IARE
INSTITUTE OF
AERONAUTICAL ENGINEERING

HIGH IMPACT PRACTICES (HIPS)

InfraNova

INFORMATION PACKET

2025 - 2026

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INSTITUTE OF AERONAUTICAL ENGINEERING
25 YEARS
2000 2025

I appreciate your interest in the Cornerstone Project (CoP), Department of CE (Civil Engineering) at the Institute of Aeronautical Engineering!

A cornerstone project (CoP) is typically introduced during the early or middle stages of an academic program at the Institute of Aeronautical Engineering. It focuses on helping students build foundational skills and understand how to apply basic concepts to real-world scenarios. These projects are usually smaller in scope, moderately complex, and designed to strengthen practical understanding of core subjects.

These projects encourage students to connect theoretical learning to data-centric applications, such as developing the data learning model, performing simple data analysis, or creating prototype engineering solutions. Emphasis is placed on learning by doing, helping students build confidence in applying methods like data preprocessing, statistical analysis, basic modeling, and reporting results. By working on InfraNova projects, students begin to understand how civil engineering principles apply to real-world infrastructure challenges. Ultimately, InfraNova serves as the foundation of experiential learning at IARE, transforming students from passive learners into active problem-solvers—equipped with essential technical skills, design thinking, and professional attitudes needed for advanced engineering education and sustainable development.

Cornerstone Project (CoP) teams are:

- Collaborative Project – This is an excellent opportunity for students who are committed to working towards social developments and emerging needs.
- Project Activity – The project coordinator listed current working areas for offering cornerstone projects with a team size of at least two students. The coordinator allotted mentors based on the work area and facilitated exclusive project laboratories for selected cornerstone project (CoP)students. This cornerstone project (CoP)bridges the gap between academic learning and real world social applications. It helps enhance the professional development
- Short-term - Each undergraduate student may participate in a project for an assigned period.

The primary goal of cornerstone projects is to provide a level of moderate complexity, expertise, and diversity of thought in social data-centric areas that will allow them to gain hands-on experience with the cornerstone projects.

- Simulate real-world infrastructure project environments – Familiarize students with the structure, expectations, and deliverables typically found in planning, designing, and executing civil engineering projects.
- Encourage interdisciplinary and sustainable thinking – Promote the integration of civil engineering with environmental science, smart technologies, architecture, and community development to address real-world challenges.
- Promote ethical and inclusive infrastructure design – Instill awareness of sustainability, accessibility, disaster resilience, and ethical construction practices during project planning and development.
- Support solution-oriented engineering practices – Enable students to propose and model civil solutions that address local needs in areas such as water management, urban safety, green building, and rural infrastructure.
- Foster hands-on project experience – Engage students in practical, model-based civil projects using tools like AutoCAD, physical prototyping, 3D printing, and basic survey techniques.
- Build strong engineering portfolios – Encourage students to document their projects through drawings, models, reports, and presentations to create career-ready portfolios showcasing innovation and design skills.
- Bridge academic learning and real-world application – Help students apply fundamental civil concepts to practical challenges involving layout planning, structural modeling, material testing, and environmental design

Cornerstone Projects (CoPs) focuses on the challenges presented by the Sustainable Development Goals (SDGs)

Sustainability Development Goals (SDGs) for the Dept. of Civil Engineering, IARE	
SDG 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
SDG 6	Ensure availability and sustainable management of water and sanitation for all
SDG 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
SDG 11	Make cities and human settlements inclusive, safe, resilient and sustainable
SDG 12	Ensure sustainable consumption and production patterns
SDG 13	Take urgent action to combat climate change and its impacts

Themes of Cornerstone Projects (CoPs) for the CE (Civil Engineering):

The following project domains are recommended for cornerstone projects (CoPs), and the students should frame the problem statements from any one of the following themes:

