Bangladesh University of Engineering and Technology

CE 404

Comprehensive Redevelopment Project for Mohammadpur Government High School Enhancing Academic Infrastructure and Sustainability

FEASIBILITY STUDY

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Executive Summary

The Comprehensive Renovation Project for Mohammadpur Government High School is a visionary initiative aimed at enhancing academic infrastructure and sustainability. Undertaken by the Ministry of Infrastructure Development and Ministry of Education, this government-led project is implemented by the Government of Bangladesh through concerned divisions of the Educational Infrastructure Division and the Planning Commission

The project focuses on the redevelopment of Mohammadpur Government High School, a key educational institution founded in 1967, covering an area of 2,114 square meters. Positioned strategically at the geographical heart of Mohammadpur, the school is owned by the government, ensuring the complete title for its use.

The decision-formulation process was enriched by comprehensive surveys, including feedback from teachers, guardians, and students. Teachers' Feedback on School Facilities survey delved into classroom conditions, teaching spaces, safety concerns, and urgent repairs. Simultaneously, guardians' feedback on the school relocation and redevelopment provided valuable insights into community expectations and preferences. Additionally, the Student's Feedback on School Facilities survey offered a student-centric perspective on infrastructure and facility needs. These surveys collectively serve as foundational pillars for our redevelopment strategy, ensuring that the project addresses the real and pressing needs of all stakeholders

The Alternative Analysis meticulously examined various project scenarios, emphasizing factors like natural light, ventilation, traffic flow, and energy-space efficiency. The evaluation extended to community integration, prioritizing a redevelopment option that emerged as the most favorable for academic infrastructure enhancement.

The Technical/Technological & Engineering Analysis for the Mohammadpur Government High School redevelopment project emphasizes modernization and safety. Following green building principles and Bangladesh National Building Code (BNBC) standards, the architectural enhancements prioritize energy efficiency. Structural engineering assessments ensure resilience against earthquakes, surpassing local building codes.

Construction involves advanced methodologies for precision. Sustainable practices, including waste management and water conservation, are seamlessly integrated. Climate change risks are embedded, considering a thorough Climate Vulnerability Assessment.

Structural improvements focus on reinforcing the foundation, walls, and roof for resilience against earthquakes. Enhanced drainage systems, featuring innovations like rain gardens, manage excess water efficiently. Emergency preparedness involves a comprehensive plan, including evacuation routes and first-aid provisions for staff and students. Modern facilities integration covers energy-efficient lighting, smart building technologies, digital learning infrastructure upgrades, and accessibility measures. This holistic approach ensures safety, sustainability, and long-term viability, aligning with the goal of creating a secure, environmentally responsible, and technologically advanced educational infrastructure.

The project undergoes a thorough financial and economic analysis, with a Economic Benefit-Cost Ratio (EBCR) of 1.79 and an Economic Internal Rate of Return (EIRR) of 14%. These indicators signify a economically sound venture, promising a positive return on investment.

An extensive Bill of Quantity meticulously details the requisite materials and labor essential for the seamless execution of the project. This comprehensive document not only serves as a practical guide for budgeting but also facilitates efficient resource allocation, ensuring a streamlined and well-planned implementation process

The Comprehensive Renovation Project spans two years, with an intricate timeline. In 2024-2025, the focus is on project kick-off, detailed planning, environmental impact assessments, and procurement approvals. Accelerated construction and furnishing follow in the subsequent months, ensuring full functionality by the end of 2025.

Section 1: Basic Information

1	**Name of the Project**	:	Comprehensive Redevelopment Project for Mohammadpur Government High School: Enhancing Academic Infrastructure and Sustainability
2	**(a) Sponsoring Ministry/Division** **(b) Implementing Agency**	:	(a) Ministry Of Education Education Engineering Department
3	**Project Objectives** **(Project to be taken based on the study)**	:	1. Modernize Infrastructure by fix physical issues, introduce digital classrooms for enhanced education quality. 2. Implementation of eco-friendly measures. 3. Upgrade facilities, prioritize health, and education for creating good learning environment
4	**Estimated Project Cost (Taka in Crore)**	:	57 Crore
5	**Sector & Sub-Sector**	:	Educational Infrastructure
6	**Project Category (Based on Environment Conservation Rules 2023)**	:	Orange
7	**Project Geographic Location** **(a) Countrywide** **(b) Division** **(c) District** **(d) Upazila** **(e) Others (City Corporation/Pourashva)**	:	(a) Bangladesh (b) Dhaka (c) Dhaka North City Corporation (d) Mohammadpur Thana Humayan Road, Dhaka 1207
8	**Project Duration:**	:	24-28 months

Section 2: Introduction

2.1 Project Background:

Rationale: The Mohammadpur Government High School Comprehensive Redevelopment Project stems from a critical need to address the deteriorating state of the school's infrastructure and educational facilities. The current condition, marked by cracked walls, damaged doors, and outdated amenities, impedes effective teaching and learning. The absence of digital classrooms further hinders technological integration, impacting students' academic progress. Inadequate sports facilities, obsolete laboratories, and insufficient focus on health and hygiene collectively diminish the overall educational quality. The project aims to rectify these shortcomings, fostering an environment conducive to modern education and sustainability.

Genesis: The genesis of this project lies in recognizing the urgency to uplift Mohammadpur Government High School from its dilapidated state. Initial surveys, site visits, and interviews with stakeholders unveiled the pressing need for comprehensive redevelopment. The project's inception involves a methodical approach, leveraging skilled professionals and software tools for data analysis. Feasibility studies, including alternatives and temporary relocation considerations, were pivotal in shaping the project's course. The genesis encapsulates a commitment to creating an optimal learning environment through infrastructural enhancements, technological integration, and sustainable practices.

