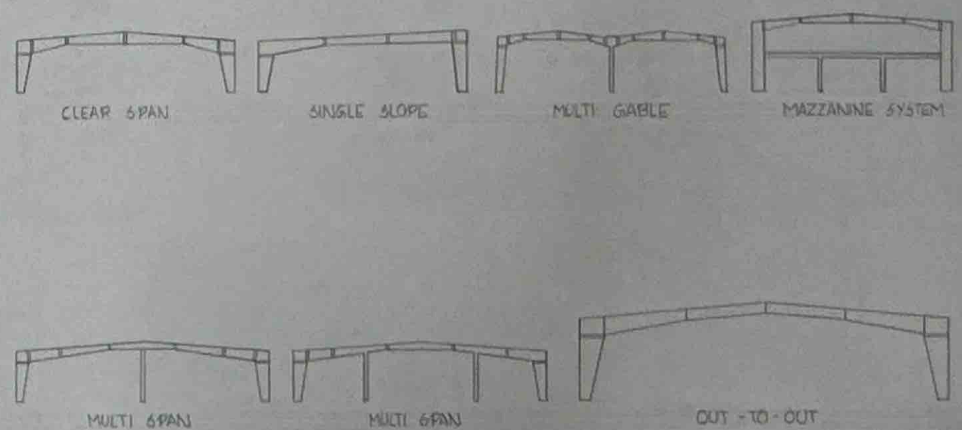
DISADVANTAGES

- LIMITED SPAN : PEB STRUCTURES MIGHT HAVE LIMITATIONS REGARDING THE SPAN THEY CAN COVER.
- DESIGN CONSTRAINTS : WHILE THEY OFFER DESIGN FLEXIBILITY, ELABORATE OR INTRICATE DESIGNS MIGHT BE CHALLENGING TO ACHIEVE WITH PEB.
- INITIAL INVESTMENT : ALTHOUGH THEY ARE COST-EFFECTIVE IN THE LONG RUN, THE INITIAL INVESTMENT FOR PEB STRUCTURES, INCLUDED ENGINEERING, MANUFACTURING AND TRANPORTATION, CAN BE HIGH.
- SKILL REQUIREMENT : SKILLED LABOUR IS NECESSARY DURING THE ERECTION OF PEB STRUCTURES.
- LIMITED AESTHETICS : FOR PROJECTS WHERE ARCHITECTURAL AESTHETICS ARE A PRIMARY CONCERN, PEB STRUCTURES MIGHT NOT OFFER THE SAME LEVEL OF AESTHETIC FREEDOM AS TRADITIONAL CONSTRUCTION METHODS.

COMPONENTS OF PEB STEEL STRUCTURES



TYPES OF PEB STEEL STRUCTURES



INTRODUCTION TO PEB STRUCTURE

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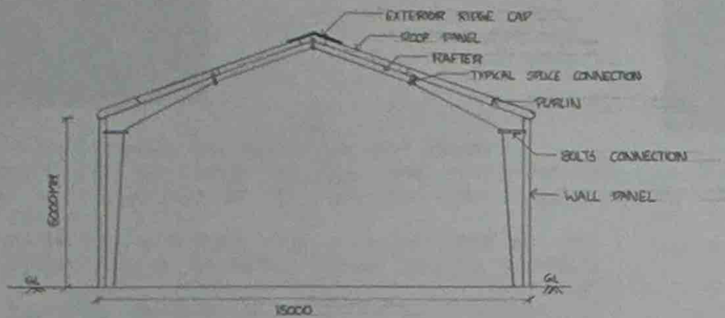
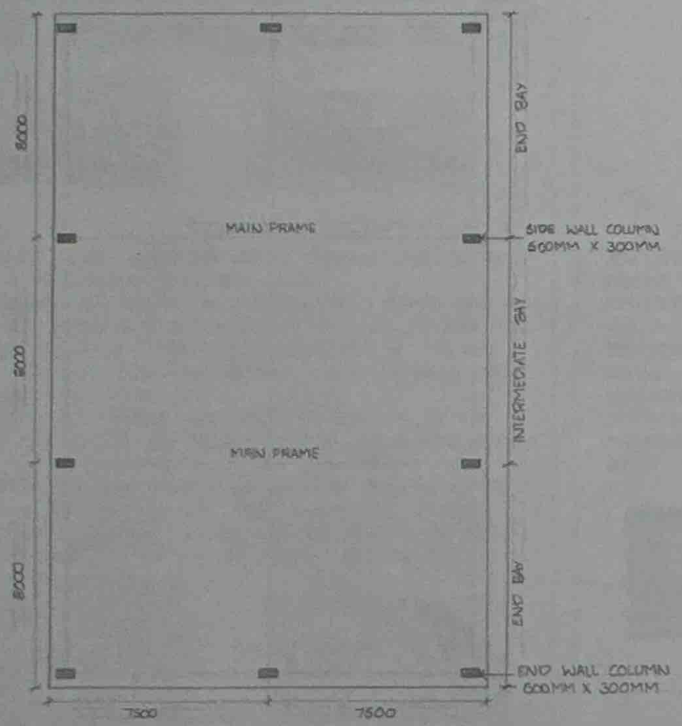
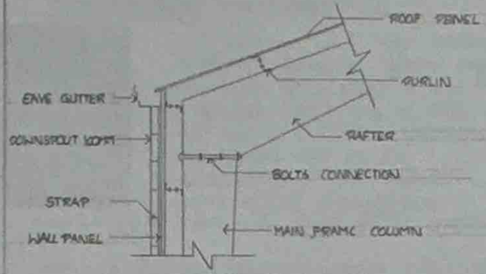


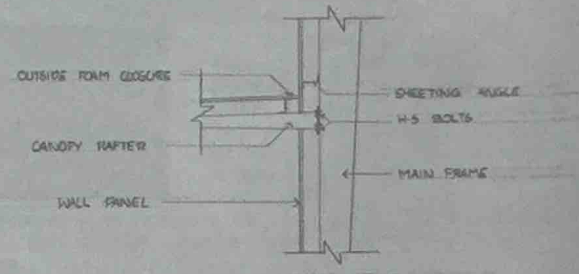
SECTION SCALE 1:100



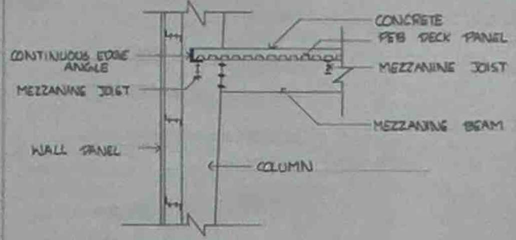
KEY PLAN
SCALE 1:100



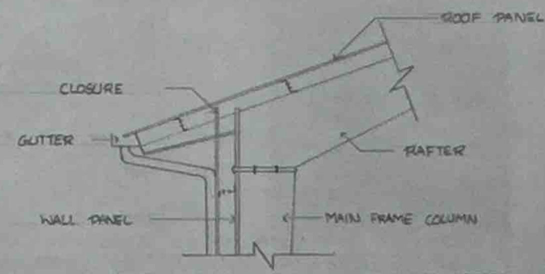
DETAIL AT A SCALE 1:10



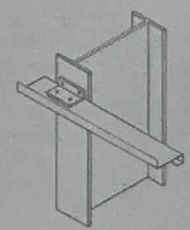
DETAIL AT B
SCALE 1:10



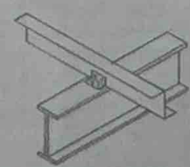
DETAIL AT C SCALE 1:10



DETAIL SHOWING SIDE WALL ROOF EXTENSION
SCALE 1:10



COLUMN TO PURLIN DETAIL



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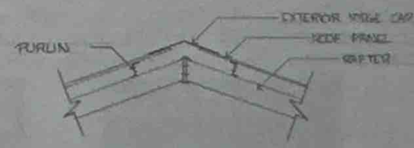
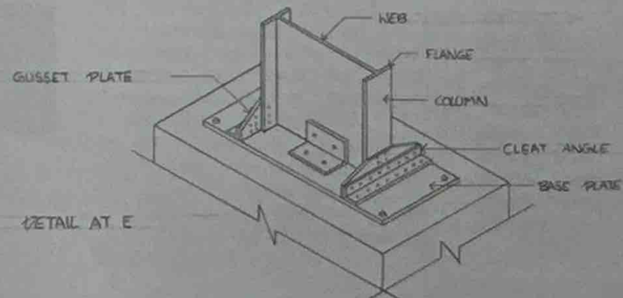
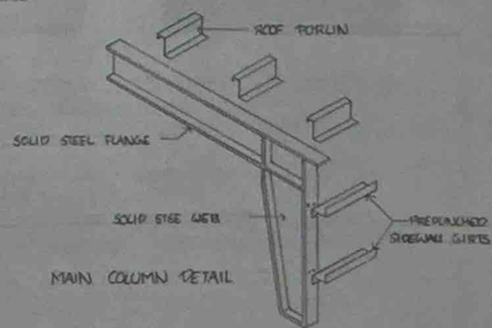


DETAIL AT D



DETAIL AT E

COLUMN TO BEAM CONNECTION



MAIN COLUMN DETAIL

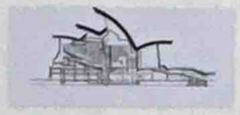
ALL MEASUREMENTS ARE IN MM

PEB STRUCTURE

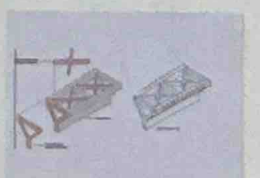
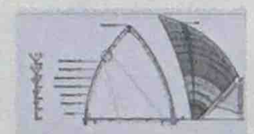
SIGNATURE	NAME : NAVEEN YADAV S M	SHEET NO
	USN : 1AA22AT010	6
	SEM : V	
	SUBJECT : MMBC-5	
	COLLEGE : ANRVSA	

SYDNEY OPERA HOUSE
(SHELL ROOF STRUCTURE)

- THE SYDNEY OPERA HOUSE SPANS UP TO 194FEET.
- THE ARCHES ARE SUPPOSED BY OVER 350KM OF TENSIONED STEEL CABLE.
- THE SHELL THICKNESS GOES FROM 3 TO 4 INCHES.
- ALL SHELLS WEIGHT A TOTAL OF 15 TONS.
- THIS INVOLVED LAYING THE FOUNDATIONS AND BUILDING A PODIUM 82FEET (25M) ABOVE SEA LEVEL. MORE THAN 39,239 CUBIC FEET (30,000 M3) OF ROCK AND SOIL WERE REMOVED BY EXCAVATORS.
- THE FOUNDATION WAS BUILT ATOP OF A LARGE ROCK THAT SAT IN SYDNEY HARBOUR. THE SECOND STAGES SAW THE BUILDING OF THE SHELLS, THE PODIUM STRUCTURE, THE STAGE TOWER, AND THE NECESSARY MACHINERY.
- CABLE BEAMS WERE BUILT AND REINFORCED BY STEEL CABLES TO RELEASE THE STRESS OF THE WEIGHT. THE STRENGTH OF THE CABLE WAS TESTED BY LOADING ADDITIONAL WEIGHTS. WHEN THE BUILDERS WERE SATISFIED THAT THE CABLES WOULD SUPPORT, THE BEAMS WERE MADE EXTENDABLE BY OTHER BEAMS.

- THE "SHELLS" WERE PERCEIVED AS A SERIES OF PARABOLAS SUPPORTED BY PRECAST CONCRETE RIBS.
- THE FORMWORK FOR USING IN-SITU CONCRETE WOULD HAVE BEEN PROHIBITIVELY EXPENSIVE BUT, BECAUSE THERE WAS NO REPETITION IN ANY OF THE ROOF FORMS, THE CONSTRUCTION OF PRE-CAST CONCRETE FOR EACH INDIVIDUAL SECTION WOULD POSSIBLY HAVE BEEN EVEN MORE EXPENSIVE.
- IN MID-1961, THE DESIGN TEAM FOUND A SOLUTION TO THE PROBLEM: THE SHELLS ALL BEING CREATED AS SECTIONS FROM A SPHERE.
- THIS SOLUTION ALLOWS ARCHES OF VARYING LENGTH TO BE CAST IN A COMMON MOULD, AND A NUMBER OF ARCH SEGMENTS OF COMMON LENGTH TO BE PLACED ADJACENT TO ONE ANOTHER, TO FORM A SPHERICAL SECTION.

YOKOHAMA PORT TERMINAL
(FOLDED PLATE STRUCTURE)

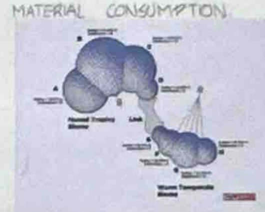
- THE TERMINAL IS A SHED BUILDING MEASURE 412 Mts IN LENGTH AND COMPOSED OF 27 STEEL TRUSSES AVERAGING 42.5 METER IN SPAN AND PLACED AT 16 Mts INTERVALS.
- THE TRUSSES ARE JOINED LONGITUDINALLY BY TRUSSED MEMBERS OF CONVENTIONAL CONFIGURATION, AND PURLINS CARRYING EITER METAL CLADDING OR GLAZING.
- THE TRUSSES ARE CARRIED ON CONCRETE PIERS EXTENDING FROM THE BASEMENT PARKING LEVEL THROUGH THE SURFACE OF THE MAIN LEVEL.

- THE LARGE SHED EMPLOYS A UNIFIED FORM THOUGH REPETITIVE STRUCTURAL UNITS TO ENCLOSE A SINGLE HOMOGENEOUS SPACE.
- THE TRANSFORMATION YIELDS A COMPLEX OF SPACES THAT SMOOTHLY INCORPORATES THE MULTIPLE TERMINAL, CIVIC AND GARDEN PROGRAMMES WITHIN AND BELOW ITS SPAN.


- THE TERMINAL WAS SEVERAL INTERNATIONAL AWARS AFTER ITS COMPLETION, INCLUDING THE 2004 ENRIC MIRALLES PRIZE, AND BROUGHT ENORMOUS RECOGNITION TO FOA ZAERA-POLO, AND MOUSSAVI.
- IT ALSO COMPLETELY CHALLENGED THE LIMITED ROLE OF TRADITIONAL PUBLIC INFRAUCTURE PROJECTS, CREATING A NEW PRECEDENT OF TECHNOLOGICAL INNOVATION AND URBAN INTEGRATION.

THE EDEN PROJECT
(GEODESIC DOMES)

- THE STRUCTURAL NETWORK OF A DOME CONSIST OF TWO CONCENTRIC SPHERICAL NETWORKS WITH A RADIUS DIFFERENCE BETWEEN THEM. THIS RADIUS DIFFERENCE IS CONNECTED BY DIAGONAL STRUTS THUS CREATING A DUAL LAYERED THREE DIMENSIONAL LOAD CARRYING NETWORK.
- THE EXTERNAL FACE CONSISTS OF HEXAGONS AND PENTOGONS WHEREAS THE INTERNAL ONE IS MADE UP OF HEXAGONS AND TRIANGLES.
- THE EXTERNAL LAYER IS REFERRED AS "HEX-NET" AND THE INTERNAL IS THE "TRI HEX-NET". THE TRI-HEX NET SHOWS SIMILARITY WITH THE MOLECULAR STRUCTURE OF SILICATES, WHICH EXHIBITS THE CHARACTERS OF MINIMAL PATH AND MINIMAL MATERIAL CONSUMPTION.




- TO HAVE A CONTINUOUS COLUMN FREE SPACE, THE SERIES OF GEODESIC DOMES ARE CONNECTED BY A TRUSS AT THEIR INTERSECTIONS. THE TRUSSES TRANSFER THE LOAD TO THEIR FOUNDATION. THE DOMES ALSO PARTY TRANSFER THE LOAD TO THE STRIP FOUNDATION ALONG ITS PERIMETER.
- THE EXTERNAL SKIN IS MADE OF ETFE TRIPLE LAYERED PILLOW FILLED WITH AIR PRESSURE. THEY ACT AS GOOD INSULATORS AND OPTIMIZES THE LIGHT PENETRATION.