1. Civ-i-Learn: Discover, Design, Develop – Identifying problems in the built environment such as drainage, access, or poor planning and developing basic solutions using sketching, AutoCAD, or physical models. **(SDG #4, SDG #9)**
2. Mini Structures, Mega Ideas – Building miniature models of bridges, buildings, and foundations using simple materials and tools to understand basic structural behavior and load transfer. **(SDG #4, SDG #9, SDG #11)**
3. Model the Future: Build with Purpose – Designing 3D printed models of smart infrastructure components such as interlocking bricks, smart roads, and water-efficient sanitation systems. **(SDG #9, SDG #12, SDG #13)**
4. Green Habitat: Living Light, Building Right – Planning small-scale sustainable housing, rooftop gardens, and passive cooling layouts to promote eco-living and energy efficiency. **(SDG #6, SDG #11, SDG #13)**
5. Survey to Serve: Mapping for Better Living – Conducting basic surveys and mapping of water flow, terrain gradients, and flood-prone zones to support better local planning and infrastructure upgrades. **(SDG #6, SDG #9, SDG #11)**
6. Design to Include: Civil for Everyone – Designing infrastructure that addresses accessibility and inclusion, such as smart bus stops, barrier-free toilets, and shelters for underserved groups. **(SDG #4, SDG #9, SDG #11)**
7. **From Sand to Structure: Material Matters** – Testing and comparing the behavior of traditional and eco-friendly materials such as clay bricks and fly ash blocks for sustainable construction. (SDG #9, SDG #12)
8. **Resilient Roots: Disaster-Smart Designs** – Developing concepts and models for infrastructure that withstands natural disasters like floods, earthquakes, and fires. (SDG #9, SDG #11, SDG #13)

9. **Smart Street, Safe Street** – Designing safe and efficient street layouts for rural and urban zones, including pedestrian pathways, lighting solutions, and traffic calming designs. (SDG #9, SDG #11)

10. **CivCraft: Build, Fail, Learn** – Creating simple civil engineering systems using recycled materials and basic hydraulics or electronics, emphasizing innovation through trial and error. (SDG #4, SDG #12)

In order to participate in cornerstone projects, you must formally apply and be accepted by the project coordinator. To proceed, please mail to the project coordinator, Dr. R. Ramya Swetha (r.ramyaswetha@iare.ac.in), Head of Civil Engineering. This will bring up all available open positions tagged as cornerstone projects.
Please note that participation by the cornerstone project (CoP) team requires registration for the accompanying project work from any of the specified domains. More information will be provided to all selected cornerstone project (CoP) applicants who have been offered a position.

If you have any questions about a particular team, please contact the faculty mentor.
We encourage you to contemplate this fascinating new opportunity. We look forward to receiving your application submission!

Civ-i-Learn: Discover, Design, Develop

Dr. R. Ramya Swetha, Associate Professor & Head, CE (Civil Engineering) – Faculty Mentor

GOALS

To introduce students to foundational civil engineering principles through problem observation, creative thinking, and design-based exploration. This project empowers students to identify small-scale infrastructure or environmental challenges in their surroundings—such as water stagnation, poor drainage, or lack of accessibility—and develop conceptual solutions using basic tools like sketching, AutoCAD, and physical modeling.

The project aims to develop practical civil awareness among students early in their academic journey. By studying the built environment, students are encouraged to think critically about functionality, layout, safety, and sustainability in civil systems.

Students will gain hands-on experience by creating simple design solutions, preparing scaled models using cardboard, clay, or other accessible materials, and learning to represent their ideas using 2D drafting tools. The goal is to promote early-stage innovation, cultivate an engineering mindset, and reinforce learning through real-world relevance and creativity.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will explore fundamental design and drafting tools, physical prototyping, and observational analysis through the following methods:

- Sketching & Visual Storyboarding – Representing ideas through freehand drawings and scenario planning
- AutoCAD Fundamentals – 2D drafting for room layouts, small structures, and site plans
- Model-Making – Using cardboard, clay, popsicle sticks for scaled structure prototypes
- Field Observation & Documentation – Identifying civil issues in the built environment and recording key findings
- Sustainable Thinking – Basic exploration of energy use, ventilation, lighting, and material choice
- Presentation Skills – Communicating ideas through posters, presentations, and models
- Basic Measurements & Estimations – Using simple tools to gather site dimensions or elevations