2.2 Objectives of The Feasibility Study:

1. **Assess Relocation Viability:** Determine the feasibility of temporary relocation to Mohammadpur Kendriya College, Dhaka during the redevelopment, considering space, accessibility, and potential educational impact.
2. **Identify Key Challenges:** Evaluate potential challenges in the redevelopment process, such as geotechnical factors, transportation issues, environmental impact, educational hamper due to relocation, and space constraints.
3. **Alternative Solutions:** Explore and analyze alternative approaches to the redevelopment, considering cost-effectiveness, efficiency, and impact on the school community.
4. **Resource Utilization:** Examine the efficient utilization of resources, including finances, skilled professionals, and materials, to ensure optimal project implementation.
5. **Educational Impact:** Evaluate the potential impact of the redevelopment on the ongoing education of students, ensuring minimal disruption and a smooth transition.
6. **Stakeholder Perspectives:** Gather insights from various stakeholders, including administrators, teachers, students, and the local community, to address their concerns and incorporate valuable input.

7. **Financial Viability:** Assess the financial feasibility of the project, considering budget constraints, potential funding sources, and the long-term sustainability of the redevelopment.
8. **Environmental Impact:** Evaluate the environmental implications of the project, ensuring that sustainability principles are integrated into the redevelopment plan.
9. **Timeline and Milestones:** Determine a realistic timeline for the project and establish milestones to track progress, ensuring timely completion and effective project management.
10. **Risk Analysis:** Identify and analyze potential risks associated with the redevelopment, developing mitigation strategies to minimize setbacks and ensure project success.

2.3 Approach And Methodology of The Feasibility Study:

Conducting a feasibility study for a community clinic project involves a structured methodology to systematically assess various aspects of the proposed project. The following is our methodology that is adapted for this study:

1) **Project Scope and Objectives:**
   - Defines the scope and objectives of the project.
   - Clearly articulate the goals and expected outcomes of the clinic

2) **Background Research:**
   - Gather information about the community, including demographics, educational needs, and existing facilities.

3) **Market Analysis:**
   - Identify and analyze the target population for the school.
   - Assess the demand in the community.
   - Analyze potential risks.
4) **Financial Analysis:**
   - Estimate the initial investment required for the project, including construction, equipment, and other costs.
   - Project the operational costs, including staffing, utilities, and maintenance. Identify potential revenue streams and estimate income generation.

5) **Technical Analysis:**
   - Evaluate the technical requirements for setting up and operating the school project.
   - Assess the availability of suitable relocations and necessary infrastructure.
6) **Operational Analysis:**
   - Define the operational processes of the school, including staffing

requirements, management structure, and service delivery.
- Identify any potential operational challenges and propose solutions.

7) Legal and Regulatory Compliance:
- Investigate and understand the legal and regulatory requirements for establishing and operating a clinic in the community.
- Ensure compliance with government regulations, licensing, and zoning laws.

8) Risk Assessment:
- Identify potential risks and challenges associated with the school project.
- Assess the likelihood and impact of each risk.
- Develop strategies to mitigate and manage identified risks.

9) Social and Environmental Impact:
- Evaluate the social and environmental impact of the school on the community.
- Consider how the school aligns with local values and needs.

10) Community Engagement:
- Gather input from key stakeholders, including residents, community leaders, and potential users of the clinic.
- Engage with the community to assess their support for the school

11) Feasibility Report:
- Compile all findings and analyses into a comprehensive feasibility report.
- Clearly present the rationale for the school, the methodologies used, and the key findings.
- Provide recommendations and conclusions based on the study.

12) Decision Making:
- Present the feasibility study to relevant stakeholders, such as investors, community leaders, and healthcare professionals.
- Use the study's findings to make informed decisions about whether to proceed with the community clinic project.

This methodology ensures a systematic and thorough examination of relevant aspects of the school project, providing stakeholders with the information needed to make informed decisions about the viability and feasibility of the proposed initiative.

2.3.1 Organization of The Feasibility Study:

The final feasibility study report contains the findings of the preliminary field surveys and investigations, school building, auditorium and parking location, schematic design, and cost estimates, environmental and social impact studies including their mitigative measures, financial& Economical evaluation and finally conclusions and recommendations

This Final Feasibility Study Report is being presented in 3 Volumes as follows:

Section 1: Basic Information

Section 2: Introduction

Section 3: Market/Demand Analysis

Section 4: Technical/Technological & Engineering Analysis

Section 5: Environmental Sustainability, Climate Resilience, and Disaster Risk Analysis

Section 6: Cost-Benefit Analysis

Section 7: Human Resources and Administrative Support Analysis

Section 8: Institutional and Legal Analysis

Section 9: Risk and Sensitivity Analysis

Section 10: Alternative/Options Analysis

Section 12: Annex

Section 3: Market/Demand Analysis

3.1 Problem Statement:

Mohammadpur Government High School faces a critical challenge characterized by deteriorating infrastructure, outdated facilities, and a lack of technological integration. Cracked walls, damaged doors, and worn-out flooring hinder the learning environment. The absence of digital classrooms impedes educational advancement. Inadequate sports facilities, outdated laboratories, and insufficient emphasis on health negatively impact the overall education quality. The Comprehensive Redevelopment Project aims to address these issues, creating a modern, sustainable, and conducive learning environment for the students.

3.2 Relevance of the Project Idea:

The Comprehensive Redevelopment Project for Mohammadpur Government High School is highly relevant due to its potential to transform a deteriorating educational institution into a modern, sustainable hub for learning. By addressing infrastructural issues, integrating technology, and promoting environmental sustainability, the project aims to elevate the quality of education. The relevance lies in fostering an optimal learning environment, empowering students, and contributing to the overall development of the community through improved educational facilities and practices

3.3 Proposed Project Interventions:

The interventions for Mohammadpur Government High School encompass upgrading infrastructure, integrating technology, and enhancing educational facilities. The project prioritizes health and hygiene, coordinates skilled professionals, and conducts feasibility studies for relocation and alternatives. Soil assessment and foundation design ensure stability. Transportation improvements, environmental sustainability, and a robust monitoring system contribute to creating a modern, sustainable, and conducive learning environment for students.