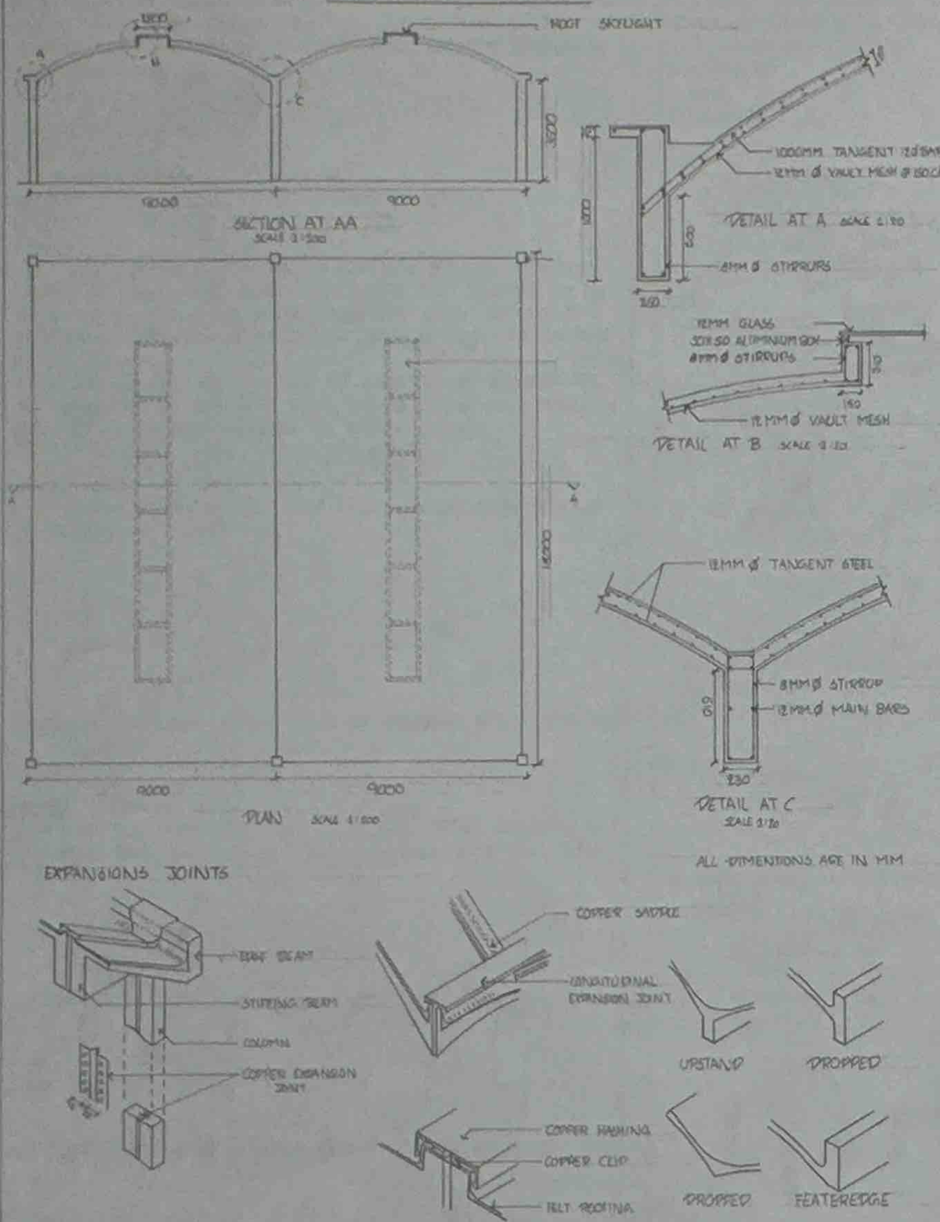

HEX-NET
- GRID CONSISTS OF SERIES OF HEXAGONS AND PENTOGONS
- RIGID CONNECTIONS THROUGH BOWL NODES
- MAXIMUM GRID SPAN IS 11m, MEMBER SIZE IS 193mm DIA

TRI-HEX-NET
- SINGLE LAYER DOMES ARE RESTRICTED TO A SPAN OF APPROXIMATELY 100Ft. (30m).
- DOMES GREATER THAN THIS SPAN EMPLOY A DOUBLE LAYER SPACE FRAME CONFIGURATION FOR GREATER STABILITY AND RIGIDITY.

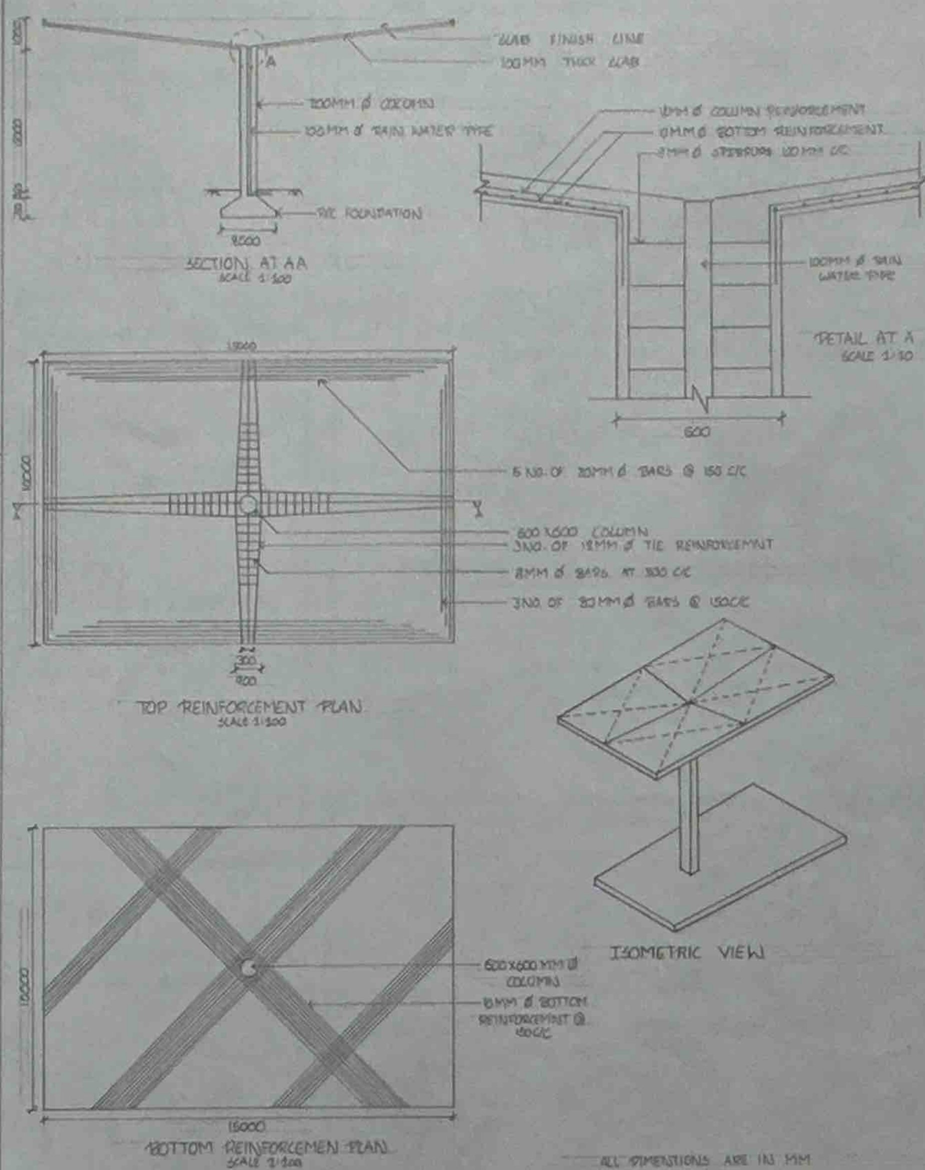
INTRODUCTION TO LONG SPAN ROOFS

SIGNATURE	NAME: NAVEEN YADAV S M	SHEET NO
	USN: 1AA22AT010	7
	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

BARREL VAULT



PYRAMIDAL ROOF



BARREL VAULT AND PYRAMIDAL ROOF

SIGNATURE	NAME NAVEEN YADAV S M	SHEET NO
	USN 1AA22AT010	8
	SEM V	
	SUBJECT MMBC-5	
	COLLEGE ANRVSA	

INTRODUCTION TO SHELL ROOF

INTRODUCTION

SHELL STRUCTURE IN BUILDING CONSTRUCTION. A THIN, CURVED PLATE STRUCTURE SHAPED TO TRANSMIT APPLIED FORCED BY COMPRESSIVE, TENSILE, AND SHEAR STRESSES THAT ACT IN THE PLANE OF THE SURFACE. THEY ARE USUALLY CONSTRUCTED OF CONCRETE REINFORCED WITH STEEL MESH.

MATERIALS USED FOR SHELL CONSTRUCTION

- REINFORCED CONCRETE
- STEEL
- ALLUMINIUM ALLOYS
- GLASS
- PLASTICS
- TIMBER
- MOST SUITABLE MATERIAL IS CONCRETE BECAUSE IT IS HIGHLY PLASTIC MATERIAL WHEN MIXED WITH WATER THAT CAN TAKE UP THE SHAPE ON CENTERING OR INSIDE FORMWORK. SMALL SECTIONS OF REINFORCING BARS CAN BE READILY BE BENT TO FOLLOW THE CURVATURE OF THE SHELLS.
- ONCE THE CEMENT HAS SET AND THE CONCRETE HAS HARDENED THE ROF MEMBRANE OR SLAB ACTS AS A STRONG SHELL WHICH SERVES AS BOTH STRUCTURE AND COVERING TO THE BUILDING.

TYPES OF CURVATURE

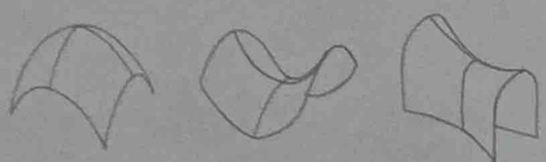
1) SINGLE CURVATURE SHELL :

SINGLE CURVATURE SHELL ARE CURVED ON ONE LINEAR AXIS AND ARE A PART OF CYLINDER / CONE.

1. MONOCLASTIC SINGLE CURVED SURFACE BENDING IN ONE DIRECTION

2) DOUBLE CURVATURE SHELL :

A DOUBLE CURVATURE SHELL IS A THIN, CURVED STRUCTURE THAT IS EITHER PART OF A SPHERE OR A HYPERBOLOID OF REVOLUTION.

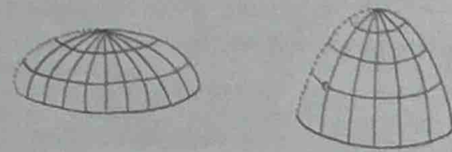


2. ANTICLASTIC - CURVATURE IN WHICH CENTRE CURVATURE ARE ON SAME PLANE

SURFACES OF REVOLUTION

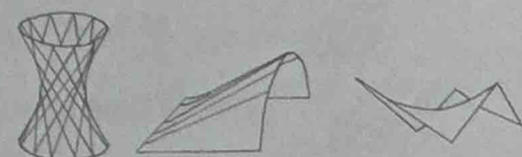
SURFACES OF REVOLUTION ARE GENERATED BY THE REVOLUTION OF A PLANE CURVE, CALLED THE MERIDIONAL CURVE ABOUT AN AXIS CALLED AXIS OF REVOLUTION. IN SPECIAL CASES THE MERIDIONAL CURVE CONSISTS OF A LINE / SEGMENT.

- CYLINDERS
- CONE
- SPHERICAL
- ELLIPTICAL DOMES
- HYPERBOLOIDS OF REVOLUTION
- TOROIDS



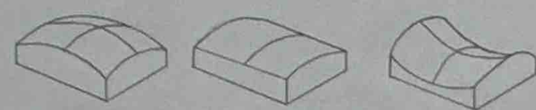
RULED SURFACE

A SURFACE SUCH THAT THROUGH EACH POINT OF IT PASSES A STRAIGHT LINE THAT IS FULLY CONTAINED IN THE SURFACE.



SURFACE OF TRANSLATION

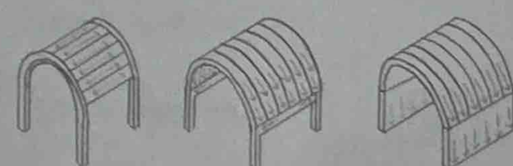
SURFACE ARE GENERATED BY SLIDING A PLANE CURVE ALONG ANOTHER PLANE CURVE WHILE KEEPING THE ORIENTATION OF THE SLIDING CURVE CONSTANT. THE LATER CURVE ON WHICH THE ORIGINAL CURVE SLIDES IS CALLED GENERATOR OF THE SURFACE.



ELLIPTICAL PARABOLOID — CYLINDRICAL PARABOLOID — HYPERBOLIC PARABOLOID

DEVELOPABLE SURFACES

IS A SURFACE THAT CAN BE UNROLLED INTO A PLATE PLATE.
IT IS FORMED BY BENDING A FLAT PLANE. THE MOST TYPICAL SHAPE OF A DEVELOPMENT SHELL IS A BARREL VAULT - WHICH IS CURVED IN ONE DIRECTION.

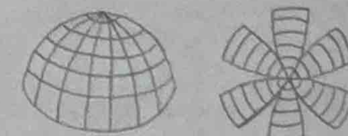


NON DEVELOPEABLE SURFACE

1) SYNCLASTIC SHELLS — 2) ANTICLASTIC SHELLS

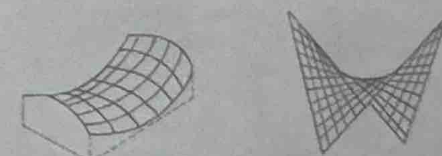
DOMES : BY ROTATING A CURVED LINE AROUND AN AXIS A DOME CAN BE SEPARATED INTO HORIZONTAL AND VERTICAL SECTIONS

- VERTICAL SECTIONS SEPERATED BY LONGITUDINAL ARCH LINES
- HORIZONTAL SECTIONS CAN BE SEPARATED BY HOOPS AND PARALLELS

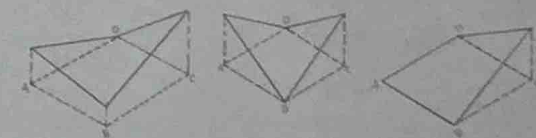


HYPERBOLIC PARABOLOID

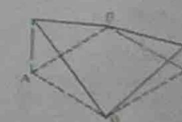
A HYPERBOLIC PARABOLOID IS A DOUBLY CURVED SURFACE IN WHICH THE SHAPE IS DEFINED THROUGH THE COMBINATION OF BOTH A CONCAVE AND A CONVEX SURFACE



HYPERBOLIC PARABOLOID (SADDLE) SURFACE



THREE CORNERS RAISED AT DIFFERENT HEIGHTS — TWO CORNERS RAISED AT SAME HEIGHT — ONE CORNER RAISED



TWO CORNERS RAISED AT DIFFERENT HEIGHTS

SETTING OUT STRAIGHT LINE LIMITED HYPERBOLIC PARABOLOID ON A SQUARE BASE

HYPERBOLIC PARABOLOID SURFACES COMBINED TO FORM A ROOF

SIGNATURE	NAME: NAVEEN YADAV S M	SEET NO
	USN: 1AA22AT010	9
	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

INTRODUCTION

- A FOLDED PLATE ROOF IS A ROOFING SYSTEM MADE OF THIN INCLINED MEMBERS.
- THEY ARE JOINED ALONG THEIR EDGES TO CONSTRUCT A 3 DIMENSIONAL SHAPE.
- MAXIMUM LENGTH ACHIEVABLE IS 30M WITH THE FOLDED ROOF THICKNESS OF 60MM.
- IT REQUIRES LESS CONCRETE AND DEMANDS A VERY ACCURATE FORMWORK AND SCAFOLDING.