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Foundational Civil Infrastructure Projects:

- Identifying relevant and realistic infrastructure problems at a local scale
- Translating physical observations into functional designs or layout improvements
- Learning standard drafting conventions and representation techniques
- Understanding spatial relationships, flow, and ergonomics in simple layouts
- Managing available resources for model-making and material representation
- Balancing creativity with structural feasibility and usability
- Working collaboratively in diverse teams to develop shared solutions
- Communicating technical ideas effectively to non-technical audiences

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Basic Structural Design – Introduction to forms, framing, and load paths
- Drafting & Drawing – Learning to read and create 2D plans and elevations

- Sustainable Design Thinking – Low-cost, environmentally friendly solutions
- Urban Awareness – Understanding infrastructure needs in communities
- Model-Based Learning – Translating concepts into tangible prototypes
- Design Communication – Using sketches, presentations, and posters to pitch ideas
- Civil Engineering Foundations – Site understanding, spatial reasoning, and layout planning

MENTOR CONTACT INFORMATION

Dr. R. Ramya Swetha
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Mini Structures, Mega Ideas

Dr. M. Venu, Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To help students understand the fundamentals of structural behavior by building small-scale models of civil engineering structures. This project encourages hands-on learning through the construction of mini bridges, foundations, and buildings using accessible materials such as ice sticks, thread, clay, and 3D printed parts.

Students will explore key civil concepts like load distribution, stability, and material selection while developing fine motor skills, visual understanding, and design intuition. These miniature models allow students to simulate how real-world structures behave under different conditions, promoting both creativity and technical awareness.

The project aims to bridge the gap between theoretical knowledge and tangible experience, fostering an early appreciation for civil engineering design, construction logic, and innovation through experimentation.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will gain hands-on experience in model construction, basic analysis, and visual demonstration through the following methods:

- **Ice Stick and Thread Modeling** – Creating trusses, beams, and towers to simulate real structures
- **Clay and Cardboard Foundations** – Designing footing layouts and testing soil-structure interaction on sandbox platforms
- **Basic 3D Printing** – Prototyping small structural components like joints or interlocking blocks
- **Arduino-based Sensors (optional)** – Measuring vibration or displacement under load
- **Load Testing Simulations** – Using weights to test stability and failure mechanisms
- **Sketches and Diagrams** – Visualizing load paths and force directions
- **Comparative Analysis** – Observing differences between structural forms (truss vs. beam, flat vs. arch, etc.)

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Building Scaled Structural Prototypes:

- Understanding basic structural systems like trusses, arches, and frames
- Selecting suitable materials for different structural roles (tension vs. compression)
- Scaling down real structures while maintaining proportion and behavior
- Managing load application and measuring basic deflection or failure
- Building stable, accurate joints in models with minimal tools
- Ensuring safe and controlled model testing with limited equipment
- Balancing aesthetics and function in small-scale representations
- Documenting performance and deriving conclusions through observation

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- **Structural Engineering Basics** – Load paths, supports, and failure modes

- Model-Making & Prototyping – Design and fabrication of physical systems
- Material Behavior – Exploring properties of clay, wood, plastic, and paper
- Engineering Creativity – Innovative forms and model aesthetics
- Sensors & Measurement (Introductory) – Vibration or deflection sensing using basic electronics
- Visualization Skills – Interpreting and creating structure diagrams
- Collaborative Building – Team coordination in design and execution

MENTOR CONTACT INFORMATION

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Model the Future: Build with Purpose

Dr. U Vamsi Mohan, Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To encourage students to prototype sustainable and futuristic civil infrastructure components using 3D printing, recycled materials, and simple design tools. This project focuses on turning environmentally responsible ideas into physical prototypes that demonstrate innovation, functionality, and sustainability.