3.4 Stakeholders:

Function	Organization/Stakeholders
Area	Dhaka North City Corporation Ward- 29
Mayor	Md. Atiqul Islam
MP	Md Sadek Khan
Councilor	Md Salimullah Solu
Administration	Ministry of Education, Government of Bangladesh (GOB)
Builder of the Structure	PWD (Public Works Department), Rajdhani Unnayan Kartripakkha (RAJUK)
Electricity	DESCO
Water supply by Lines and Sewage System	Dhaka Water Supply and Sewerage Authority (DWASA)
Constructors	Real Estate Companies
Consultants & Supervisors:	Faculty Members of the Department of Civil Engineering, BUET Architects
Users and Consumers	Students, Teachers, Parents & Administration of Mohammadpur Govt. High School

3.5 Demand Analysis:

3.5.1 Current Demand:

While assessing the demand for this project, it is important to note that its value extends beyond economic and financial metrics. The survey depicts a comprehensive picture of the current demand, capturing the dire needs and expectations of students, teachers, and guardians. This perspective highlights the multipronged nature of the project's demand, encompassing infrastructure upgrades, technological advancements, safety considerations, and a desire for a more inclusive and conducive learning environment.

1. **Infrastructure Upgrade Urgency:**
    - Students express a strong need for modernized classrooms and updated study areas, highlighting an urgent demand for infrastructure upgrades.
2. **Technology Integration:**
    - Both students and teachers emphasize the need for additional technological tools and equipment in classrooms, indicating a demand for enhanced learning experiences through technology.
3. **Safety and Maintenance Concerns:**
    - Safety concerns raised by both students and teachers, coupled with requests for urgent repairs, underscore the immediate need for addressing maintenance issues to ensure a secure environment.
4. **Co-Curricular Facilities Alignment:**
    - Students express varying levels of satisfaction with existing co-curricular facilities, suggesting a demand for alignment with diverse student interests to enhance extracurricular experiences.
5. **Outdoor Spaces and Sports Facilities Enhancement:**
    - Students' suggestions for improved maintenance of outdoor spaces and diverse sports options highlight a demand for upgraded recreational facilities.
6. **Inclusivity and Accessibility:**
    - Both students and teachers indicate a need for improved inclusivity in the school design, especially for students with special needs, emphasizing the demand for a more accessible and accommodating environment.
7. **Communication and Transparency:**

- Guardian feedback indicates a strong demand for transparent communication channels and regular updates during the redevelopment process, reflecting the importance of keeping stakeholders well-informed.

8. **Learning Environment Vision:**

- Students' vision for an ideal learning environment includes modern classrooms, advanced technology, well-equipped laboratories, and a safe atmosphere, indicating a demand for a holistic and conducive learning space.

9. **Redevelopment Priorities:**

- Teachers and guardians prioritize modernized facilities, state-of-the-art labs, an expanded library, safe spaces, and green features during the redevelopment, aligning with the broader demand for comprehensive improvements.

10. **Concerns about Relocation:**

- Guardian concerns about safety, academic continuity, and extracurricular activities during the relocation process highlight a demand for careful planning and transparent communication to address these apprehensions.

11. **Educational Resources Adequacy:**

- Mixed opinions on the adequacy of educational resources signal a demand for a more consistent and improved availability of textbooks, learning materials, and technology tools.

12. **Outdoor Recreational Expansion:**

- Student suggestions for a small swimming pool, resting room, prayer room, and locker room indicate a demand for expanded recreational and amenities spaces.

3.5.2 Survey Database:

To estimate the current demand, we undertook three surveys, the results of which are detailed below.

"Survey on School Facilities and Student Feedback"

Section 1: School Facilities Assessment

1. What facilities or resources do you think are currently missing in the school that would greatly improve your learning experience?

2. How would you rate the overall condition of the classrooms and study areas? (Scale: Excellent, Good, Average, Poor)

3. Are there any safety concerns or maintenance issues around the school that you have noticed?

4. Are there any technological tools or equipment you believe would enhance your learning experience in the classrooms?

Section 2: Co-Curricular and Recreational Spaces

5. How satisfied are you with the existing common areas, such as lounges and recreational spaces? (Scale: Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied)

6. Do you feel that the co-curricular facilities meet your interests and needs? If not, please specify what you would like to see.

7. Are there any amenities or features you would like to suggest for improving the school's recreational areas?

Section 3: School Infrastructure and Environment

8. In your opinion, what changes or improvements could be made to the school's infrastructure to create a more conducive learning environment?
9. Do you face any challenges accessing parts of the school? If so, please describe.

10. How well do you think the current school facilities support your curriculum and extracurricular activities? (Scale: Well-aligned, somewhat aligned, not well-aligned)

Section 4: Outdoor Spaces and Sports Facilities

11. Are the outdoor spaces, including playgrounds and sports areas, meeting your needs? If not, please provide suggestions for improvement.

12. How often do you encounter issues related to noise levels or distractions in classrooms that affect your learning? (Scale: Rarely, Sometimes, Often)

Section 5: Educational Resources and Support

13. How would you rate the availability and adequacy of educational resources, such as textbooks, learning materials, and technology tools? (Scale: Excellent, Good, Average, Poor)

14. Do you believe the current school design is accommodating for students with special needs or disabilities? (Scale: Well, Somewhat, Not well)

Section 6: Overall Satisfaction

15. Overall, how satisfied are you with the existing school infrastructure and facilities? (Scale: Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied)

16. If you have any additional comments, suggestions, or specific areas you'd like to address, please feel free to share.

"Summary of Student's Feedback on School Facilities and Infrastructure"

Section 1: School Facilities Assessment

- Missing Facilities/Resources: Students highlighted the need for improved facilities such as modernized classrooms, updated study areas, and additional resources like interactive learning tools and libraries to enhance their learning experience.

- Classroom Condition: A significant number of students rated the overall condition of classrooms and study areas as "Average," indicating a desire for improvements.

- Safety Concerns/Maintenance: Some students mentioned safety concerns related to building maintenance and requested better maintenance practices to ensure a safer environment.

- Technological Tools: Several students emphasized the importance of having more technological tools and equipment in classrooms to make learning more engaging and interactive

Section 2: Co-Curricular and Recreational Spaces

- Common Areas Satisfaction: A majority of students expressed satisfaction with existing common areas, although there were some who indicated varying levels of dissatisfaction.

- Co-Curricular Facilities: Some students felt that the co-curricular facilities could be more aligned with their interests, suggesting the addition of new clubs or activities.