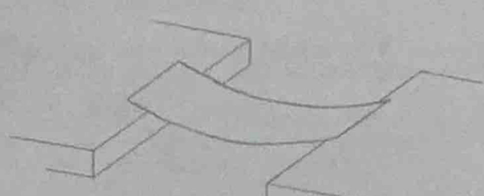
COMPONENTS

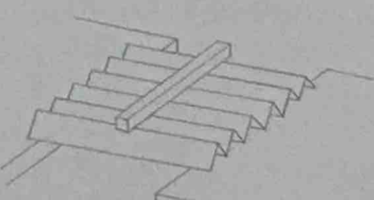
- FOLDED PLATES - INCLINED PLATE
- EDGE PLATES - STIFFEN THE PLATE

PRINCIPLES OF FOLDING TO PROVIDE STIFFNESS

THE STRUCTURAL CHARACTERISTICS OF FOLDING STRUCTURES DEPENDS ON

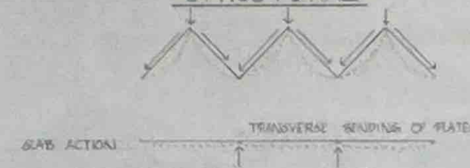
- THE PATTERN OF THE FOLDING
- THEIR GEOMETRICAL BASIC SHAPE
- ITS MATERIAL AND CONNECTION OF THE DIFFEREN FOLDING PLATE
- THE DESIGN OF THE BEARINGS.
- MOVABLE FORM WORK CAN BE EMPLOYED.
- FORM WORK REQUIRES IS RELATIVELY SIMPLER.
- DESIGN INVOLVES SIMPLER CALCULATIONS.





STRUCTURAL BEHVIOUR OF FOLDED ROOF

STRUCTURAL



- EXTERNAL FORCES ARE TRANSFERED TO SHORTER EDGE OF ONE FOLDING ELEMENT.
- THERE ACTION ON A AXIAL FORCE IS DIVIDED BETWEEN THE ADJECENT COLUMNS.
- FORCE TRANFERED TO BEARING.

TYPES OF FOLDING ROOF STRUCTURE

FOLDED PLATE SURFACE

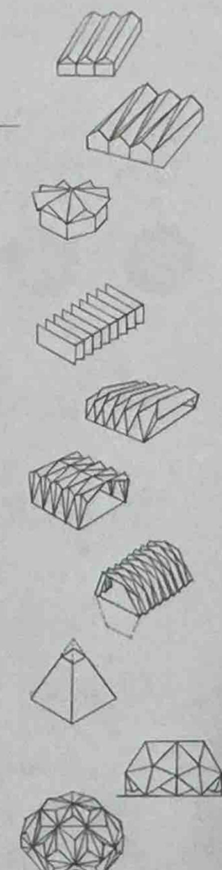
- LINEAR ADDITIONS
- COMBINATION OF ADDITIONS
- RADIAL ADDITIONS

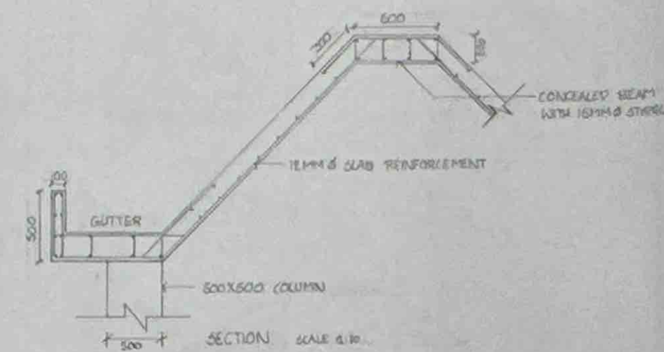
FOLDED PLATE FRAMES

- CONTINUOUS
- TWO-HINGED
- TREE-HINGED
- FOLDED PLATE PANEL

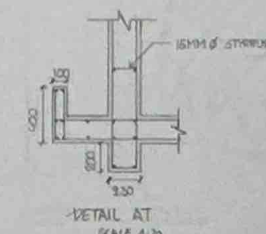
SPATIAL FOLDED PLATE

- PYRAMIDAL FOLDED PLATE
- POLYHEDRAL FOLDED PLATE
- COMBINATIONS

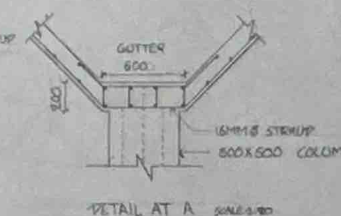




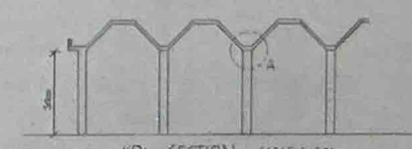
SECTION SCALE 1:10



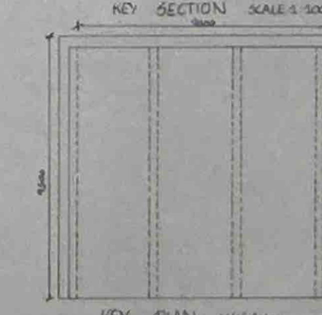
DETAIL AT SCALE 1:20



DETAIL AT A SCALE 1:20



KEY SECTION SCALE 1:200



KEY PLAN SCALE 1:100

ALL MEASUREMENT ARE IN MM

INTRODUCTION TO FOLDED PLATE STRUCTION

SIGNATURE	NAME NAVEEN YADAV S M	SHEET NO
	USN 1AA22AT010	10
	SEM V	
	SUBJECT MMBC-5	
	COLLEGE ANRVSA	

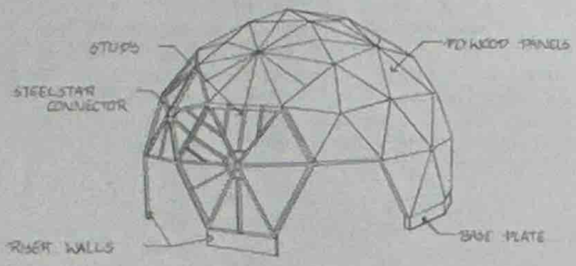
GEODESIC DOME

INTRODUCTION

A GEODESIC DOME IS A SPHERE LIKE STRUCTURE COMPOSED OF A COMPLEX NETWORK OF TRIANGLES.

- THE TRIANGLES CREATE A SELF-BRACING FRAMEWORK THAT GIVES STRUCTURAL STRENGTH WHILE USING A MINIMUM OF MATERIAL.
- THE TERM GEODESIC IS FROM LATIN, MEANING EARTH DIVIDING.
- GEODESIC DOMES HAVE MOST MEMBERS IS COMPRESSION. THE LOWER HORIZONTAL STRUTS CAN BE IN TENSION.
- THE STRUCTURE BECOMES MORE AND MORE SPHERE LIKE AS THE NUMBER OF THE DIVERSE SIZES OF THE STRUTS INCREASES.

PARTS OF GEODESIC DOME



- STRUTS:
  MEMBERS THAT FORM A NETWORK OF TRIANGLES TYPICALLY LIGHTWEIGHT AND MADE OF MATERIALS SUCH AS METAL OR PLASTIC.
- HUBS / NODES:
  ALSO KNOWN AS CONNECTORS, THE POINTS WHERE THE STRUTS MEET AND INTERSECT.
- BASE PLATE:
  SUPPORTS THE WEIGHT OF GEODESIC DOME, AND ANCHORS IT TO THE GROUND. SIZES CAN VERY AS PER REQUIREMENTS.
- COVERING MATERIAL:
  GEODESIC DOMES CAN BE COVERED WITH VARIOUS MATERIALS DEPENDING ON THE INTENDED USE AND ENVIRONMENT.
  EXAMPLE: FABRIC, POLYCARBONATE PANELS ETC.
- FASTENERS:
  BOLTS OR NUTS USED TO CONNECTS THE STRUTS TO HUBS.

MATERIALS

GEODESIC DOMES FRAMES CAN BE BUILD OF:

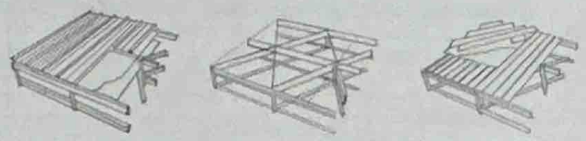
- PVC PIPES
- GALVANIZED STEEL
- ALUMINUM STRUTS

CLADDING:

- GLASS
- PLYWOOD
- CEDAR SHINGLES
- FIBERGLASS
- PLEXIGLASS
- ACRYLIC, METAL OR PLASTIC SHEETS

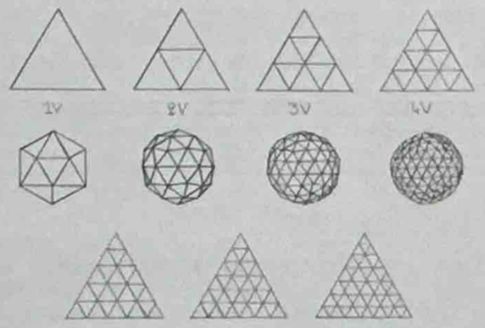
TYPES OF CLADDING

- GEOMETRICAL STRUCTURES MAY BE CLAD WITH A VARIETY OF DIFFERENT SKIN SYSTEMS.
- OPAQUE, TRANSPARENT OR TRANSLUCENT SYSTEMS PROVIDE FOR NATURAL LIGHT AND PROTECTION.

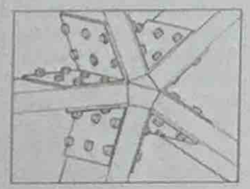


FREQUENCIES OF DOME

- THE FREQUENCY OF A DOME INDICATES HOW MANY TIMES EACH OF THE SIDES OF A TRIANGULATED BASE (FACE) IS SUBDIVIDED TO CREATE ADDITIONAL SECTIONS, AKA STRUTS.
- THOSE NEW POINTS ARE, THEN, CONNECTED TO DIVIDE THE ORIGINAL TRIANGLE INTO SMALLER TRIANGLES.
- COMMON FREQUENCIES ARE:



TYPES OF HUB CONNECTIONS



BOLTED JOINT

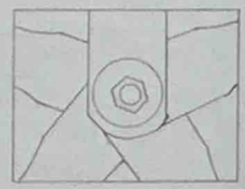
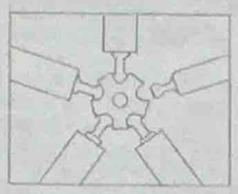
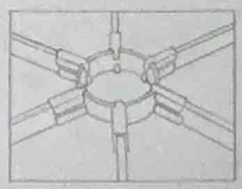


PLATE END JOINT

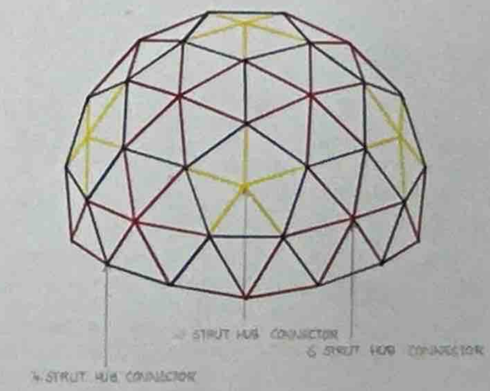


TUBULAR JOINT



HUB JOINT

3 FREQUENCIES DOME



DOME ASSEMBLY METHOD

- THE ASSEMBLY SHOULD BE PLANNED ACCORDING TO THE CLASS AND COMPLEXITY OF THE DOME CONSTRUCTED.
- IT ALSO DEPEND ON WHAT ARRANGEMENT WILL THE TRIANGLES BE, FOR EXAMPLE PENTAGON, HEXAGON.
- IT IS BETTER TO START THE ASSEMBLY FROM TOP PIECES AND GRADUALLY COMING DOWNWARDS.

V. Good!

SIGNATURE	NAME: NAVEEN YADAV GM	SHEET NO
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	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

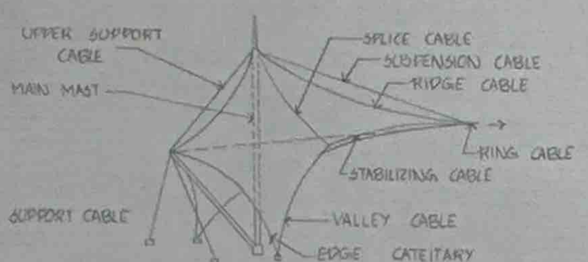
INTRODUCTION

- TENSILE STRUCTURE IS ONE OF THE UNIQUE COMPLEX STRUCTURES. ITS STRUCTURAL MEMBERS CAN ONLY CARRY TENSION BUT THERE CAN BE NO COMPRESSION OR BENDING.
- IT NORMALLY CONSISTS OF EXTERIOR FABRIC MATERIAL WITH ITS FRAMEWORK SUCH AS CABLES.
- THE FABRIC AND THE CABLES ARE MAINTAINED IN TENSION IN ALL DIRECTIONS TO PROVIDE STABILITY.
- MEMBRANCES ARE ONE OF THE COMMON FABRIC MATERIAL USED IN THE TENSILE STRUCTURE.

HISTORY

- TENSILE FABRIC STRUCTURE HAVE BEEN WITH US SINCE THE MONGOLINS SWEPT DOWN FROM THE PLAINS, WITH THEIR YURTS AS THEIR TRANSPORTABLE OVERNIGHT ACCOMMODATION.
- AND THERE'S EVIDENCE THAT THE ROMANS EVEN COVERED THE COLOSSEUM WITH MASSIVE CANOPIES. HOISTED BY AN INTRICATE SYSTEM OF PULLEYS. TO PROTECT THE AUDIENCE FROM THE ELEMENTS.
- BUT THEY REALLY CAME INTO THEIR OWN IN LAST HALF OF THE 20TH CENTURY. WHEN DESIGNS LIKE THIS BY GERMANY'S FREI OTTO.

PARTS OF TENSILE ROOF



COMPONENTS

- BASE PLATE:
  CONNECTION TO CONCRETE FOUNDATION PILLAR
- MEMBRANES:
  FORMS THE ENCLOSURE OF THE STRUCTURE. CONNECTING CAN BE GLUED OR HEAT WELDED.
- BALE RING / MEMBRANE PLATE:
  - BALE RINGS ARE USED AT THE TOP OF CONICAL SHAPES.
  - MEMBRANE PLATES ACCEPT CENTENARY CABLES AND PIN CONNECTION HARDWARE.
- TYPE OF FABRIC MEMBRANCE:
  - PVC
  - TEFLON GLASS
  - SILICON GLASS

TENSILE ROOF COVERING OPTIONS

- FABRIC: FABRIC IS A CLOTH PRODUCED BY WEAVING TOGETHER COTTON, NYLON, WOOL, SILK OR OTHER THREADS.
- CABLE NET MEMBRANCE: IT'S TYPICALLY FOUND IN STADIUMS OR LARGE SPACES. 3D CABLE NET
- POLYESTERS: THE PROPERTY OF STRENGTH, DURABILITY, COST AND STRETCH MAKES IT THE MOST WIDELY USED IN FABRIC STRUCTURES.
- PVC: ACRYLIC LACQUERED PVC (POLYVINYL CHLORIDE), COMMONLY KNOWN AS PVC FABRIC, IS A VERSATILE AND WIDELY USED MATERIAL IN FABRIC STRUCTURE.

CHARACTERISTICS

- LIGHT WEIGHT: TENSILE ROOFS ARE LIGHTWEIGHT AND CAN COVER LARGER SPACES WITH MINIMAL SUPPORT.
- DURABLE: TENSILE ROOFS ARE DURABLE AND FIRE RESISTANCE
- TRANSLUCENT: THEY ALLOW NATURAL LIGHT TO PASS THROUGH, CREATING A COMFORTABLE SPACE.
- GOOD ACOUSTICS: THEY CAN REDUCE NOICE
- DOUBLE - CURVED: TENSILE ROOFS ARE OFTEN DOUBLE-CURVED TO RESIST UPLIFT AND DOWN-FORCES
- QUICK INSTALLATION: THEY CAN BE INSTALLED QUICKLY AND COST-EFFECTIVELY
- ENVIRONMENTALLY FRIENDLY: THEY CAN BE MADE FROM RECYCLED MATERIALS AND LIGHT COLOURS TO REDUCE HEAT.
- MALLEABLE: TENSILE ROOFS ARE MALLEABLE AND CAN BE PRE-FABRICATED
- HIGH SUN REFLECTIVITY: THEY REFLECT SUNLIGHT AND ABSORB LITTLE OF IT. WHICH CAN HELP REDUCE ENERGY USE IN NEARBY BUILDINGS.