Students will conceptualize and model elements such as interlocking bricks, smart road sections, and water-saving sanitation systems, which are relevant to current urban and rural infrastructure needs. The objective is to nurture awareness about resource efficiency, climate-responsive design, and smart construction.

Through this project, students will develop the ability to link civil engineering creativity with technological tools and sustainable practices, preparing them for future-focused engineering challenges.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will explore a blend of physical and digital design tools to prototype and test sustainable civil systems using the following methods:

- 3D Modeling and Printing – Designing and fabricating small-scale components like bricks or road elements
- TinkerCAD / SketchUp – Beginner-friendly software for 3D visualization
- Eco-Material Use – Experimenting with recycled plastic, papercrete, or fly ash-based mixtures
- Smart Add-Ons (Optional) – Incorporating ducts for lighting/sensors in models
- Modular Assembly Techniques – Building and testing the fit and usability of components
- Water Efficiency Demonstrations – Prototyping low-flow or dual-use toilet systems
- Presentation Boards – Displaying the model, design intent, and sustainability logic

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Prototyping Sustainable Infrastructure Elements:

- Designing compact, printable components with structural and functional integrity
- Choosing appropriate dimensions, tolerances, and modular connections for 3D printed parts
- Balancing material sustainability with durability in physical models
- Incorporating water-saving and energy-efficient features into design concepts
- Ensuring user-friendly, cost-effective, and replicable designs
- Handling limitations of basic 3D printers (material compatibility, print size, resolution)
- Communicating sustainability metrics (water saved, energy reduced, material reused)
- Collaborating across roles—designer, fabricator, analyst—for prototype execution

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Sustainable Civil Engineering – Eco-design principles and climate-resilient thinking
- 3D Design & Digital Fabrication – Modeling, slicing, and printing components

- Smart Infrastructure Concepts – Basic integration of lighting or sensor pathways
- Material Innovation – Use of recycled or low-impact building materials
- Prototyping & Model Assembly – Working with small, modular structures
- Water Conservation Design – Creating systems that reduce waste
- Design Documentation – Recording and presenting prototype performance

MENTOR CONTACT INFORMATION

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Green Habitat: Living Light, Building Right

Dr. U Vamsi Mohan, Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To enable students to design small-scale, eco-friendly built environments that emphasize energy efficiency, space optimization, and sustainable living. This project focuses on developing green infrastructure concepts such as passively ventilated homes, rooftop gardens, and rainwater harvesting systems suitable for urban and semi-urban settings.

Students will gain insights into climate-responsive architecture, renewable resource usage, and environmentally conscious planning. They will learn to integrate passive design strategies like daylighting, cross-ventilation, and minimal energy use into their layouts.

The goal is to empower students to envision the built environment not just as a physical structure but as a living, breathing system in harmony with nature, preparing them to meet the demands of sustainable urban growth.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will apply sustainability-focused design thinking through the following methods:

- **Basic House Planning** – Designing compact, efficient 1BHK or 2BHK house layouts
- **Passive Design Integration** – Planning for natural ventilation, sunlight, and heat minimization
- **Rooftop Garden Modeling** – Demonstrating water flow and plant layout on flat roof prototypes
- **Rainwater Harvesting Demonstrations** – Creating small-scale collection and filtration models
- **Solar Positioning Awareness** – Identifying window placements based on daylight paths
- **Eco-Materials in Models** – Using recycled/reusable materials for physical representations
- **Green Metrics Mapping** – Estimating energy and water savings in design concepts

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Designing Climate-Responsive and Resource-Efficient Structures:

- Aligning design features with climate and site orientation
- Balancing functionality and sustainability in compact layouts
- Ensuring rooftop gardens are structurally and spatially feasible
- Demonstrating water collection, storage, and reuse within a model
- Choosing model materials that visually and functionally represent eco-elements
- Simplifying solar access, shading, and airflow principles for beginner-level application
- Addressing urban constraints like limited space, pollution, and accessibility
- Communicating green performance in terms of cost, comfort, and resilience