- Recreational Area Suggestions: Students proposed ideas like expanding recreational areas, adding more sports facilities, and creating spaces for relaxation and social interaction.

Section 3: School Infrastructure and Environment

- Infrastructure Improvements: Students offered suggestions for creating a better learning environment, including improvements to classroom design, lighting, and ventilation.

- Accessibility Challenges: A few students mentioned challenges accessing certain parts of the school and suggested making the campus more accessible to all students.

- Curriculum Support: Opinions varied on how well current school facilities align with the curriculum and extracurricular activities, with some students feeling they are not well-aligned.

Section 4: Outdoor Spaces and Sports Facilities

- Outdoor Spaces: Some students expressed satisfaction with outdoor spaces, while others suggested enhancements like improved maintenance, better equipment, and diverse sports options.
- Noise and Distractions: Students indicated encountering issues related to noise levels or distractions in classrooms, with responses varying between "Sometimes" and "Often."

Section 5: Educational Resources and Support

- Educational Resources: Students had mixed opinions about the availability and adequacy of educational resources. Responses ranged from "Excellent" to "Average" to "Poor."

- Inclusivity and Design: Most students believed that the current school design is not accommodating for students with special needs or disabilities, highlighting the need for greater inclusivity.

Section 6: Overall Satisfaction

- Overall Satisfaction: Student satisfaction with the existing school infrastructure and facilities varied, with responses spread across the scale from "Very Satisfied" to "Very Dissatisfied."

Additional Comments and Suggestions:

Students provided diverse feedback and suggestions, including requests for more collaborative spaces, better communication about facility updates, increased focus on environmental sustainability, and the incorporation of innovative technologies to enhance learning experiences.

Survey on School Relocation, Redevelopment and Guardian Feedback

- Are you aware that our school is undergoing a redevelopment project to improve the facilities and enhance the learning environment for the students?

a) Yes: 96% b) No: 4%

- How do you feel about the redevelopment initiative?

Excited:29% b) Supportive:66% c) Uncertain:4.9% d) No need:0.1%

- What specific facilities or areas of the school do you believe require the most attention during the redevelopment?
- Are you aware that during the redevelopment, we will need to relocate the school to a temporary

a) Safety and Security Measures

b) Classrooms and Learning Spaces

c) Playgrounds and Sports Facilities

d) Technology Integration

e) Washroom and Common room development

- location to ensure the safety and smooth execution of the project?

a) Yes: 94% b) No: 6%

- What are your main concerns or questions about the relocation process from your point of view?

a) School Environment

b) Academic Continuity

c) Transportation and Commuting

d) Safety and Security

e) Access to Resources

f) Duration of Relocation

g) Extracurricular Activities

- How do you envision the ideal temporary location for the school during the redevelopment?

a) Proximity
b) Adequate Facilities
c) Conducive Learning Environment
d) Community and Social Considerations
e) Communication and Transparency
f) Flexibility and Adaptability

- What communication channels do you prefer to receive updates and information about the redevelopment and the relocation process?

a) SMS or Text Messages: 29.6%
b) School Website: 28.7%
c) Parent Meetings: 20.3%
d) Email Updates: 8.6%
e) Social Media:12.8%

- How do you envision the ideal learning environment for your child, and what improvements would you like to see as part of the redevelopment?

a) Modern and Spacious Classrooms
b) Advanced Technology Integration
c) Well-Equipped Laboratories and Libraries
d) Safe and Nurturing Atmosphere
e) Extracurricular and Sports Facilities
f) Wash Room Facilities

- What aspects of the current school facilities do you believe are working well and should be preserved or improved upon during the redevelopment?

a) Experienced and Dedicated Teachers
b) Strong Community and Cultural Values
c) Existing Extra-Curricular Programs

- Are you open to participating in any parent/guardian forums or feedback sessions to provide further input on the redevelopment plans?

a) Yes: 99.8% b) NO: 0.2%

How important is it for you to be kept informed about the progress of the redevelopment at different stages?
(a)Very Important: 68%
(b)Important: 22%
(c)Neutral: 9.45%

(d)Not Important: 0.55%

- What do you believe should be the main priorities for the school during the redevelopment to ensure the best outcomes for the students?

a) Modernized Classrooms
b) State-of-the-art Laboratories
c) Expanded and Resourceful Library
d) Safe and Accessible Facilities
e) Modern Sports and Recreation Areas
f) Versatile Auditorium and Assembly Areas
g) Green and Sustainable Features
h) Inclusive Accessibility

- Do you have any additional questions or suggestions related to the redevelopment and relocation

process that you would like to share with us?

Questions:

i) How will the school handle any potential disruptions in the academic calendar due to the relocation?

ii) Will there be any opportunities for the school to involve parents/guardians in volunteering or supporting the redevelopment process in any capacity?

iii) How will the school ensure that the project stays on schedule and minimizes disruptions to the students' education?

Suggestion:

i)Regular communication regarding the academic calendar and any adjustments will be essential, along with providing academic support to help students cope with any changes during the relocation.

ii)Creating a volunteer program or parent involvement committee during the redevelopment can help strengthen the school community and foster a sense of ownership and pride in the new facilities.

iii)It would be helpful to provide a detailed relocation handbook or guide for parents and students, outlining important information, frequently asked questions, and contacts for assistance.

Survey on School Facilities and Teacher Feedback Questions

1. What facilities or resources do you feel are currently lacking in the school that would significantly enhance the teaching and learning experience?

2. How would you rate the overall condition of the classrooms and teaching spaces?
(Scale: Excellent, Good, Average, Poor)

3. Are there any specific safety concerns or maintenance issues that need to be addressed within the school premises?

4. What technology or equipment do you believe would be beneficial to have in the classrooms to support your teaching methods?

5. How satisfied are you with the current staff rooms and common areas?
(Scale: Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied)

6. In your opinion, what changes or improvements could be made to the school's infrastructure to create a more conducive learning environment?

7. Are there any accessibility challenges within the school that should be addressed to better accommodate students and staff?

8. How well do the current school facilities align with the curriculum and extracurricular activities? (Scale: Well-aligned, somewhat aligned, not well-aligned)

9. Do you feel that the outdoor spaces, such as playgrounds and sports areas, meet the needs of students and staff?

10. Are there any specific amenities or features you would like to see incorporated into the school's redevelopment plan?