ADVANTAGES

- MATERIALS CAN BE RE-USED IN FORM
- MOST MATERIALS ARE COMPLETELY RECYCLABLE
- LESS IMPACT ON SITE
- LESS CONSTRUCTION DEBRIS AFTER DEMOLITION
- UNIQUE DESIGNS
- LIGHT WEIGHT AND FLEXIBLE
- ENVIRONMENTALLY SENSITIVE
- HEIGHT STRENGTH - WEIGHT RATIO

DISADVANTAGES

- LOSS OF TENSION IS DANGEROUS FOR STABILITY
- THERMAL VALUES LIMIT USE
- LIMITED LIFESPAN: DEPENDS ON MATERIALS
- STRUCTURAL DEPENDENCY: HEAVILY DEPENDENT ON INTERGRITY THE SUPPORTING FRAMWORK.
- NOISE: MIGHT BE UNDESIRABLE IN SOME SETTINGS.
- LIMITED INSULATION: OFTEN LACK SAME LEVEL OF INSULATION
- HIGH INITIAL COST
- VULNERABILITY TO EXTREME WEATHER
- COMPLEX DESIGN AND ENGINEERING

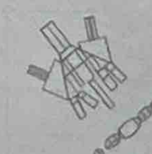
CASE STUDY
MUNICH OLYMPIC STADIUM

- LOCATION: MUNICH, BAVARIA, GERMANY
- DATE BUILT: 1972
- ARCHITECT: FREI OTTO AND GUNTHER GRZIMEK
- STRUCTURE: TENSILE STRUCTURE
- CAPACITY: 80,000
- GROSS: 2 MILLION m^2

A FLAT PLOT OF LAND ON THE EDGE OF MUNICH. WHICH WAS CHARACTERISED BY A FORMER RUBBISH DUMP IS NOW A MOUNTAIN FROM WHICH THE WHOLE SITE CAN BE VIEWED THE SPORTS FIELDS, THE TELEVISION TOWER, AN ARTIFICAL LAKE FED BY THE NYMPHENBURG CANAL AND THE SMALL THEATRE FOR OPEN-AIR ACTIVITIES. STADIUM, SPORTS HALL AND SWIMMING POOL SPATIALLY CONNECTED BY A SHARED UNDULATING ROOF.

CONSTRUCTION DETAILS

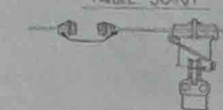
CABLE JOINT



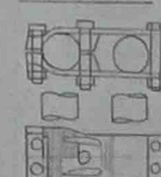
- HELD TENSION, THE DEFLECTION FOLL OF THE PERIPHERY CABLE IS TAKEN UP BY A MAIN CABLE AND TRANSFERRED TO THE FOUNDATION.
- THE ENDS OF THE PERIPHERY CABLES ARE STABILIZED BY THE TWO PIECE CASTING WHICH IS HELD TOGETHER BY HV SCREWS.

- THE CABLE NET WITH A WEATHER COVERING OF ACRYLIC GLASS PANEL (3x3m) AND NEOPRENE SEAMS ON NEOPRENE BUFFER.
- LONGITUDINAL AND LATERAL SEAM JOINTS WITH ALUMINIUM LONG AND BRACKET LATCHES FOR CONNECTING NONSUPPORTED PANEL SECTIONS VIA THE SEAMS.

PANEL JOINT



TURNBUCKLES



- THE TURNBUCKLES AND PERIPHERY CABLE CONNECTING CLAMP PERIPHERY.
- CABLE WITH CONNECTOR CLAMP. THE CLAMP IS SECURED TO THE PERIPHERY CABLE WITH FOUR HV SCREWS.
- THE NET CABLE IS CONNECTED BY THE WAY OF THE BOLTS.

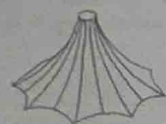
SECTION

INTRODUCTION TO TENSILE STRUCTURES

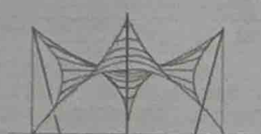
SIGNATURE	NAME: NAVEEN YADAV S M	SHEET NO
	USN: 1AA22AT010	12
	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

TYPES OF TENSILE STRUCTURES

1 CONIC OR PAVILION TYPES:
- THEY ARE HIGHLY EFFECTIVE FOR COVERING LARGE AREAS.
- IT CAN FEATURE EITHER ANGLE OR MULTIPLE MASTS.
- THE MEMBRANES ARE TENSIONED BETWEEN A RING AT THE PINNACLE AND THE LOWER ARE SUPPORT COLUMNS.



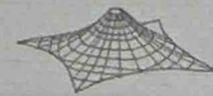
2) HYPER OR ANTICLASTIC TYPE:
- RELY ON TWO OPPOSING CURVATURE, ALSO KNOWN AS ANTICLASTIC, FOR THEIR STABILITY.
- SHAPE DERIVED FROM A HYPERBOLIC PARABOLID.
- IDEAL FOR SHADE OVER SEATING AREAS OR HIGH TRAFFIC WALKWAYS.
- THEY CAN BE FORMED FROM STRAIGHT LINES.



3) ARCH TYPE STRUCTURE
- MEMBRANE SUPPORTED WITH RIGID ARCHED EDGES IN DIFFERENT CONFIGURATIONS.
- CAN SPAN LONG DISTANCES IF PARALLEL ARCHES ARE USED. MAKING IT REPETITIVE AND EFFICIENT.
- THE ARCHES WORK IN COMPRESSION. WHILE CABLES ARE FLEXIBLE AND WORK IN TENSION.
- THEY ARE STRUCTURALLY STABLE BECAUSE THEY DISTRIBUTE LOAD EVENLY THROUGHOUT THEIR FORM.

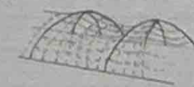
TYPES OF SUPPORTS

1) MAST SUPPORTED



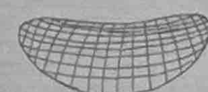
- TENT LIKE STRUCTURES CONTAINING ONE OR MORE PEAKS SUPPORTED BY POLES (MASTS).
- OR A COMPRESSION RING THAT CONNECTS THE FIBRIC TO THE CENTRAL SUPPORT.
- IT COMBINES STEEL MASTS AND TENSIONED FABRIC MEMBRANIC TO CREATE A ROOF OR CANOPY.

2) ARCH SUPPORTED



- THE CURVED COMPRESSION MEMBERS ARE USED AS THE MAIN SUPPORTING ELEMENTS.
- CROSS ARCHES ARE USED FOR LATERAL STABILITY
- THEN A FABRIC MATERIAL STRETCHED OVER A FRAMEWORK TO PROVIDE STABILITY.

3) SADDLE ROOF



- FOUR OR MORE POINT SYSTEM WHEN THE FABRIC IS STRETCHED BETWEEN A SET OF ALTERNATING HIGH AND LOW POINTS.
- IT IS A TYPE THAT USES A FABRIC MEMBRANE STRECHED OVER A HYPERBOLIC PARABOLID SHAPE

4) COMBINATIONS

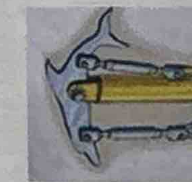
- COMBINATION OF SEVERAL SUPPORT TYPES.
- THEY ARE MADEUP OF ELEMENTS THAT ONLY CARRY TENSION, AND ARE OFTEN SUPPORTED BY THE COMPRESSION OR BENDING ELEMENTS.

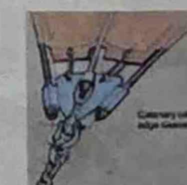
5) POINT SUPPORTED

- THE POINT SUPPORTED TENSILE STRUCTURES ARE USED TO AT LEAST FOUR POINTS OF ATTACHMENTS TO CREATE A CLEAR SPAN WITHOUT A CENTER MAST.
- THE FABRIC IS SUPPORTED BY AN ENTERIOR FRAME, OR PERIMETER MASTS.

EDGE CONDITIONS

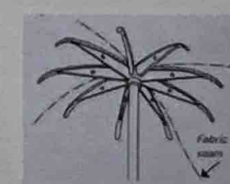
1) ROPE EDGES: A CABLE RUNNING IN A SLEEVE AND CONNECTED TO A RIGID STRUCTURE AT BOTH THE ENDS.
2) HARD EDGES: A CONTINUOUS CONNECTION TO A RIGID STRUCTURE THROUGH CLAMPING PLATES WITH OR WITHOUT PRESTRESSING DEVICES.

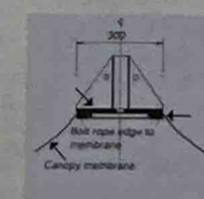




POINT SUPPORTS

- MASTS CAPABLE OF RESISTING COMPRESSION AND BUCKLING FORCES.
- THE MAGNITUDE OF FORCES AT THE POINT SUPPORTED REQUIRE DISTRIBUTION VIA RINGS OR UMBRELLAS.





TYPES AND DETAILES OF TENSILE STRUCTURES

SIGNATURE	NAME: NAVEEN YADAV S.M.	SHEET NO
	USN: 1AA22AT010	13
	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

INTRODUCTION

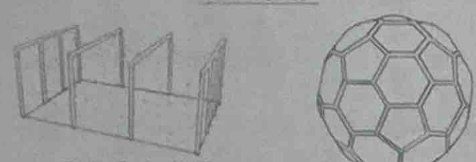
- PNEUMATIC STRUCTURES ARE MEMBRANE STRUCTURES COMPRISED OF THE VOLUME OF INFLATED AIR.
- AN EXISTING INTERNAL PRESSURES THE ENVELOPING MEMBRANES THAT ARE SUBJECTED TO TENSION AND COUNTERACTS THE EXTERNAL LOADS.
- THEY ARE EXTREMELY LIGHTWEIGHT STRUCTURES.
- THEY WERE ORIGINALLY USED FOR EMERGENCY SHELTERS.
- NOWADAYS PNEUMATIC STRUCTURES ARE USED FOR SPORTS STADIUMS, SWIMMING POOLS, WAREHOUSES, AND TEMPORARY ART INSTALLATIONS.

TYPES OF PNEUMATIC STRUCTURE

- AIR SUPPORTED STRUCTURES :

IT CONSIST OF A SINGLE MEMBRANE CENCLOSING A FUNCTIONALLY USEFUL SPACE,WHICH IS SUPPORTED BY A SMALL INTERNAL PRESSURE DIFFERENCE THE INTERNAL VOLUME OF A BUILDING AIR IS CONSEQUENTLY AT A PRESSURE HIGHER THAN ATMOSPHERIC.

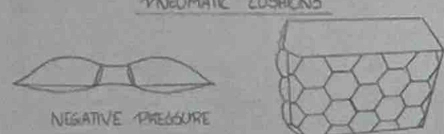
AIR DOMES



- AIR INFLATED STRUCTURES :

IT IS SUPPORTED BY PRESSURIZED AIR CONTAINED WITHIN INFLATED BUILDING ELEMENT. THE PRESSURIZED AIR IN THE PILLOW SERVES ONLY TO STABILIZING THE LOAD CARRYING MEMBRANE. THE COVERED SPACE IS NOT PRESSURIZED.

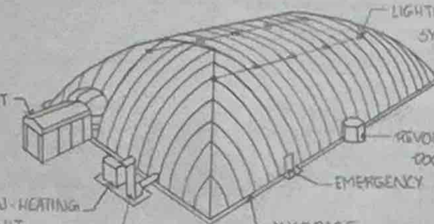
PNEUMATIC CUSHIONS



- HIGH PRESSURE :

INFLATABLE TUBES

PARTS OF PNEUMATIC STRUCTURE

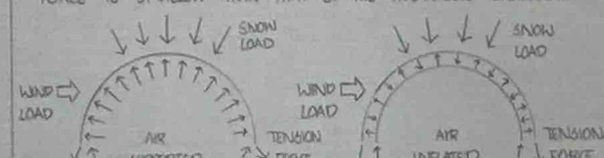


ADVANTAGES

1) PNEUMATIC DEVICE IS SIMPLE IN STRUCTURE, LIGHT IN WEIGHT, SIMPLE IN INSTALLATION AND MAINTENANCE. THE MEDIUM IS AIR COMPARED WITH THE HYDRAULIC MEDIUM IS NOT EASY TO BURN, SO THE USE OF SAFETY.
2) THE WORKING MEDIUM IS INEXHAUSTIBLE AIR. AIR ITSELF DOES NOT COST MONEY EXHAUST TREATMENT IS SIMPLE, DOES NOT POLLUTE THE ENVIRONMENT, LOW COST.
3) THE ADJUSTMENT OF OUTPUT FORCE AND WORKING SPEED IS VERY EASY. CYLINDER MOVEMENT SPEED IS GENERALLY LESS THAN 1M/S, FASTER THAN THE HYDRAULIC AND ELECTRICAL MODE OF MOVEMENT SPEED.
4) HIGH RELIABILITY AND LONG SERVICE LIFE. THE NUMBER OF EFFECTIVE ACTIONS OF ELECTRICAL COMPONENTS IS ABOUT ONE MILLION TIMES, AND THE LIFE OF THE GENERAL SOLENOID VALVE IS MORE THAN 30 MILLION TIMES.
5) FULL PNEUMATIC CONTROL WITH FIRE, EXPLOSION-PROOF, MOISTURE-PROOF ABILITY. COMPARED WITH HYDRAULIC MODE, PNEUMATIC MODE CAN USE IN HIGH TEMPERATURE OCCASIONS.
6) COMPRESSED AIR CAN BE CENTRALLY SUPPLIED AND TRANSPORTED LONG DISTANCE.

DISADVANTAGES

1) DUE TO THE COMPRESSIBILITY OF AIR, THE OPERATING SPEED OF THE CYLINDER IS SUSCEPTIBLE TO CHANGES IN LOAD. THE GAS-LIQUID LINKAGE CAN OVERCOME THIS DEFECT.
2) WHEN THE CYLINDER MOVES AT LOW SPEED, ITS STABILITY AT LOW SPEED IS NOT AS GOOD AS THAT OF THE HYDRAULIC CYLINDER DUE TO THE LARGE PROPORTION OF FRICTION IN THRUST.
3) ALTHOUGH IN MANY APPLICATION, THE OUTPUT FORCE OF THE CYLINDER CAN MEET THE WORKING REQUIREMENTS, ITS OUTPUT FORCE IS SMALLER THAN THAT OF THE HYDRAULIC CYLINDER.



CASE STUDY

MILWAUKEE ART MUSEUM

- LOCATION : WISCONSIN, USA
- DATE BUILT : 2001
- ARCHITECT : SANTIAGO CALATRAVA
- STRUCTURE : PNEUMATIC STRUCTURE

MUSEUM COLLECTION CONTINUED TO EXPAND THROUGHOUT THE 1980s AND 90s. ATTENDANCE INCREASED DRAMATICALLY, APPROCHING 200,000 ANNUAL VISITORS. BOTH FACTORS PROMPTED CONSIDERATION OF AN EXPANSION.

LOOKING FOR A STRONG ARCHITECTURAL STATEMENT, MUSEUM OFFICIALS TURNED TO ARCHITECT AND ENGINEER SANTIAGO CALATRAVA IN 1994, CALATRAVA'S DESIGN WAS UNVEILED IN MARCH 1996, RECEIVING AN ENTHUSIASTIC RESPONSE FROM THE COMMUNITY.

DESIGN CONCEPT

- THE CITY OF MILWAUKEE WAS LOOKING FOR A "STRONG ARCHITECTURAL STATEMENT IN AN EXCITING YET FUNCTIONAL BUILDING "SET AN ARCHITECTURAL STANDARD FOR THE NEXT MILLENNIUM".
- ARCHITECT SANTIAGO CALATRAVA'S RESPONSE WAS TO DESIGN A "GLOWING LANTERN ON THE DOWNTOWN LAKEFRONT, RADIATING LIGHT IN ALL DIRECTIONS."