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Sustainable Architecture & Planning – Energy-efficient housing and spatial layout
- Rainwater & Water Management – Low-tech solutions for water conservation
- Green Infrastructure – Urban gardens, permeable surfaces, green roofs
- Thermal Comfort & Passive Design – Natural ventilation and lighting strategies
- Eco-Conscious Material Use – Using biodegradable or upcycled materials
- Design Metrics & Visualization – Visual representation of energy/water savings
- Urban & Rural Housing Models – Adaptable designs for different community types

MENTOR CONTACT INFORMATION

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Survey to Serve: Mapping for Better Living

Dr. Praveena Rao, Assistant Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To expose students to the fundamentals of surveying, mapping, and terrain analysis through observation-based projects that solve real-life infrastructure problems. This project encourages students to explore and document the built environment using basic survey tools, GIS concepts, and visual mapping techniques.

Students will identify infrastructure challenges such as improper water flow, road gradient issues, or poorly planned spaces, and propose simple layout improvements. The goal is to build early competency in data collection, gradient analysis, and site visualization, which are foundational to many areas of civil engineering.

This project instills a spirit of civic engagement and spatial thinking, helping students understand how surveying and mapping can be used to improve living conditions and enable better infrastructure planning.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will use manual and digital tools to collect, document, and interpret civil data through the following methods:

- **Basic Leveling and Measurement Tools** – Using dumpy levels, hand levels, or auto-levels for slope and elevation
- **Campus or Neighborhood Mapping** – Recording locations of tanks, drains, slopes, and pathways
- **Gradient Analysis** – Identifying high and low points and analyzing drainage patterns
- **GIS & Mobile Mapping Tools (optional)** – Using mobile apps or open GIS tools for map creation
- **Topographical Sketching** – Hand-drawn site layouts with elevation indicators
- **Problem Marking & Solution Overlay** – Identifying infrastructure gaps and sketching corrective layouts
- **Field Photography & Documentation** – Visual evidence of surveyed issues and before-after proposals

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Survey-Based Infrastructure Mapping and Improvement:

- Performing accurate manual measurements with simple tools in diverse terrain
- Visualizing gradients, elevations, and flow paths effectively
- Translating field data into legible, useful maps and layout diagrams
- Ensuring map scale, orientation, and symbols follow basic cartographic standards
- Understanding spatial relationships and zoning needs in civil infrastructure
- Capturing real-world conditions and linking them to technical proposals
- Managing team roles in fieldwork—measurement, sketching, data entry, photography

- Proposing meaningful, feasible improvements based on the survey outcomes

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Surveying & Geomatics – Foundational skills in measurement and mapping
- Topographic and Drainage Analysis – Identifying terrain-linked civil challenges
- GIS & Spatial Visualization – Using digital or hand-drawn tools for geographic planning
- Site Planning & Development – Proposing functional infrastructure solutions
- Field Data Collection – Manual and photographic surveying techniques
- Civil Communication & Reporting – Presenting observations and technical proposals
- Community-Focused Infrastructure – Addressing public needs through micro-interventions

MENTOR CONTACT INFORMATION

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Design to Include: Civil for Everyone

Dr. N. Sri Ramya, Assistant Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To encourage students to design **inclusive and accessible public infrastructure** that meets the needs of all users, including differently abled individuals, elderly populations, women, and children. This project emphasizes **universal design principles**, human-centered planning, and social equity in civil spaces.

Students will develop concepts and models for structures like **barrier-free toilets**, **smart bus stops**, and **emergency shelters**, focusing on accessibility, safety, and comfort. The project promotes empathy-driven civil engineering, teaching students to see infrastructure through the lens of diverse users.