11. How often do you encounter issues related to classroom acoustics or noise levels that may affect teaching and learning?
(Scale: less, often, regular)

12. How would you rate the availability and adequacy of educational resources, such as textbooks, learning materials, and technology tools?
(Scale: Excellent, Good, Average, Poor)

13. How well does the current school design accommodate students with special needs or disabilities? (Scale: Well, Somewhat, not well)

14. Overall, how satisfied are you with the school's existing infrastructure and facilities?
(Scale: Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied)

Summary of Teacher Feedback

1. School Facilities Assessment:

- Well-managed washrooms for teachers and students
- Lab facilities and a modern auditorium
- Cycle stand, guardian shade, and changing room for games
- Library and locker room for teachers

2. Classroom Condition and Teaching Spaces:

- 70% of teachers find the overall condition poor
- 20% of teachers find the overall condition average
- 10% of teachers find the overall condition well

3. Safety Concerns and Urgent Repairs:

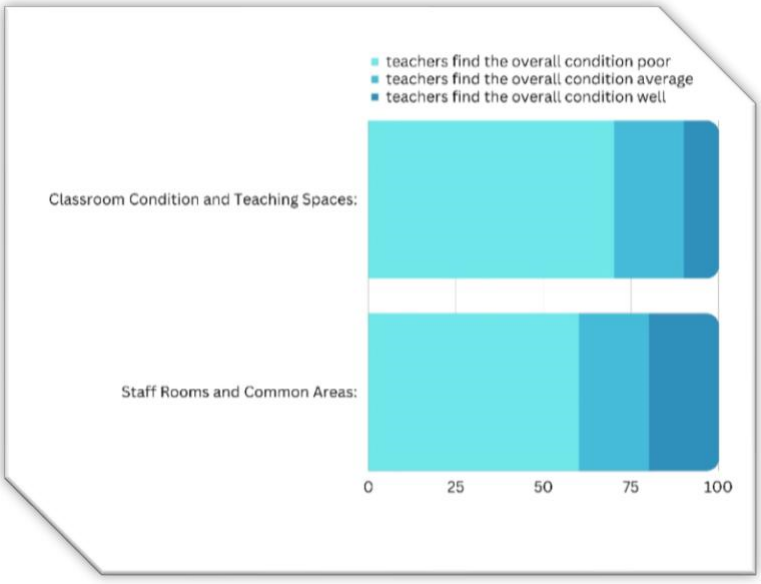
- Teachers concerned about safety due to nearby under-construction buildings
- Demand for a high fence around the school
- Urgent repairment of washrooms and lab facilities requested

4. Technology and Classroom Size:

- Teachers request multimedia projectors or digital boards
- Smaller class size proposed for improved teaching quality

5. Staff Rooms and Common Areas:

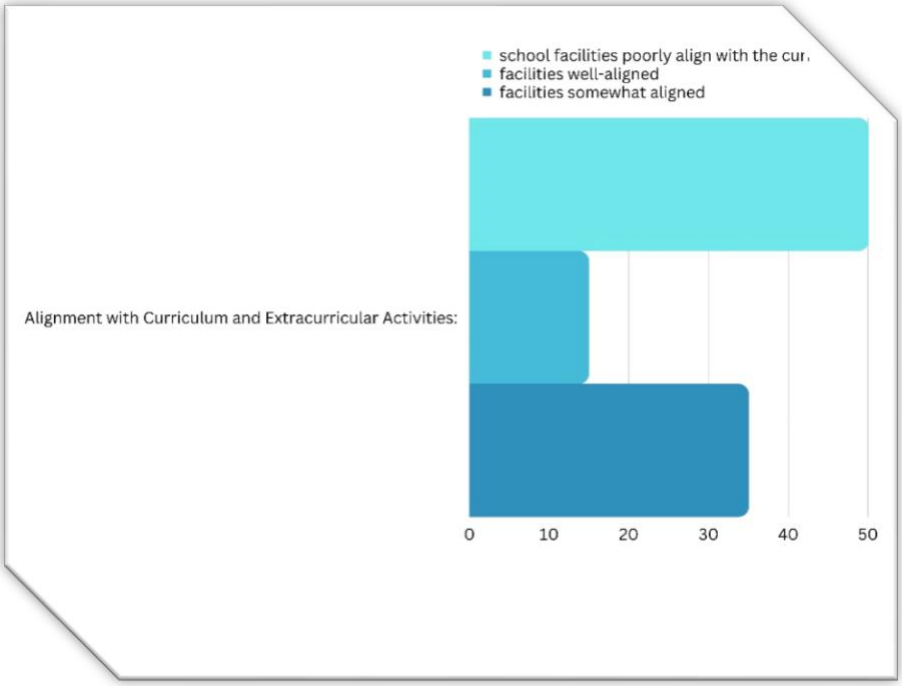
- 60% of teachers dissatisfied with current staff rooms and common areas
- 20% of teachers somewhat satisfied with current staff rooms and common areas
- 20% of teachers satisfied with current staff rooms and common areas



6. Co-Curricular Facilities:
- Need for an extra room for co-curricular activities
- Request for dedicated space for science, math clubs, and fairs

7. Residence Facility for Teachers:
- Demand for a residence facility within the campus

8. Alignment with Curriculum and Extracurricular Activities:
- 50% of teachers feel current school facilities poorly align with the curriculum
- 15% of teachers find facilities well-aligned
- 35% of teachers find facilities somewhat aligned