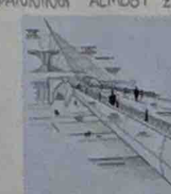
STRUCTURAL FEATURES

FINITE ELEMENT MODEL

- THE COMPLEXITY OF THE QUADRACCI PAVILLION REQUIRED THAT THE MAT FOUNDATION SLAB, PAVILLION, A-FRAME, RING BEAMS, AND BURKE BRISESOLEIL BE DESIGNED THROUGH A DETAILED FINITE ELEMENT MODEL ANALYSIS.

BURKE BRISE - SOLEIL

- THE SIGNATURE ELEMENT OF THE CALATRAVA ADDITIONAL IS COMPOSED OF TWO LARGE OPERABLE WINGS. EACH MADE UP OF 36 INTERCONNECTED FINS, SPANNING ALMOST 220FEET.



PEDESTRIAN BRIDGE

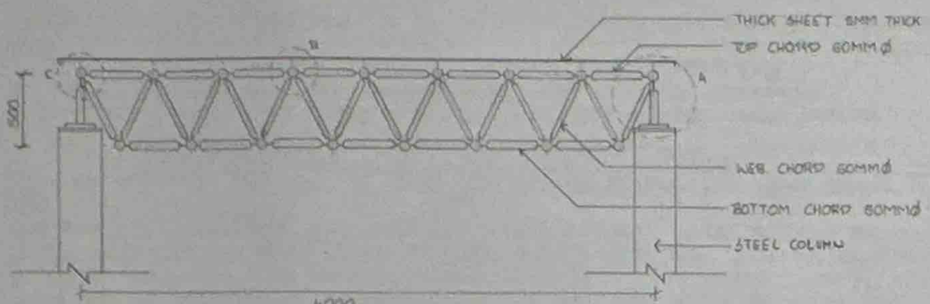
- A CABLE-STAYED PEDESTRIAN BRIDGE FEATURING A STEEPLY RAKED PYLON AND 'BOOMERANG' ABUTMENT SPANS 230FEET ACROSS A MAJOR THOROUGHFARE, CONNECTING MILWAUKEE'S DOWNTOWN WITH THE WATERFRONT.

BUILDING SECTION

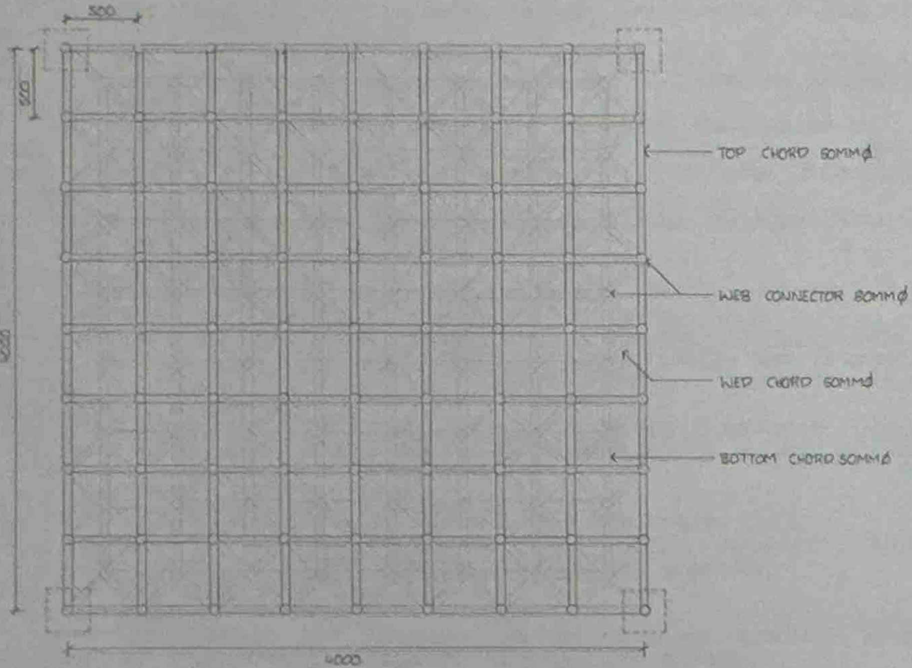
- A QUICK STUDY OF A PARTIAL BUILDING SECTION REVEALS THE CLEVER ARRANGEMENT OF PINNED CONCRETE ARCH ELEMENTS WHICH TRANSFERS STRUCTURAL LOADS TO THE

INTRODUCTION TO PNEUMATIC STRUCTURE

SIGNATURE	NAME : NAVEEN YADAV S M	SHEET NO
	USN : 1AA22AT010	14
	SEM : V	
	SUBJECT : MMBC-5	
	COLLEGE : ANRVSA	

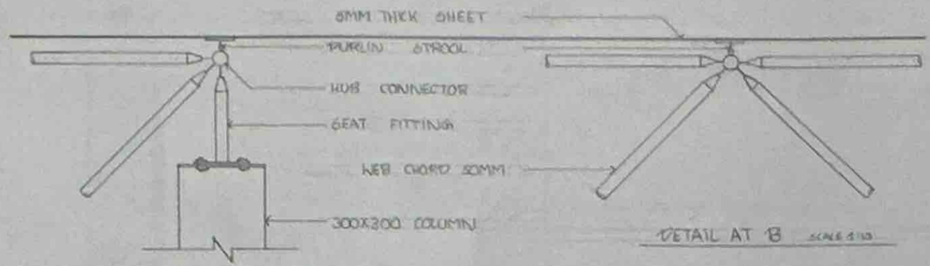


FRONT ELEVATION (SCALE 1:20)



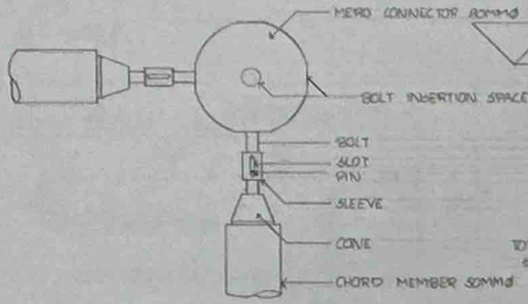
PLAN (SCALE 1:20)

ALL DIMENSIONS ARE IN MM

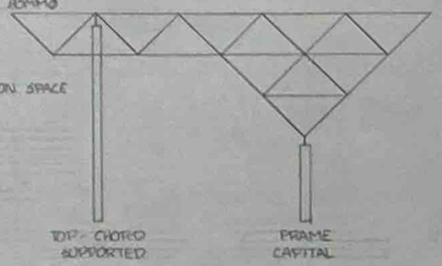


DETAIL AT A SCALE 1:10

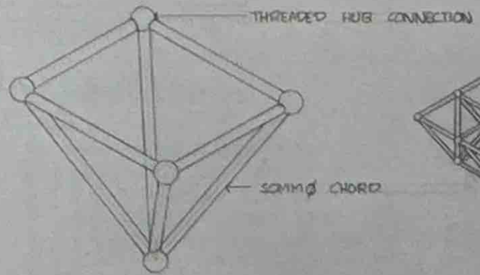
DETAIL AT B SCALE 1:10

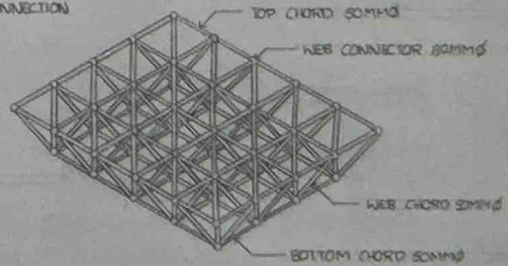


THREADED CONNECTION AT C



ALTERNATE CONSTRUCTION METHOD





ISOMETRIC VIEW SCALE 1:20

V. Good !

SPACE FRAME STRUCTURE

SIGNATURE	NAME : NAVEEN YADAV GM	SHEET NO
	USN : 1AA22AT010	15
	SEM : V	
	SUBJECT : MMBC-5	
	COLLEGE : ANRVSA	

INTRODUCTION

- WATERPROOFING IS THE FORMATION OF AN IMPERVIOUS BARRIER OVER SURFACES OF FOUNDATION ROOFS, WALLS AND OTHER STRUCTURAL MEMBERS.
- THE FUNCTION OF THE IMPERMEABLE BARRIER IS TO PREVENT WATER PENETRATIONS.
- THE BUILDING SURFACES ARE MADE WATER-RESISTANT AND SOMETIMES WATERPROOF.
- WATERPROOFING REDUCES THE HUMIDITY IN THE HOUSED INTERIORS, PREVENTING DAMAGES.

IMPORTANCE OF WATERPROOFING

- IT HELPS TO PROTECT THE WALLS OF HOUSE FROM SEEPAGE. IT PREVENTS WATER DAMAGE AS WELL.
- WATERPROOFING IS SUGGESTED IN A HOUSE AS IT PREVENTS HEALTH ISSUES. THE WALLS AND CEILINGS OF THE HOUSE BECOMES DAMP WHEN MOISTURE ENTERS AND THUS LEADS TO THE SPREAD OF MOULD AND MILDEW. THIS PRODUCES SPORES, WHICH RESULTS IN SEVERAL HEALTH ISSUES.
- WATERPROOFING HELPS TO SEAL A NEW CONSTRUCTION SITE EARLY, WHICH PROMOTES LONG-TERM COMFORT.

WATERPROOFING METHOD

CEMENTITIOUS
- IT IS THE EASIEST METHOD WITH MATERIALS READILY AVAILABLE FROM SUPPLIERS OF MASONRY PRODUCTS.
- THE APPLICATIONS OF THE CEMENTITIOUS WATERPROOFING TECHNIQUE ARE IN THE INTERNAL WET AREAS SUCH AS TOILETS. IT DOES NOT GO THROUGH THE CONTRACT AND EXPANSION PROCESS.

LIQUID WATERPROOFING MEMBRANE
- IT CONSISTS OF A PRIMER COAT AND TWO TOPCOATS AND APPLIED BY SPRAY ROLLER OR TOWEL.
- LIQUID MEMBRANE IS THIN AND OFFERS MORE FLEXIBILITY THAN CEMENTITIOUS WATERPROOFING TECHNIQUE.
- THE LIQUID CURES INTO A RUBBERY COATING ON THE WALL AND THE ELONGATION PROPERTIES CAN REACH 280%.

BITUMINOUS COATING WATERPROOFING
- IT IS MADE OF BITUMINOUS BASED MATERIAL AND IS A FLEXIBLE PROTECTIVE COAT BASED ON ITS FORMULATION.
- MOST COMMON APPLICATIONS OF BITUMINOUS COATINGS INCLUDE AREAS THAT ARE BENEATH SCREED WET.
- EXCELLENT PROTECTIVE COATING AND WATERPROOFING, ESPECIALLY ON SURFACES SUCH AS CONCRETE FOOTINGS.

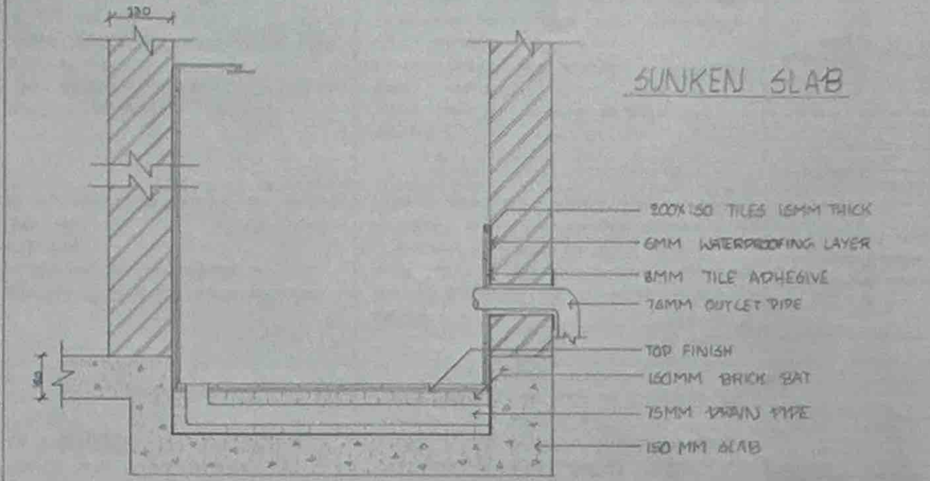
POLYURETHANE LIQUID MEMBRANE
- USED FOR FLAT ROOF AREA AND EXPOSED TO WATHERING. THIS METHOD IS EXPENSIVE.
- POLYURETHANE LIQUID MEMBRANE CAN OFFER HIGHER FLEXIBILITY AND IS SENSITIVE TO MOISTURE CONTENT.

BRICK BAT COBA
- TRADITIONAL METHOD COST EFFECTIVE BUT INCREASES DEAD LOAD ON SLAB.
- LAYING OF BROKEN BRICKS ON THE FLAT SURFACE OF THE CONCRETE AND GROUT IT WITH A WATERPROOFING COMPOUND PROPER SLOPE TO DRAIN OFF THE RAINWATER.
- APPLICATIONS - ROOF, BATHROOMS.

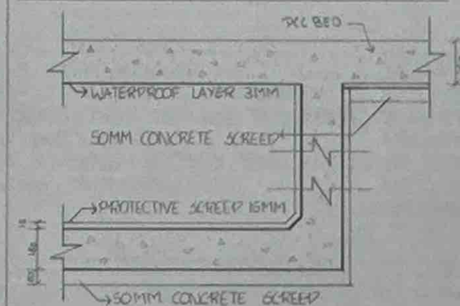
BITUMINOUS MEMBRANE WATERPROOFING
- IF YOU OPT FOR WATERPROOF TECH COATING, YOU CAN PICK THIS METHOD BECAUSE IT HAS BEEN USED FOR LOW-SLOPED ROOFS BECAUSE OF ITS PROVEN PERFORMANCE.
- IT IS SELF ADHESIVE DUE TO THE COMPOSITION OF ASPHALT, FILLER, AND POLYMERS. MOREOVER, IT ALSO HAS CERTAIN OILS AND RESINS ADDED TO IMPROVE ADHESION.
- IT ALSO HAS COVERED AND EXPOSED TYPES OF TORCH ON THE MEMBRANE.
- THE EXPOSED TYPE IS ABLE TO WITHSTAND WEAR AND TEAR OF THE WEATHERING PROCESS DUE TO THE MINERAL GRANULAR AGGREGATE.