The ultimate goal is to foster **civic responsibility and design sensitivity** among students, helping them become engineers who build not just for efficiency, but for dignity and inclusion.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will apply user-focused design principles and visualization tools using the following methods:

- **Needs Assessment** – Identifying challenges faced by marginalized or underrepresented user groups
- **Universal Design Sketching** – Drawing layouts with accessibility features like ramps, tactile paths, handrails
- **AutoCAD Layouts** – Drafting floor plans with attention to circulation space and ergonomic placement
- **Smart Infrastructure Concepts** – Adding solar lighting, signage, and safety alarms where applicable
- **Physical Prototypes** – Model-making of public toilets, bus shelters, or small shelters using simple materials
- **Scenario-Based Design** – Simulating real-world usage situations to test accessibility and safety
- **Poster and Presentation Boards** – Communicating design intent, social value, and user benefits

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Inclusive Infrastructure Development:

- Understanding user needs across age, gender, and ability levels
- Complying with accessibility standards in circulation space and entry points
- Integrating ramps, grab bars, tactile surfaces, and adequate lighting in small-scale designs

- Designing within space, cost, and material constraints for community infrastructure
- Creating safe, ventilated, and easy-to-maintain facilities
- Addressing visibility, signage, and navigation for diverse user groups
- Balancing functionality with comfort and dignity in public usage
- Communicating inclusive value through technical presentations and models

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest:
Relevant Fields and Skills Development Through Project Execution:

- **Inclusive Civil Design** – Barrier-free infrastructure for all users
- **Architectural Planning & Ergonomics** – Human-centric space design
- **Public Health & Sanitation Engineering** – Safe, hygienic, and accessible facilities
- **Smart Infrastructure Basics** – Lighting, alarms, and solar integration
- **Model-Based Learning** – Prototyping inclusive structures with real-world relevance
- **Socially Responsible Engineering** – Civil designs aligned with equity and dignity
- **Empathy-Driven Problem Solving** – Designing through user experience simulation

MENTOR CONTACT INFORMATION

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From Sand to Structure: Material Matters

Mr. K. Anand Goud, Assistant Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To introduce students to the **behavior, sustainability, and performance of construction materials** through hands-on experimentation and comparative testing. This project aims to help students understand how material properties influence structural design, environmental impact, and usability in construction.

Students will work with traditional materials like **clay bricks and cement** and compare them with alternative or recycled options such as **fly ash bricks**, **plastic bricks**, or **eco-concrete blocks**. The project promotes curiosity-driven learning and lays the groundwork for understanding **material selection, durability, and environmental responsibility** in civil engineering.

The primary goal is to build awareness of **sustainable construction practices** and give students a tangible understanding of how materials behave under various loads and conditions.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will conduct material experiments, observations, and tests using the following methods:

- **Brick Comparison Tests** – Analyzing properties like water absorption, hardness, and size uniformity
- **Preparation of Eco-Bricks** – Creating test bricks from fly ash, recycled plastic, or papercrete
- **Mini Compression Testing Setup** – Testing failure behavior under small applied loads
- **Observation of Defects** – Studying cracks, chipping, and shrinkage under varying conditions
- **Density & Water Absorption Calculations** – Measuring material efficiency and porosity
- **Sustainable Metrics** – Comparing carbon footprint, recyclability, and strength
- **Documentation** – Tabulating results, sketching cross-sections, and creating observation logs

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Comparative Study of Traditional and Sustainable Building Materials:

- Understanding how material choice affects strength, safety, and cost in real structures
- Mixing, curing, and forming alternative construction materials with limited lab resources
- Performing low-scale material testing without professional-grade equipment
- Managing consistency in material mix ratios and environmental exposure during testing

- Documenting results through observation, photos, and comparative charts
- Identifying ideal use cases for each material type based on performance
- Communicating sustainability impacts and trade-offs to a non-technical audience
- Handling waste material safely and responsibly during testing

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest:
Relevant Fields and Skills Development Through Project Execution:

- Construction Materials & Testing – Understanding material properties and behavior
- Green Construction Practices – Using recycled or low-impact materials
- Experimental Methods – Hands-on testing, data recording, and analysis
- Sustainable Engineering – Evaluating environmental and lifecycle impacts
- Visual Documentation – Sketching, tabulating, and comparing physical outcomes
- Lab Safety & Process Control – Handling and testing materials safely
- Real-World Civil Application – Connecting lab behavior to structural use

MENTOR CONTACT INFORMATION

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Resilient Roots: Disaster-Smart Designs

Dr. K. Kavita Singh, Assistant Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To introduce students to the principles of disaster-resilient infrastructure by developing conceptual models of structures that can withstand natural hazards such as floods, earthquakes, and fires. This project emphasizes safety-focused engineering and proactive design thinking to protect communities in vulnerable regions.