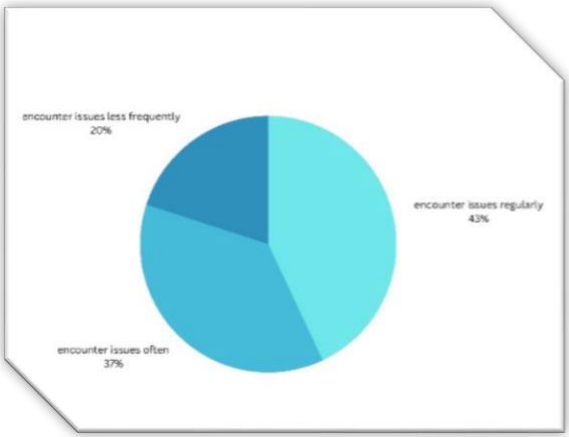


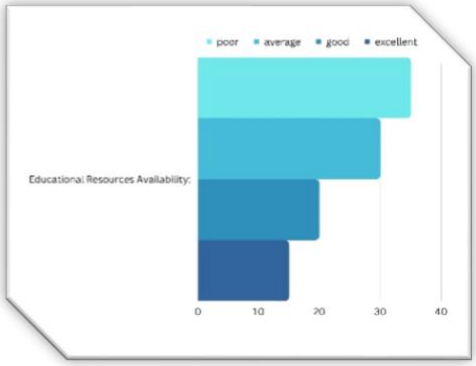
9. Playground and Safety Concerns:
- Poor drainage and cleanliness around the outer edges of the playground
- Safety concerns about the basketball ground
- Proposal for a wired fence

10. Additional Facilities Requested:
- a small swimming pool
- resting room
- prayer room
- locker room

11. Classroom Acoustics and Noise Levels:

- 43% of teachers encounter issues regularly
- 37% of teachers encounter issues often
- 20% of teachers encounter issues less frequently



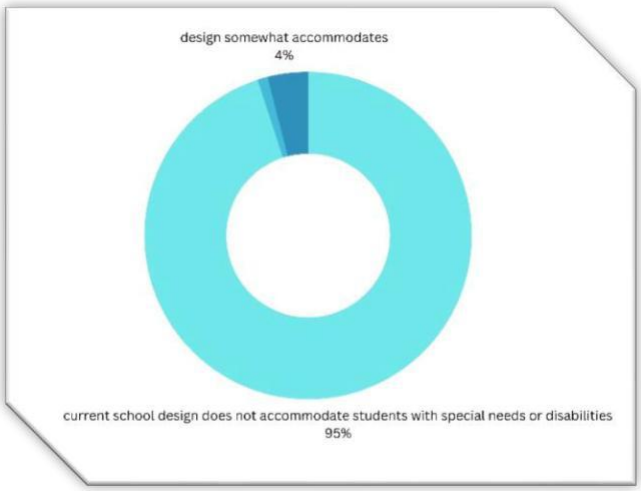


12. Educational Resources Availability:

- 35% of teachers rate availability as poor
- 30% of teachers rate availability as average
- 20% of teachers rate availability as good
- 15% of teachers rate availability as excellent

13. Inclusivity and Special Needs:

- 95% of teachers believe the current school design does not accommodate students with special needs or disabilities
- 1% of teachers believe the design accommodates well
- 4% of teachers believe the design somewhat accommodates



3.5.3 Future Demand:

The future demand for the Comprehensive Redevelopment Project for Mohammadpur Government High School is poised to significantly increase. The strategic location of Mohammadpur, at the heart of the city and amidst a burgeoning residential area, coupled with its proximity to crucial government offices, has led to a notable population surge. The presence of the Bihari camp adjacent to the school further underscores the area's significance. With the ongoing population growth and urban development trends, the anticipated future demand for the project is expected to escalate considerably. This emphasizes the necessity of the redevelopment to cater to the evolving needs of the expanding community and ensure a sustainable and modern educational infrastructure for the upcoming days.

3.6 SWOT Analysis:

Strengths:

1. **Government Backing:** Strong support and funding from the government enhances project credibility.
2. **Comprehensive Surveys:** Informed decision-making based on detailed surveys ensures alignment with stakeholder needs.
3. **Sustainable Practices:** Integration of sustainable and green building practices demonstrates a commitment to environmental responsibility.
4. **Technological Advancements:** Emphasis on modernization and smart technologies enhances the educational infrastructure.
5. **Financial Viability:** Positive economic indicators with a high Economic Benefit-Cost Ratio (EBCR) and Economic Internal Rate of Return (EIRR) ensure financial soundness.

Weaknesses:

1. **Construction Risks:** Construction complexities and potential delays may pose challenges to the project timeline.

2. **Dependency on External Factors:** External factors like weather conditions and regulatory approvals may impact project progress

3. **Relocation Challenges:** Temporary school relocation may disrupt the educational process for students and staff.

4. **Initial Investment:** High upfront costs may strain financial resources, requiring careful budget management.
5. **Technology Adoption:** Ensuring effective adoption and integration of smart technologies may face resistance or technical challenges.

Opportunities:

1. **Community Integration:** The project provides an opportunity to strengthen ties with the local community through improved infrastructure.

2. **Technological Learning Environment:** The creation of a technologically advanced learning environment enhances educational outcomes.

3. **Economic Stimulus:** The construction phase contributes to the local economy, providing job opportunities and stimulating growth.

4. **Long-Term Educational Impact:** Improved facilities create a positive impact on student learning experiences and academic achievements.

5. **Environmental Stewardship:** Emphasizing environmental sustainability aligns with global trends and enhances the project's reputation.

Threats:

1. **Regulatory Changes:** Changes in building codes or other regulations may necessitate adjustments to the project plan.

2. **Public Opposition:** Community resistance or opposition may arise due to concerns about the project's impact on the neighborhood.

3. **Economic Fluctuations:** Economic uncertainties or fluctuations may affect the availability of funds or project financing.

4. **Unforeseen Disasters:** Natural disasters or unforeseen events may pose risks to the project's timeline and implementation.

5. **Technology Risks:** Technical glitches or challenges in adopting new technologies may hinder the project's success.