APPLICATION OF WATERPROOFING

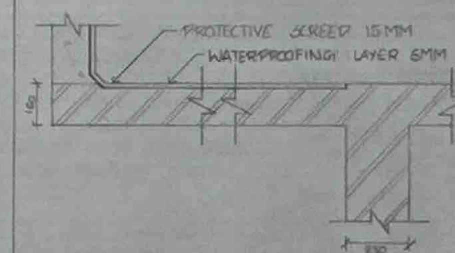
SUNKEN SLAB



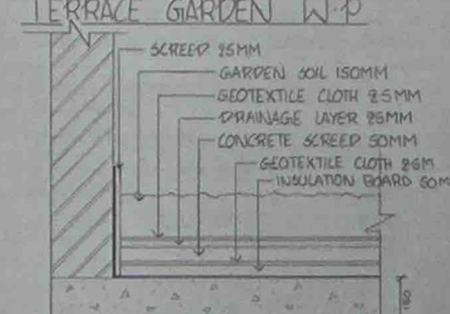
UG SUMP WATERPROOFING



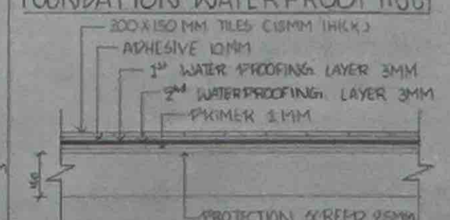
BALCONY WATERPROOFING



TERRACE GARDEN W.P



FOUNDATION WATERPROOFING



ALL DIMENSIONS ARE IN MM

INTRODUCTION TO WATERPROOFING

SIGNATURE	NAME: NAVEEN YADAV S M	SHEET NO
	USN: 1AA22AT010	16
	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

MATERIAL	REFERENCE	FEATURES	TYPES	ADVANTAGES	DISADVANTAGES	PRICE PER KG.
WATERPROOF ELEMENT		• DESIGNED TO SEAL AND A PROTECT SURFACES FROM A WATER DAMAGE. • REFERS TO SUBSTANCES THAT ARE WATER - RESISTANT DUE TO ITS CHEMICAL COMPOSITION	• BITUMINOUS COATING • POLYURETHANT MEMBRANES • WATER PROOF PLASTER • ACRYLIC - BASED MEMBRANE • CRYSTALLINE WATER PROOFING • TORCH - ON - MEMBRANES • THERMOPLASTIC OIFIN MEMBRANE	• PROTECTION FROM WATER DAMAGE • DURABILITY AND LONGEVITY • INCREASED VERSATILITY IN OUTDOOR AND A AQUATIC SETTING • THESE CAN ENSURE THE SAFETY OF ELECTRONIC DEVICES OR SYSTEM.	• INCREASED COST. THESE TEND TO BE MORE EXPENSIVE THAN THEIR NON - WATERPROOF COUNTERPARTS. • MAINTENANCE AND DURABILITY OF WATERPROOF COATINGS. • THESE CAN BE WEIGHT OR BULK TO PRODUCTS.	PER LITRE ₹ 179/- VARRIES ON LITRES
WATERPROOF ELEMENT		• DESIGNED TO SEAL APPALIED TO A MATERIAL TO PREVENT WATER FROM PENETRATING. • CREATES A PROJECTIVE LAYER ON SURFACE OF MATERIAL WHICH PHYSICALLY BLOCKS ENTERING OF WATER	• BITUMINOUS COATING • ACRYLIC COATING • EPOXY COATING • POLYURETHANE • SILICONE • POLYUREA • RUBBERIZED	• FORMS A PHYSICAL ON SURFACE OF MATERIAL • COMMONLY USED FOR ROOF'S, FOUNDATIONS, CONCRETE WALLS. • ALTER THE TEXTURE APPERANCE • HIGH - QUALITY WATER PROOFING COATINGS.	• LIMITED DURABILITY UNDER EXTREME CONDITION • POTENTIAL TO ALTER SURFACE CHARATERISTICS • SLIPPERY SURFACE - IN SOME CASES • SOME BECAME BRITTLE OR CRACK OVER TIME DUE TO EXPOSURE TO ENVIRONMENTAL FACTOR.	PER LITRE ₹ 61/- AND FOR 20 LITRE ₹ 620/- VARRIES ON LITRES
PLASTER OF PARIS		• MATERIAL WHICH HAS AN NUMEROUS APPLICATIONS IN MEDICAL FIELDS AND CONSTRUCT. • MADE BY MEATING GYPSUM ABOUT 150°C.	• REGULAR PLASTER OF PARIS • CASTING PLASTER OF PARIS • DENTAL POP • MODIFIED PLASTER OF PARIS.	• COST EFFECTIVE : WHEN BUDGETING IN A SMALL SCALE. • EASE OF APPLICATION : POP CAN BE MIXED WITH WATER AND EASILY APPLIED. • TEMPORARY WATERPROOFING : POP CAN PROVIDE A TEMPORARY MOISTURE BARRIER.	• WATER ABSORPTION. POP IS INHERENTLY POROUS CAN ABSORB MOISTURE. • PRONE TO CRACK : POP IS BRITTLE ONCE SET AND CAN CRACK UNDER STRESS. • NOT DURABLE IN WET CONDITIONS : IN AN WET ENVIRONMENTS POP IS DEGRADATION.	PER KG ₹ 8-10/-
GYPSUM		• IS WIDELY USED IN CONSTRUCTION. • IN THE FORM OF GYSUM BOARD, PLASTER, PLASTER BOARD. • ALTHOUGH IT IS NOT INHERENLY WATERPROOF. • IT IS USE AS WATERPROOFING COMPONENT BY COMBINING.	• WATER RESISTANT GYPSUM BOARD • WATER GYPSUM PLASTER • MOISTURE RESISTANT GYSUM PANEL • GYPSUM - CEMENT - BASED	• GYPSUM NATURALLY RESISTS FIRE • GYPSUM IS EASY TO HANDLE AND APPLY • LIGHTWEIGHT - MAKE THEM EASY TO TRANSPORT HANDLE AND INSTALL. • SOUND INSULATION : ESPECIALLY THOSE WITH A THICKER COMPOSITION.	• LOW NATURAL WATER RESISTANCE • NOT SUITABLE FOR CONTINOUS EXPOSURE TO WATER. • VULNERABILITY TO MOLD AND MILDEW THESE CAN BECOME A BREEDING GROUND FOR MOLD WHEN EXPOSED TO DAMP CONDITIONS. • CRACKING UNDER MOISTURE STRESS.	PER KG ₹ 7-15 ON GYPSUM POWDER VARRIES ON PLASTER AND PRODUCTS
POLYSTYRENES		• IS A VERSATILE PLASTIC MATERIAL USED AS WATERPROOF MATERIAL. • USUALLY FOUND IN A FORM OF EXPANDED PS, EXTRUDED PS, RIGID PS SHEETS.	• EXPANDED POLYSTRENE • EXTRUDED POLYSTRENE • RIGID POLYSTRENE SHEETS	• WATER RESISTANCE - MAKE THEM EFFECTIVE IN STRUCTURES, FOUND IN FOUNDATION AND BASEMENT. • OFFERS EXCELLENT THERMAL RESISTANCE • DURABLE AND LONG - LASTING IN OUTDOOR CONDITIONS. • ITS CLOSED - CELL STRUCTURE RESIST MOLD. MILDEW RESISTANCE.	• UV DEGRADATION WHEN EXPOSED TO SUNLIGHT. • ENVIRONMENTAL IMPACT NON - BIODEGRADABLE AND POSES CHALLENGES FOR DISPOSAL. • CAN BE DAMAGED OR WEAKENED BY CERTAIN CHEMICALS. • LIMITED FLEXIBILITY : SINCE WATERPROOFING POLYSTRENES RIGIDITY MAY BE A DRAWBACK.	EPS - ₹ 60 TO ₹ 120 / KG XPS - ₹ 120 TO ₹ 180/KG RPS - ₹ 100 TO ₹ 200/KG
SEALANTS		• COMMONLY USED IN WATERPROOF OF APPLICATIONS TO CREATE AN WATERTIGHT SEALANT. • HELPS MAINTAINING STRUCTURAL INTERGRITY OF STRUCTURES. • PREVENT WATER INFILTRATION.	• SILICONE SEALANTS • POLYURETHANE SEALANTS • ACYLIC SEALANTS • BUTYL RUBBER SEALANTS • BITUMINOUS SEALANTS • POLYMER SEALANTS	• CREATE A BARRIER THAT PREVENTS WATER IN FILRATATION. • REMAINS FLEXIBLE EVEN AFTER CURING. • MOST ARE EASY TO APPLY, DOES NOT REQUIRE ANY TOOLS. • SEALANTS CAN BE USED ON VARIETY OF A MATERIALS LIKE CONCRETE, METAL, WOOD AND GLASS.	• LIMITED DURABILITY UNDER HARSH CONDITION. • NEED REGULAR MAINTENANCE • SENSITIVE TO SURFACE PREPARATION • SOME SEALANT MAY ADHERE WELL TO SOME OF MATERIALS. • SOME SEALANT CAN DEGRADE WHEN EXPOSED TO DIRECT SUNLIGHT.	- SILICONE SEALANT - ₹350 TO 800/- PER KG - POLYURETHANE SEALANT - ₹250 TO ₹600 / KG - ACRYLIC SEALANT - ₹150 TO ₹ 500 PER KG

WATERPROOF COMPONENTS

SIGNATURE	NAME : NAVEEN YADAV S M	SHEET NO
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	SEM : IV	
	SUBJECT : MMBC-5	
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INTRODUCTION

- PLASTIC IS A NATURAL OR SYNTHETIC ORGANIC MATERIAL PREPARED FROM RESIN. WHICH IS CAPABLE OF PLASTIC DEFORMATION WHEN HEAT AND PRESSURE ARE APPLIED TO IT.
- PLASTIC IS A MODERN INDUSTRIALLY-PRODUCED MATERIAL WITH NUMEROUS USES AND CAN BE MOLDED TO THE REQUIRED SIZE AND SHAPE.
- IT IS LIGHT IN WEIGHT AND HAS TOUGHNESS AND GOOD TENSILE STRENGTH
- THERE ARE MORE THAN 10,000 VARIETIES OF PLASTICS. AND THEIR NUMBER IS INCREASING DAY TO DAY

PROPERTIES

- COLOUR: SOME PLASTICS ARE FULLY TRASPARENT THEY CAN BE COLOURED USING PIGMENTS.
- CHEMICAL RESISTANCE: THEY OFFER GREAT RESISTANCE AGAINST CHEMICALS AND CORROSION.
- FIRE RESISTANCE: ELEMENTS LIKE PHENOL FORMALDEHYDE AND UREA FORMALDEHYDE RESIST FIRE.
- ELECTRICAL INSULATION: GOOD INSULATORS OF ELECTRICITY. HENCE USED FOR PLUGS, SWITCHES, ETC.,
- OPTICAL PROPERTY: MANY VARIETIES OF PLASTIC ARE TRANSPARENT AND TRANSLUCENT.
- STRENGTH: PLASTICS ARE REASONABLY STRONG. THEIR TENSILE STRENGTH CAN BE INCREASED BY REINFORCING THEM WITH VARIOUS FIBROUS MATERIALS.

APPLICATION IN CONSTRUCTION

- FLOORING:

  PLASTIC ARE USED IN THE FORM OF TILES OR SHEETS FOR FLOORING IN OFFICE BUILDINGS AS WELL AS IN RESIDENTIAL AND NON-RESIDENTIAL BUILDINGS. THEY PROVIDE A RESILIENT, DECORATIVE AND NON-POROUS SURFACE WHICH CAN BE EASILY CLEANED BUT CARE SHOULD BE TAKEN TO PREVENT BURNING STUMPS TO GET INTO CONTACT WITH PVC FLOOR.
- ROOFING:

  TWO LAYERS OF PLASTIC MATERIALS ARE USED TO ENSURE THAT THERE IS NO DAMAGE TO THE ROOF ONE LAYER OF PLASTIC, WHICH IS THE UPPER PART, IS MADE OF THERMOPLASTIC OLEFIN OR VINYL, WHERE AS THE LOWER PART IS MADE OF POLYURETHANE FOAM. THESE PLASTIC MATERIALS CONSUME LESS HEAT AND ENSURE THAT THE INTERIOR OF THE HOUSE IS KEPT COOLER.
- INSULATION:

  THERMOCOL SHEETS ARE LIGHT CELLULAR PLASTIC MATERIALS USED FOR SOUND AND HEAT INSULATION. POLYURETHANE FOAM IS KNOWN BECAUSE IT IS LIGHT WEIGHT, CHEMICAL RESISTANT AND FAME RETARDANT.
- WINDOWS AND DOORS:

  POLY CARBONATE IS KNOWN FOR BEING MORE BURGLAR-PROOF COMPARED TO REGULAR GLASS WINDOWS.

  PLASTIC MATERIALS LIKE FIBERGLASS AND VINYL ARE ALSO USED TO MANUFACTURE WINDOW FRAMES.

  MANY CONSTRUCTION PROJECTS USE POLYURETHANE FOAM WITH A FIBRE-REINFORCED PLASTIC (FRP) COATING FOR MANUFACTURING DOORS. THIS STRUCTURE MAKES THEM INCREDIBLY STRONG.
- PLUMBING:

  CISTERN BALL FLOATS ARE ALWAYS MADE WITH PLASTIC. THE WATER SUPPLY PIPES ARE MADE FROM POLYETHYLENE, PVS, ACRYLONITRILE BUTADIENE STYRENE (ABS), AND CPVC. THEY ARE KNOWN FOR BEING WATER AND CHEMICAL RESISTANT.

  PLASTIC TAPS ARE ALSO POPULAR, AND EVEN BATHTUBS ARE MADE WITH PLASTIC.

  OVERHEAD WATER TANKS ARE MADE OF HIGH-DENSITY OR LOW-DENSITY POLYTHENE (HDPE OR LDPE).
- ELECTRICAL CONDUITS:

  PLASTIC PIPES ARE USED AS ELECTRICAL CONDUITS, ELECTRICAL PRODUCTS LIKE SWITCHES, SWITCHBOARDS, PLUGS AND SO ON ARE MADE INVARIABLY WITH PLASTIC.

TYPES OF PLASTIC

POLYCARBONATE:
- PC ARE A GROUP OF THERMOPLASTIC POLYMERS CONTAINING CARBONATE GROUPS IN THEIR CHEMICAL STRUCTURES.
- USED FOR SHEETING IN A GREENHOUSE. ALSO USED IN CONSTRUCTION INDUSTRY Eg DOMELIGHTS, ROOFING, WALLS ETC

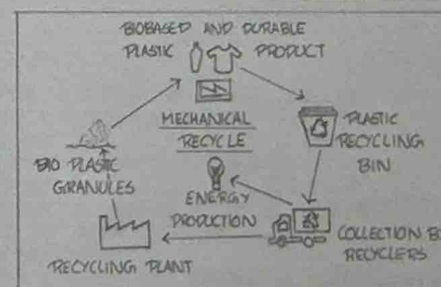
FIBRE-REINFORCED PLASTIC:
- FRP; ALSO CALLED FIBRE-REINFORCED PLASTIC, IS A COMPOSITE MATERIAL MADE OF A POLYMER MATRIX REINFORCED WITH FIBRES. THE FIBRES ARE USUALLY GLASS, CARBON, ARAMID OR BASALT.
- USED IN AEROSPACE, AUTOMATIVE, MARINE AND CONSTRUCTION INDUSTRIES

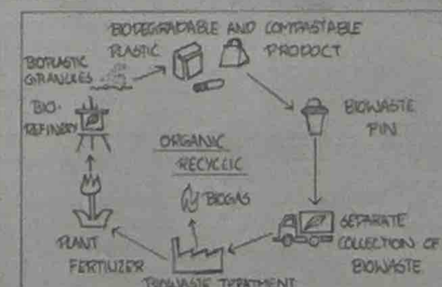
POLYVINYL CHLORIDE:
- PVC COMES IN RIGID AND FLEXIBLE FORMS. RIGID PVC IS USED IN CONSTRUCTION FOR PIPE DOORS AND WINDOWS.
- ADDING PLASTICIZERS MAKES PVC SOFTER AND MORE FLEXIBLE USED IN PLUMBING, ELECTRICAL INSULATION, ETC.,

ENERGY EFFICIENCY OF PLASTIC MATERIALS

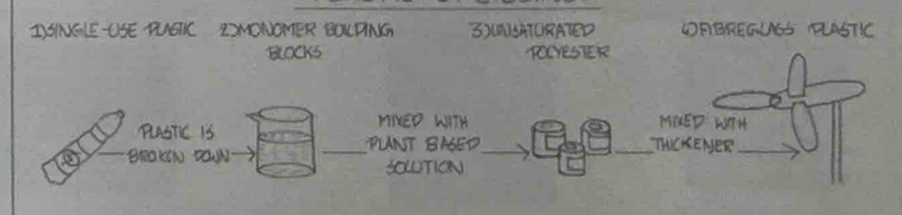
- ELECTRICITY BASED POWER IS THE COMMON FORM OF ENERGY IN POLYMER PROCESSING AND PROVIDES OBVIOUS POTENTIAL FOR A REDUCTION IN ENERGY USE AND COSTS.
- PLASTIC CAN BE USED INNOVATIVELY IN SUSTAINABLE CONSTRUCTION TO ENHANCE ENERGY EFFICIENCY, REDUSE WASTE, AND IMPROVE THE OVERALL ENVIRONMENTAL IMPACT OF BUILDING AND INFRASTRUCTURE.
- PHENOLIC POLYURETHANE (PUR), POLYSIOCYANURATE (PIR), EXPANDED POLYSTYRENE (EPS) OR EXTRUDED POLYSTYRENE (XPS) CAN SAVE MORE THAN 200TIMES THE ENERGY USED IN PRODUCTION PROCESS.
- PLASTICS IN CONSTRUCTION ARE LIGHTER, FLEXIBLE, DURABLE THAN THEIR ALTERNATIVES, MAKING IT A SUSTAINABLE CHOICE FOR CONSTRUCTION. THESE MATERIALS REDUCES GREENHOUSE GAS EMISSIONS.