Students will explore design features like elevated platforms, shear walls, emergency exits, and fire-safe materials, simulating how these contribute to structural stability and safety during disasters. The goal is to instill an understanding of risk reduction, structural resilience, and emergency preparedness in civil engineering design.

By engaging in this project, students develop the mindset of civil engineers who build not just for function and aesthetics, but also for survivability and recovery in the face of unpredictable events.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will use observation, research, and prototyping methods to simulate disaster-resilient systems, including:

- **Scaled Structural Models** – Designing buildings with features like braced frames, shear walls, or sloped foundations
- **Elevated House Prototypes** – Building flood-safe models with raised bases and drainage slopes
- **Base Isolation Simulation (Optional)** – Demonstrating earthquake resistance with foam pads or spring supports
- **Fire Safety Layout Planning** – Including exits, fire breaks, and non-flammable zones in shelter designs
- **Material Research** – Identifying locally available and disaster-resistant building materials
- **Scenario Mapping** – Planning response strategies in models (evacuation routes, water flow paths)
- **Awareness Posters** – Creating educational visuals on building for disaster readiness

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Designing Disaster-Resilient Civil Infrastructure Models:

- Balancing strength and flexibility in small-scale structural models
- Incorporating functional and space-efficient emergency design features
- Representing realistic hazard scenarios in scaled-down environments
- Understanding how materials behave under high stress or exposure
- Designing cost-effective and replicable models suitable for low-resource communities
- Communicating design intent and protective functions effectively
- Aligning prototypes with basic disaster safety standards or best practices

- Creating awareness around infrastructure planning for vulnerable populations

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Disaster Risk Engineering – Earthquake, flood, and fire-resistant structures
- Emergency Infrastructure Design – Planning for evacuation and safety
- Material Performance – Behavior of structures during hazard conditions
- Rural & Community Engineering – Low-cost disaster-safe housing concepts
- Resilient Planning – Combining structural safety with spatial strategy
- Civil Prototyping – Simulating response and recovery solutions
- Safety-Centered Innovation – Designing for protection, not just usability

MENTOR CONTACT INFORMATION

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Smart Street, Safe Street

Ms. B. Bhavani, Assistant Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To introduce students to the principles of urban safety, traffic planning, and smart infrastructure design by working on small-scale layouts and models of streets, intersections, and public spaces. This project emphasizes people-first planning, safe mobility, and smart elements like lighting and signage for improving urban living.

Students will design infrastructure that considers pedestrian crossings, traffic calming features, and rural/urban road enhancements. They will explore how thoughtful street design can reduce accidents, enhance comfort, and make public spaces more inclusive and efficient.

The ultimate goal is to develop design awareness for road safety and urban livability, enabling students to contribute meaningfully to the creation of smarter, safer civil environments.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will design, analyze, and prototype street and transport solutions using the following methods:

- **Street Layout Planning** – Drafting road cross-sections, walkways, drainage, and lane zoning
- **AutoCAD 2D Drafting** – Preparing layouts of smart intersections, speed breakers, and pedestrian zones
- **Model-Making** – Building physical models of traffic junctions using cardboard or recycled materials
- **Traffic Flow Simulation (Optional)** – Using tokens or mobile-based tools to simulate vehicle/pedestrian movement
- **Smart Additions** – Incorporating solar-powered lighting, signage, or reflective elements
- **Safety Element Integration** – Designing crosswalks, bollards, speed tables, and tactile paths
- **Data Collection** – Observing traffic behavior in nearby streets or campus roads for design context