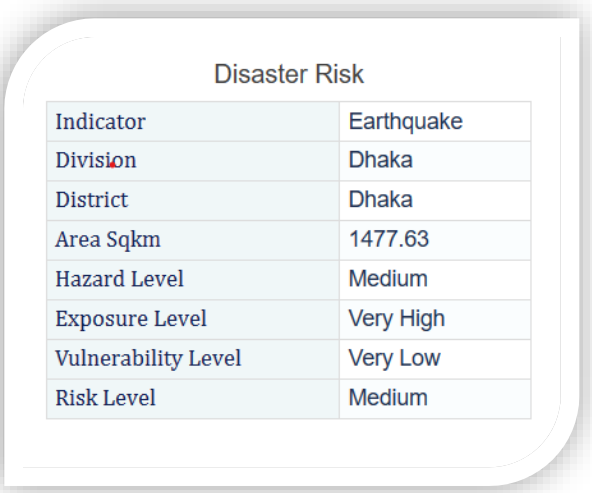
Section 4: Technical/Technological & Engineering Analysis

4.1 Location:

The Comprehensive Renovation Project for Mohammadpur Government High School, titled "Enhancing Academic Infrastructure and Sustainability," is under the joint development oversight of the Ministry of Infrastructure Development and the Ministry of Education. The project is implemented by the Government of Bangladesh (GOB) through the relevant divisions within the Educational Infrastructure Division of the Planning Commission. Strategically located at the heart of Mohammadpur, as illustrated in the attached map, the school, established in 1967, covers an area of 2,114 square meters. Being a government-owned high school, it enjoys complete ownership rights granted by the government for its utilization.

Geographic Location of Mohammadpur Govt. Boys High School

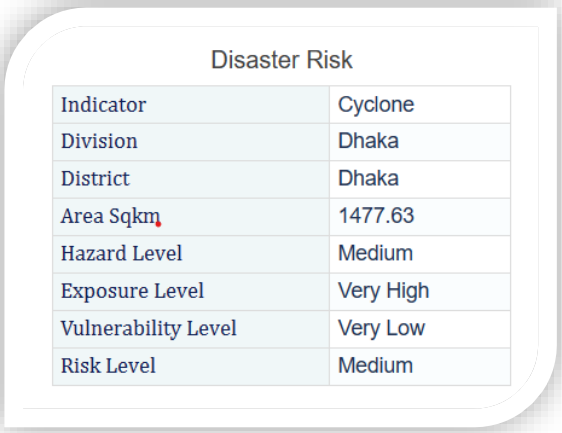
The risk level for both earthquakes and cyclones are assessed as medium, emphasizing the importance of integrating robust safety measures. This central location optimizes accessibility for students and facilitates community engagement. No utility shifting is necessary, streamlining implementation. Disaster risks, both existing and potential, were thoroughly assessed. The project site was mapped against hazard data to identify and address vulnerabilities proactively.



Disaster Risk

Indicator	Earthquake
Division	Dhaka
District	Dhaka
Area Sqkm	1477.63
Hazard Level	Medium
Exposure Level	Very High
Vulnerability Level	Very Low
Risk Level	Medium

- Risk of Earthquake in the area



Disaster Risk

Indicator	Cyclone
Division	Dhaka
District	Dhaka
Area Sqkm	1477.63
Hazard Level	Medium
Exposure Level	Very High
Vulnerability Level	Very Low
Risk Level	Medium