PLASTIC RECYCLE





PLASTIC UPCYCLING



PLASTIC AS A BUILDING MATERIAL

SIGNATURE	NAME: NAVEEN YADAV S M	SHEET NO
	USN: 1AA22AT010	18
	SEM: V	
	SUBJECT: MMBC-5	
	COLLEGE: ANRVSA	

INTRODUCTION

ECO-FRIENDLY MATERIALS ALSO KNOWN AS ENVIRONMENT FRIENDLY OR SUSTAINABLE MATERIALS ARE DESIGNED AND PRODUCED TO MINIMIZE HARM TO THE ENVIRONMENT. THESE ARE CHARACTERIZED BY THEIR ABILITY TO CONSERVE RESOURCES, REDUCE POLLUTION, AND PROMOTE SUSTAINABILITY. BY ADOPTING ECO-FRIENDLY MATERIALS, WE CAN MAKE A SIGNIFICANT DIFFERENCE IN REDUCING OUR ECOLOGICAL FOOTPRINT.

COB

- COB OR CLOM IS A NATURAL BUILDING MATERIAL MADE FROM SUBSOIL, WATER, FIBROUS ORGANIC MATERIAL, AND SOMETIMES LIME.
- THE CONTENT OF SUBSOIL VARY, AND IF IT DOES NOT CONTAIN THE RIGHT MIXTURE, IT CAN BE MODIFIED WITH SAND OR CLAY.
- ADVANTAGES : NATURAL MATERIAL SUPER EASY TO USE.
- CREATES NATURAL INSULATION AND IS VERY
- ENERGY EFFICIENT
- COB HOUSES MAY NOT REQUIRE HEATING.

RECYCLED STEEL

- RECYCLED STEEL IS A TYPE OF MATERIAL THAT DOESN'T LOSE ITS PROPERTIES WHEN RECYCLED
- RECYCLING STEEL SAVES ENERGY AND REDUCES POLLUTION
- THE USE OF SCRAP STEEL SAVES UPTO 75% OF THE ENERGY NEEDED TO MAKE STEEL FROM VIRGIN MATERIALS.
- ADVANTAGE : STRUCTURE WILL BE STRONG
- MASSIVE SAVER IN ENERGY COSTS.

SHEEP'S WOOL

- SHEEP'S WOOL IS ENTIRELY NATURAL AND ECO FRIENDLY MATERIAL THAT CAN BE REGROWN QUICKLY.
- WOOL IS BEST KNOWN FOR BEING USED FOR COSY WARM BLANKETS AND SWEATERS.
- BUT IT ALSO PLAYS A ROLE AS AN OUTSTANDING HOME INSULATOR - WITH ITS FIBER FORMING MILLIONS OF TINY AIR POCKETS THAT TRAP AIR.
- WOOLS CAN BE INCORPORATED IN THE CEILING, WALLS OR ATTICS.
- ADVANTAGES : EASY TO SOURCE, ENERGY-SAVING MATERIAL.

CORK

- CORK IS MADE OF CORK OAK TREE, WHICH IS ONE OF THE HEIGHLY RENEWABLE AND ECO-FRIENDLY RESOURCES.
- ANOTHER FANTASTIC GREEN BUOYANT MATERIAL FOUND ITS UNIQUE PURPOSE IN BUILDING CORK CEILING PANELS, ACOUSTIC WALL AND FLOORING.
- ADVANTAGES : CORK IS A RESILIENT MATERIAL
- RESISTANT TO MOISTURE AND ANY LIQUID
- DUE TO ITS STRUCTURE, IT CAN ABSORB VIBRATION.
- CORK HARVESTING FIGHTS AGAINST GLOBAL WARMING.

STRAW BALES

- STRAW BALES ALSO HAVE HIGH INSULATING PROPERTIES.
- THESE ARE USUALLY PLACED IN WALLS, ATTICS AND CEILINGS TO KEEP THE TEMPERATURE STABLE.
- STRAW CAN BE HARVESTED AND RE-PLANTED WITH MINIMUM ENVIRONMENTAL IMPACT.
- ADVANTAGES : 100% RECYCLABLE
- 100% BIODEGRADABLE
- SUSTAINABLE METHOD FOR BUILDING, FROM SOURCING TO ENERGY EFFICIENCY.
- CAN BE USED AS INSULATION CLADDING.

MYCELIUM

- MYCELIUM IS THE VEGETATIVE PART OF A FUNGUS FIBRE THAT RUNS UNDERNEATH THE GROUND.
- ONCE IT'S DRIED, IT CAN BE USED AS A BUILDING MATERIAL.
- IT HAS CUSTOMISABLE MATERIAL PROPERTIES AND CAN REPLACE FOAMS, TIMBER OR PLASTICS FOR APPLICATIONS.
- IT IS TYPICALLY USED FOR INSULATION, DOOR CORES, FLOORING AND OTHER FURNISHINGS.
- ADVANTAGES : IT IS SUPER ECO-FRIENDLY MATERIAL.
- WATER, MOULD AND FIRE-RESISTANT.

CASE STUDY

THE ATELIER SCHOOL, BANGALORE

- THIS IS AN ELEMENTARY AND MIDDLE SCHOOL IN BANGALORE, INDIA - DESIGNED BY BIOME ENVIRONMENTAL SOLUTIONS. ECO-FRIENDLY BUILDING TECHNIQUES
- VARIOUS BUILDING TECHNIQUES MAKE THE DESIGN ECONOMICAL AND ECO-FRIENDLY.

1) CHAPPADI GRANITE STONE SLAB FOUNDATION
2) PAPER TUBE PARTITION WALLS
3) PAVER BLACK FLOORING
4) CSEB'S MADE FROM LOCAL SOIL
5) CEILING MADE OF BAMBOO MAT PLYWOOD
6) EXTERNAL FABRICATED FACADE IS A TACK WELDED MILD STEEL FRAME WITH PANELS OF PERFORATED METAL SHEET
7) USE OF PINEWOOD AND REFLECTIVE GLASSES

- LIGHT DURABLE FURNITURES MADE OF HONEYCOMB AND PAPER TUBES. THE VERSATILITY OF MATERIALS PERMITS A VARIETY OF CONFIGURATIONS.

PIXEL BUILDING, AUSTRALIA

- THIS IS AN OFFICE BUILDING IN AUSTRALIA - DESIGNED BY STUDIO505. A 6 STAR CARBON NEUTRAL HOME.

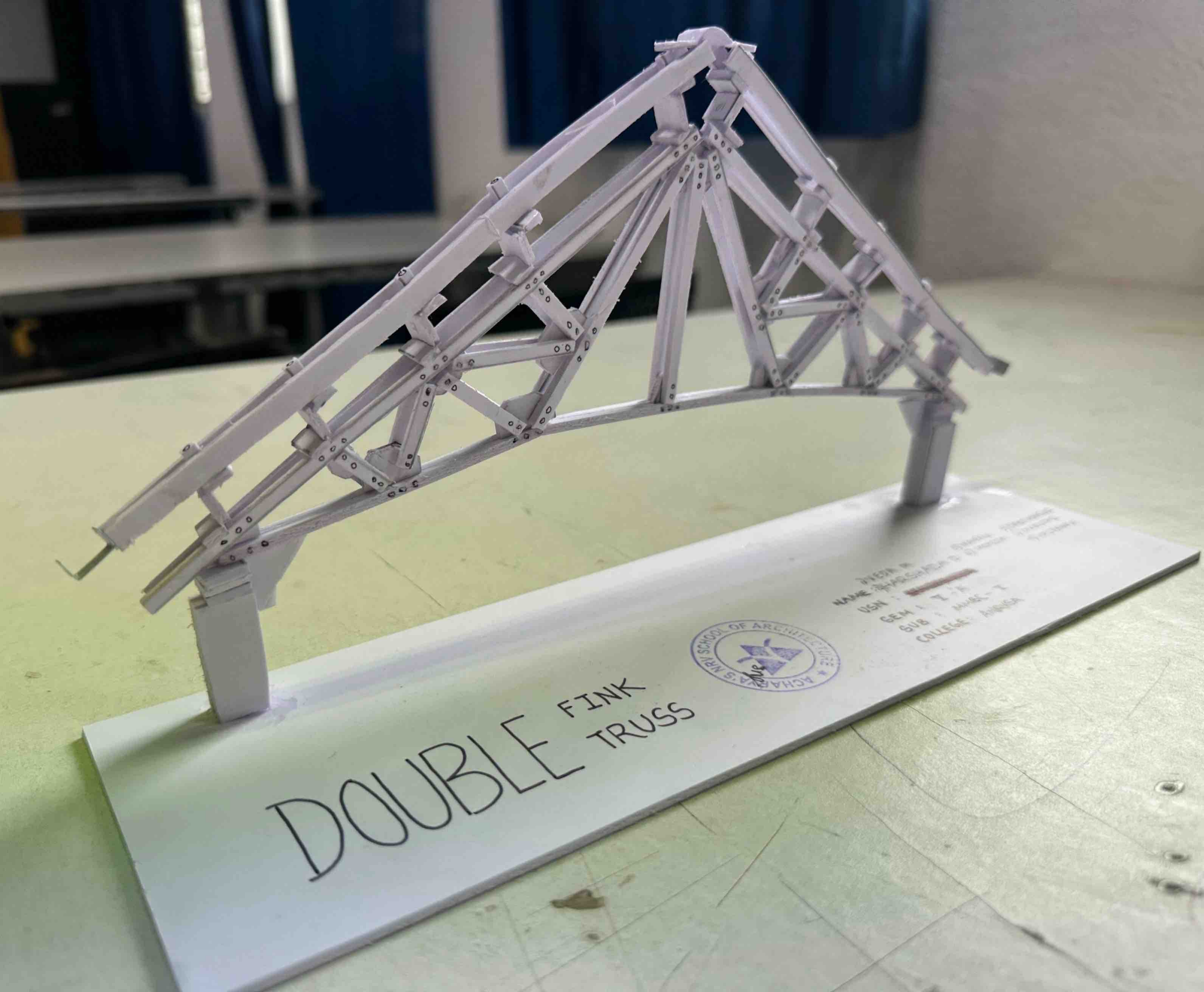
PROPERTIES OF MATERIAL

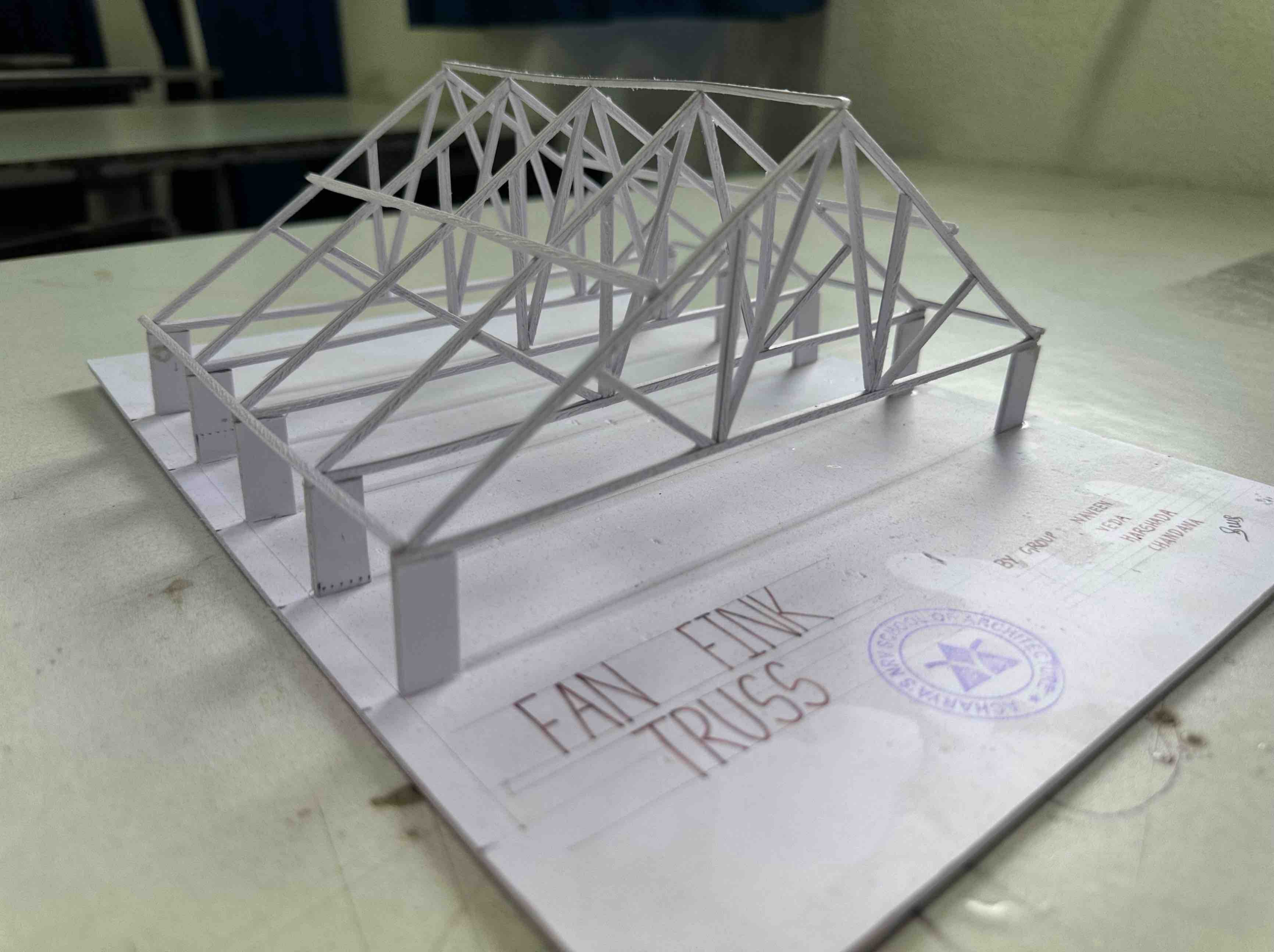
- THE RECYCLED PANELS INCLUDE ALUMINIUM SKINS WITH A NON-COMBUSTIBLE MINERAL FILLED CORE, AND A COATING OF FLUOROCARBON PAINT.
- THE FACADE IS A SYSTEM OF PERIMETER PLANTERS, FIXED SHADING LOUVERS, DOUBLE GLAZED WINDOW WALLS AND SOLAR PANEL SHADING.
- RECYCLED COLOUR PANELS PROVIDE MAXIMIZED DAYLIGHT, SHADE, AND MANEUVERABLE LOUVERS. A LIVING ROOF, SPECIALIZED CONCRETE, RECYCLED PANELS AND SMART WINDOW TECHNOLOGY.