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Developing Smart and Safe Road Infrastructure Prototypes:

- Balancing pedestrian and vehicular movement in limited space
- Incorporating safety features for children, elderly, and differently abled users
- Designing appropriate road slopes and drainage features for water runoff
- Representing traffic elements (lane widths, signs, signals) at appropriate scale
- Integrating smart or sustainable components like solar lights or signage
- Simulating real-time usage scenarios with physical or digital tools
- Making design cost-effective, modular, and suitable for rural/urban contexts
- Presenting a comprehensive street design solution through drawings and models

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Urban Planning & Transportation Design – Safe and efficient street layout
- Road Safety Engineering – Design for accident prevention and visibility
- Smart Infrastructure – Solar lighting, sensors, and signage in public spaces
- Civil Drafting & Modeling – Creating scaled layouts and street models
- Inclusive Design – Planning for accessibility and mobility equity
- Environmental Design – Drainage, green buffers, and waste management zones
- Public Infrastructure Thinking – Designing for practical community needs

MENTOR CONTACT INFORMATION

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CivCraft: Build, Fail, Learn

Dr. M. Venu, Professor, Dept. of CE (Civil Engineering) – Faculty Mentor

GOALS

To inspire **hands-on, maker-style exploration of civil engineering concepts** through DIY projects using recycled materials and simple mechanisms. This project focuses on cultivating creativity, experimentation, and resilience by encouraging students to **build structural and functional models**, test them, learn from failures, and iterate improvements.

Students will work with **low-cost materials** like cardboard, popsicle sticks, syringes, and sand to create basic hydraulic systems, model domes, self-watering planters, or lift bridges. The aim is to give students the **freedom to explore civil ideas physically**, develop problem-solving skills, and learn by doing.

The ultimate goal is to foster a culture of **explorative learning, trial and error, and teamwork**, essential for innovation and long-term success in civil engineering.

METHODS & TECHNOLOGIES

The Cornerstone Project (CoP) Team will apply tinkering techniques, simple mechanics, and creative assembly methods using:

- **Recycled Material Prototyping** – Using waste materials to build functional models
- **Hydraulic Mechanisms** – Using syringes and tubes to demonstrate lift bridges or gates
- **Basic Load-Bearing Models** – Constructing arches, domes, and trusses with popsicle sticks or paper
- **Self-Watering Systems** – Building low-tech irrigation planters using capillary action
- **Sandbox Testing Platforms** – Observing foundation behavior, slope failure, or soil compaction
- **Failure Analysis** – Observing, documenting, and improving failed or collapsed prototypes
- **Iteration Journals** – Recording multiple design versions and what was learned through failure

DESIGN & TECHNICAL ISSUES

The Cornerstone Project (CoP) Project team interested in from the following majors or areas of interest: Challenges and Design Considerations in Maker-Based Civil Exploration Projects:

- Selecting materials that are lightweight, safe, and easy to work with
- Creating simple but functional mechanisms to simulate real civil systems
- Managing fluid control in hydraulic models at small scale
- Understanding why models fail (overload, imbalance, poor joints) and correcting them
- Encouraging creativity within the boundaries of material and time constraints
- Developing resilience through repeated design, testing, and modification cycles
- Collaborating in teams to divide roles (design, build, test, document)
- Communicating outcomes, learnings, and real-world relevance clearly

MAJORS & AREAS OF INTEREST

Cornerstone Project (CoP) team interested in from the following majors or areas of interest: Relevant Fields and Skills Development Through Project Execution:

- Structural Mechanics (Introductory) – Forces, reactions, and failure types
- Hydraulic Structures – Basic operation of gates, bridges, and water movement
- Eco-Design & Recycling – Material reuse and sustainable creativity
- Physical Prototyping – Model-making using everyday materials
- Iterative Design Thinking – Learning through failure and improvement
- Collaborative Engineering – Team-based learning and task sharing
- Engineering Storytelling – Presenting projects and the journey behind them

MENTOR CONTACT INFORMATION

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