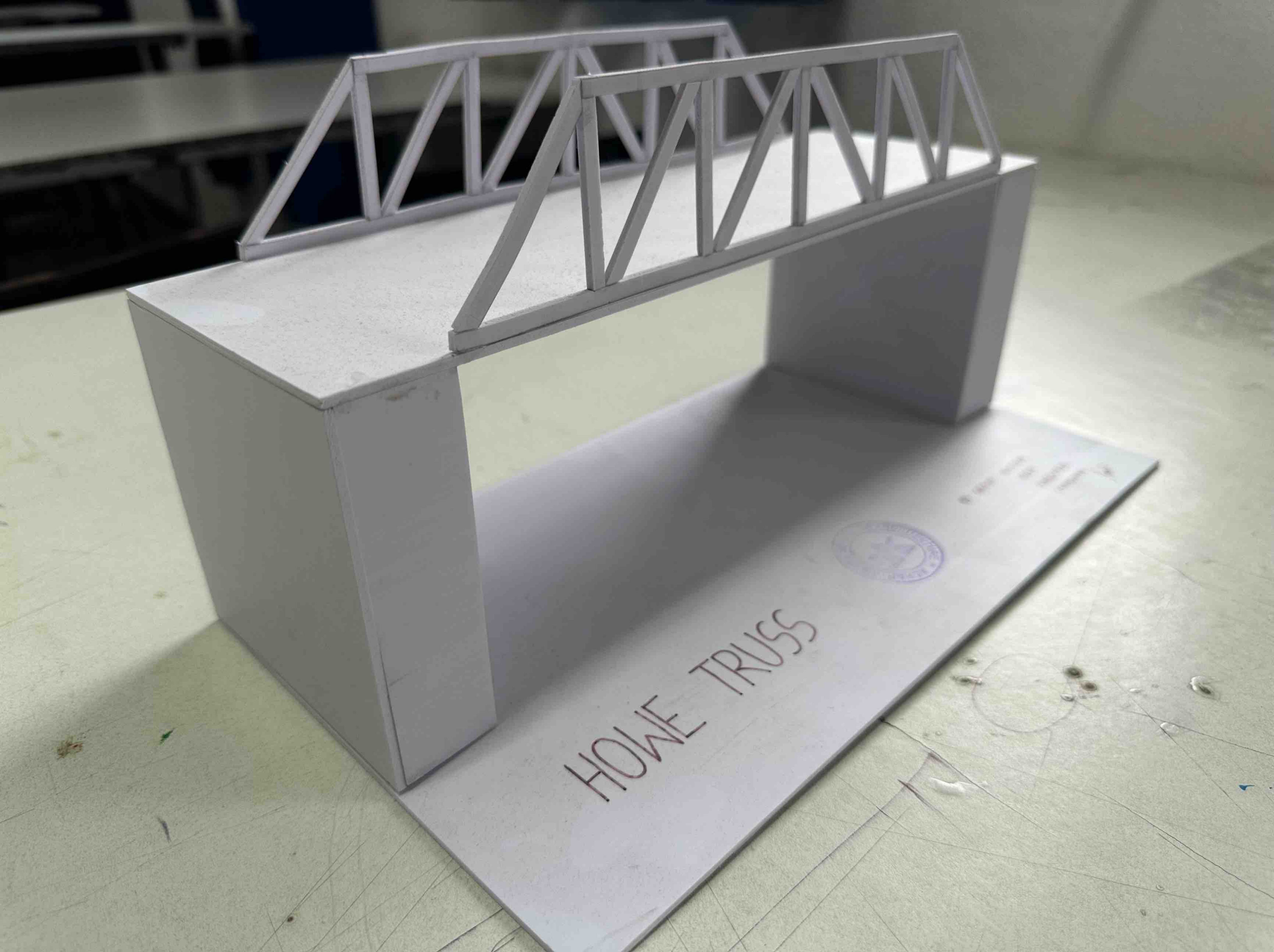
STRUCTURAL CONCRETE : THE CONCRETE USED IN THE PROJECT INCORPORATES A LARGE AMOUNT OF RECYCLED AND RECLAIMED AGGREGATES IN ITS MIX, CALLED PIXELCRETE.

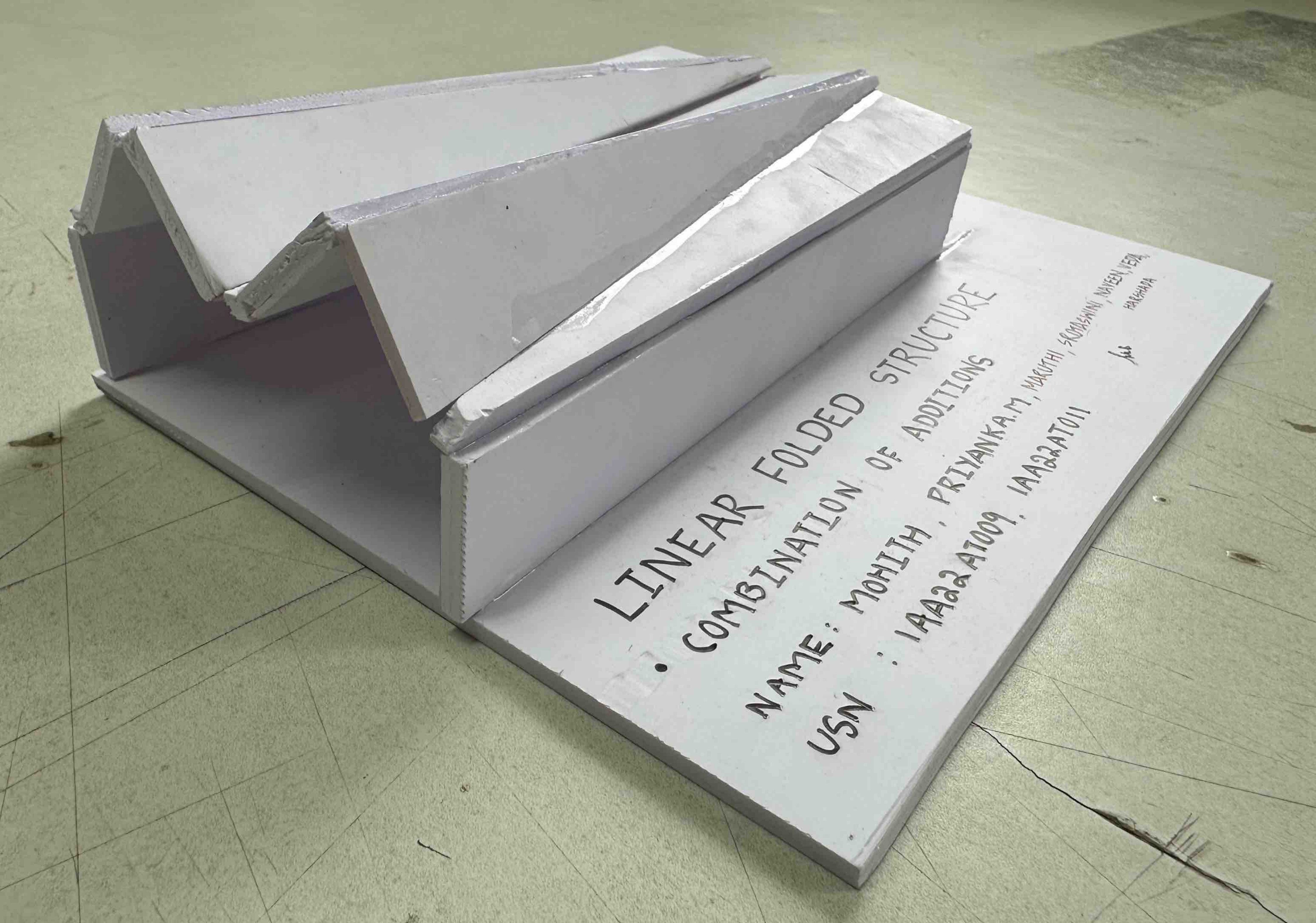
ENVIRONMENTAL FRIENDLY MATERIALS

SIGNATURE	NAME NAVEEN YADAV G M	SHEET NO.
	USN 1AA22AT010	19
	SEM : V	
	SUBJECT MMBC-5	
	COLLEGE ANRVSA	


DOUBLE FINK TRUSS
ACHARYA'S NRV SCHOOL OF ARCHITECTURE

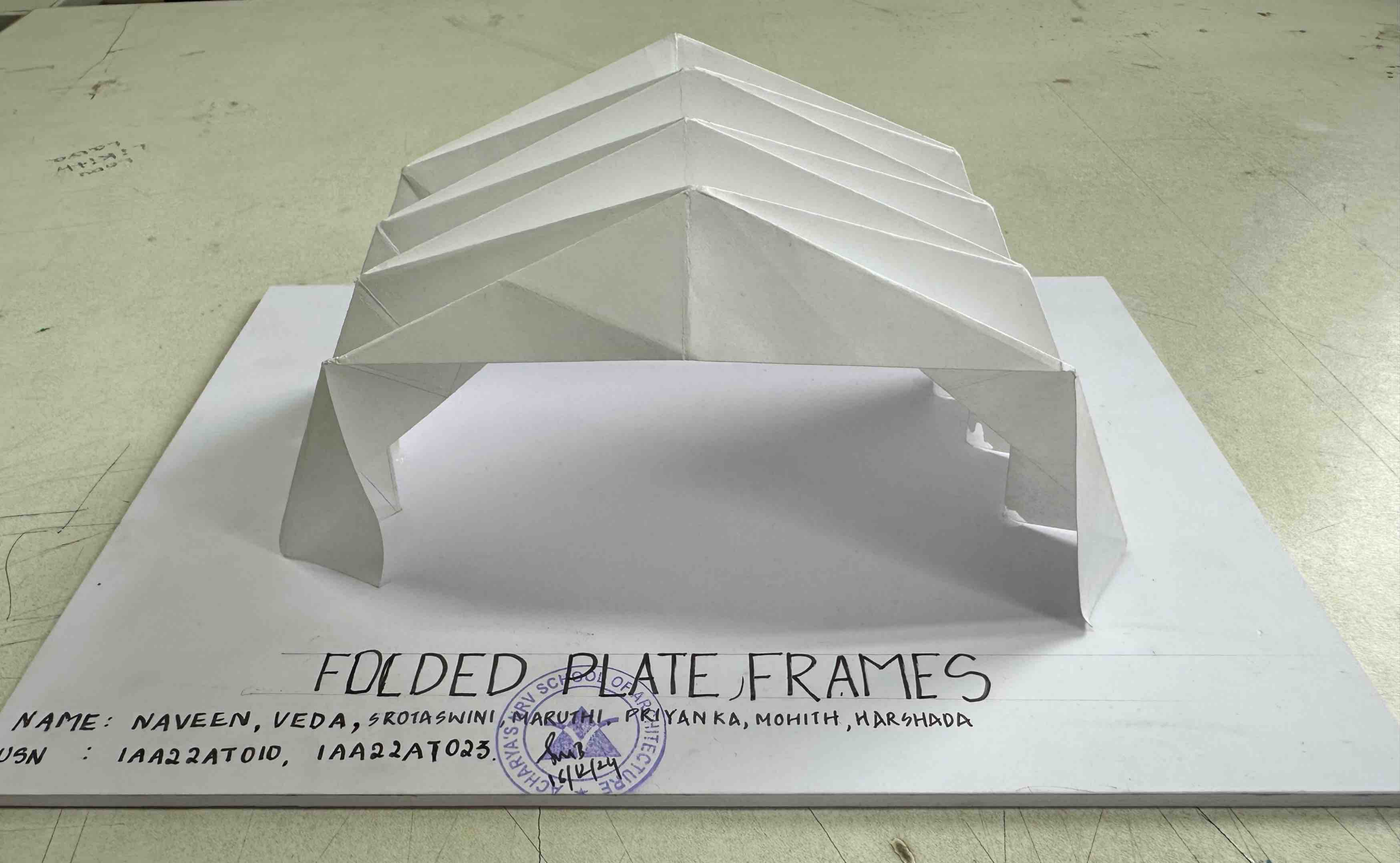

FAN FINK
TRUSS
BY GROUP : NAVEEN
YEDA
HARSHADA
CHANDANA
SCHOOL OF ARCHITECTURE

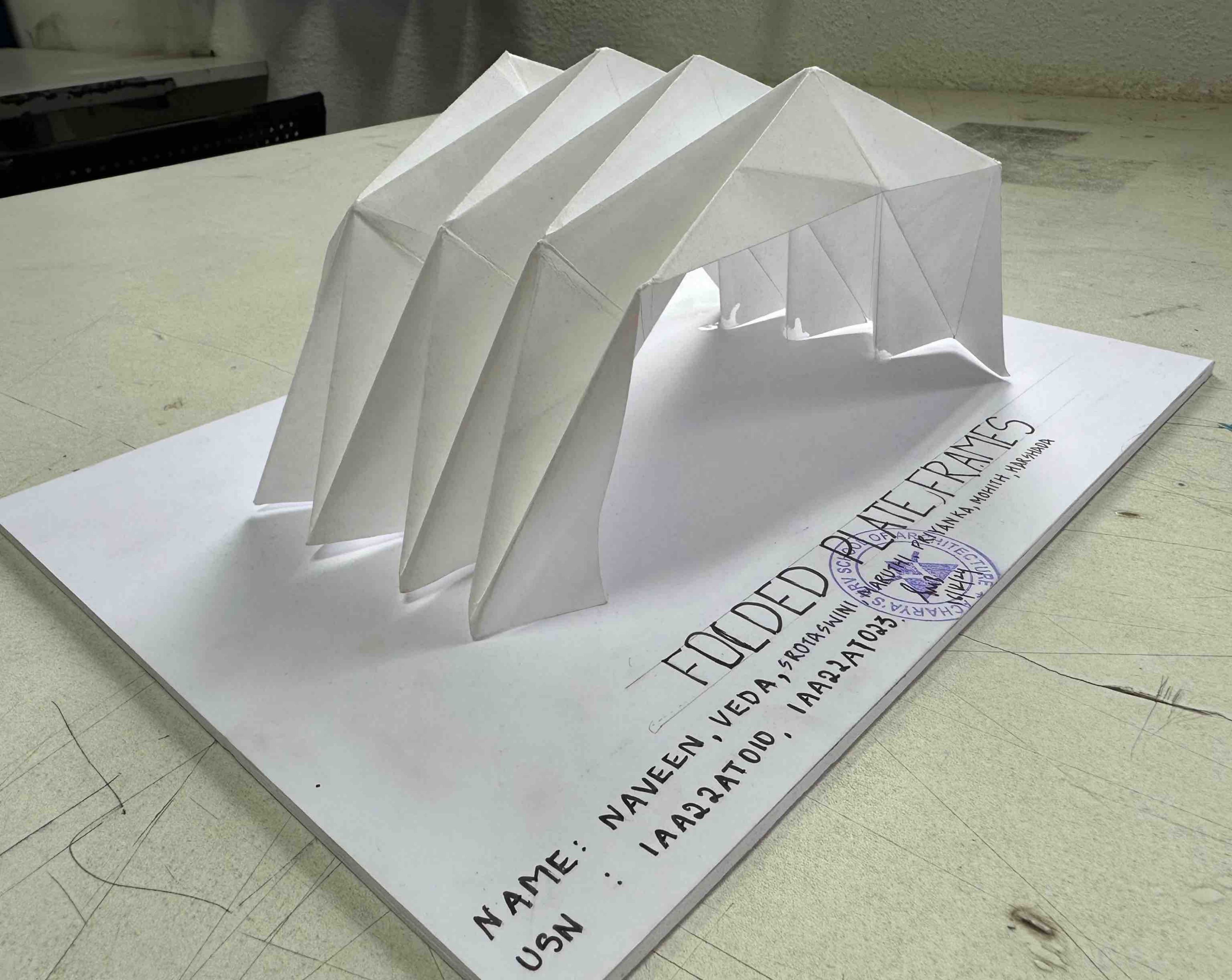

HOWE TRUSS


LINEAR FOLDED STRUCTURE
• COMBINATION OF ADDITIONS
NAME: MOHITH, PRIYANKA.M, MARUTHI, SROAASHINI, NAVEEN, VEDA, HARSHADA
USN : 1AA22AT009, 1AA22AT011


• LINEAR FOLDED STRUCTURE
NAME: PRIYANKA.M, MOHITH, SROTASWINI, MARUTHI, NAVEEN
USN: 1AA22AT011, 1AA22AT009
VEDA

Example:
Kanteerava
Indoor
Stadium
(Bangalore)
ACHARYA'S NRV SCHOOL OF ARCHITECTURE
SPATIAL FOLDED PLATE
STRUCTURE
NAME: SROTASWINI, MARUTHI,
MOHITH, PRIYANKA,
NAVEEN, VEDA,
HARSHADA.
M: 5TH
MMBC-V
NRVSA


FOLDED PLATE FRAMES
NAME: NAVEEN, VEDA, SROTASWINI, MARUTHI, PRIYANKA, MOHITH, HARSHADA
USN : 1AA22AT010, 1AA22AT023.



FOLDED PLATE FRAMES
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