- Risk of Cyclone in the area

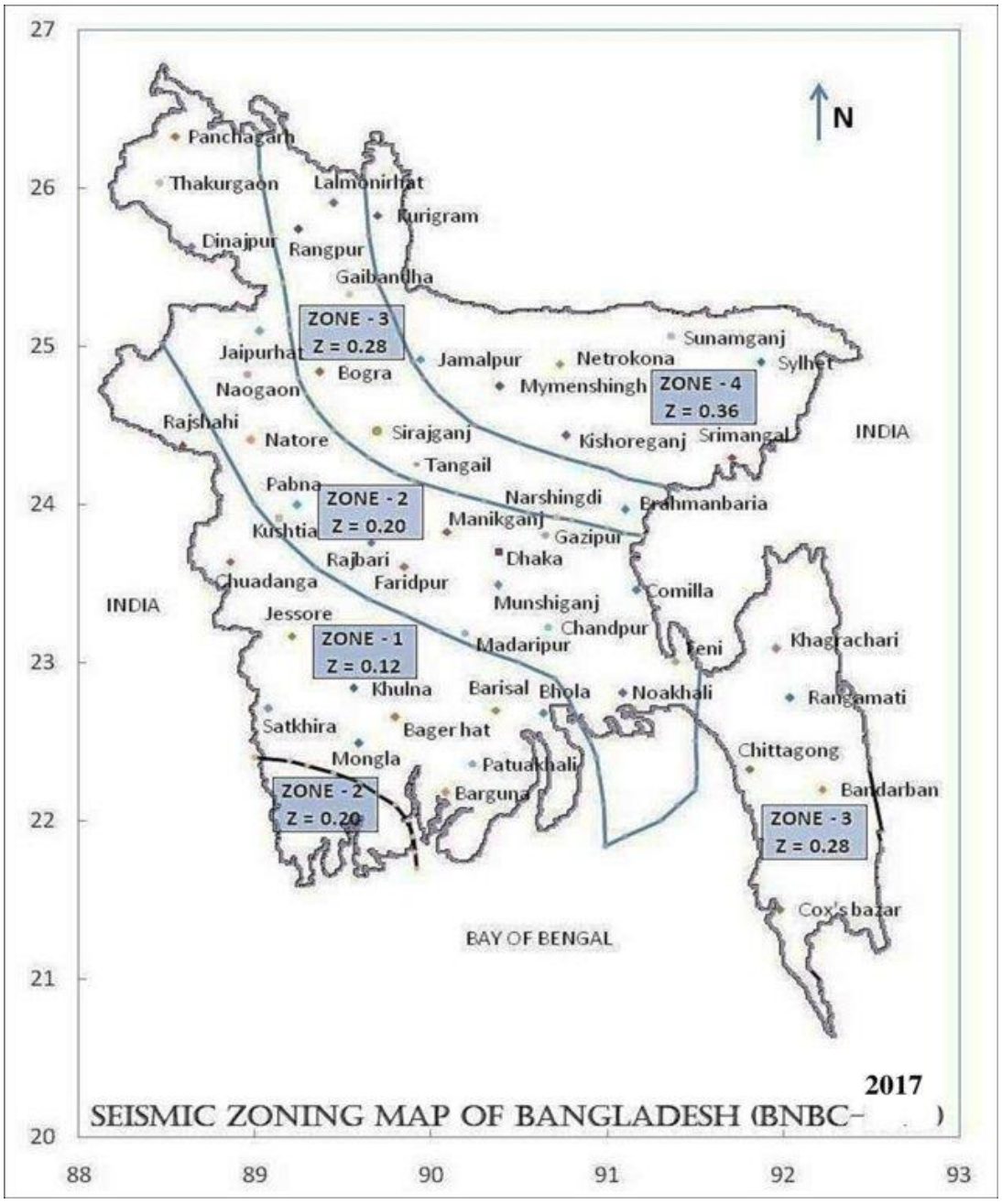


Fig- Seismic zoning map of Bangladesh

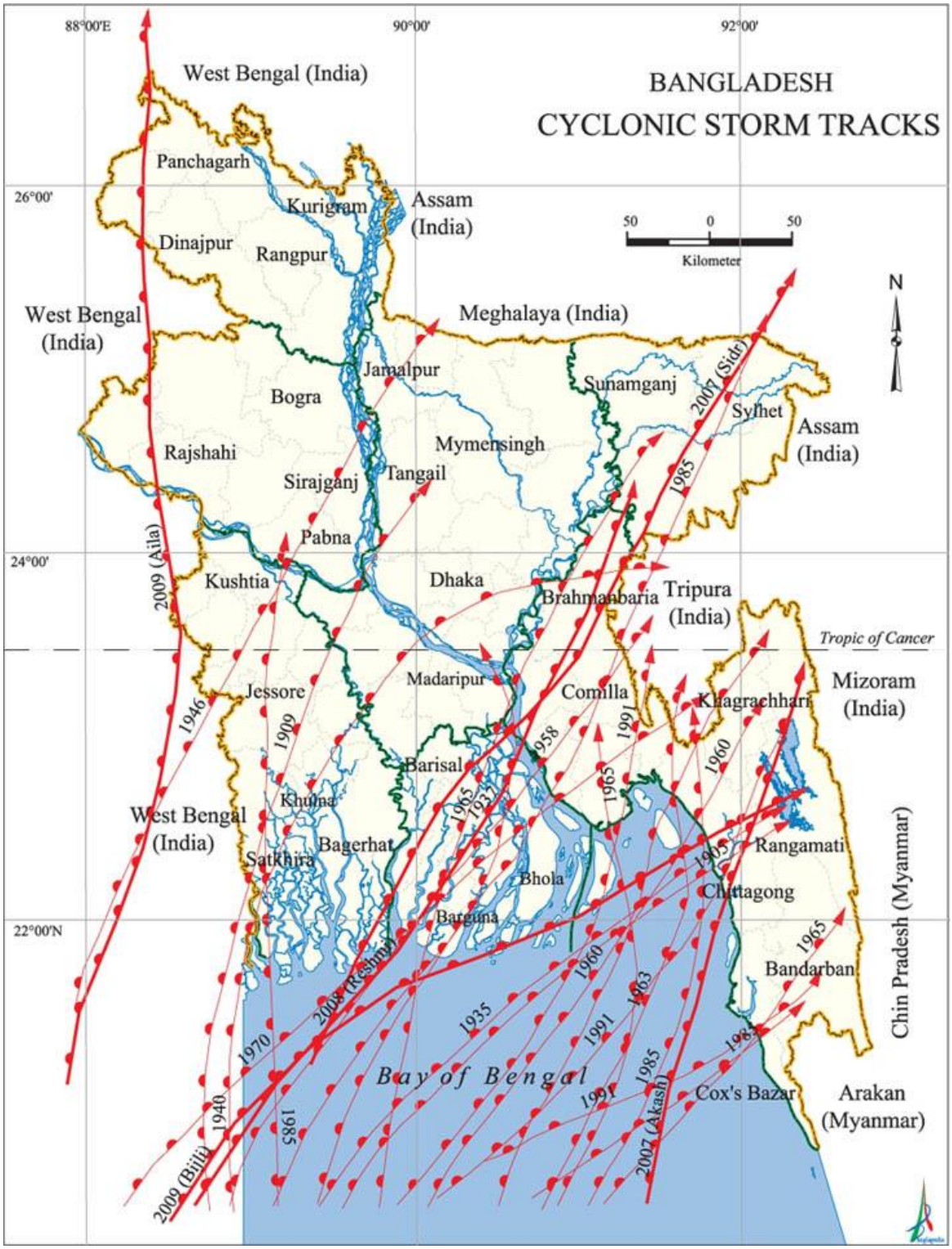


Fig- Bangladesh Cyclone Storm tracks

Reference: Disaster and Climate Risk Information Platform (DRIP) prepared by Government of Bangladesh.

4.2 Technical design:

The Mohammadpur Government High School redevelopment project integrates cutting-edge elements for modernization and safety. Adhering to green building principles and Bangladesh National Building Code (BNBC) standards, architectural enhancements prioritize energy efficiency.

The project comprises five main components:

i. Academic Building:

The RCC structure boasts a concrete strength of 4ksi and steel strength of 60ksi. With a total of five floors, it houses 43 classrooms accommodating 2752 students. Each classroom measures 40'x30'. The ground floor strategically includes vital areas such as classrooms, a cafeteria, a Scouts den, a sports room, and office space. The upper floors host well-designed classrooms and laboratories.

ii. Auditorium:

The auditorium, spanning 125' x 70', accommodates 510 students with 17 rows of seating. The front stage measures 25' x 61', complemented by 2 female and 2 male washrooms each measuring 12'x10'. Additionally, three green rooms are positioned backstage.

iii. Parking Area:

Located on the east side, the parking area spans 200'x200' and accommodates 7 cars along with a bus stand. Two bicycle stands are also provided for students who commute to school on bicycles.

iv. Football Field:

Positioned to the west of the academic building, the football field is constructed to international standards.

v. Basketball Court:

Situated between the school building and the football field, the basketball court measures 100'x60' and adheres to international standards.

Structural engineering assessments ensure earthquake resilience, surpassing local codes for heightened safety. Sustainable practices, including waste management and water conservation, are seamlessly integrated. Disaster and climate change risks are integral to the technical design, aligning with the Bangladesh National Building Code (BNBC) standards. The design undergoes a Climate Vulnerability Assessment to address potential impacts.

4.3 Climate Vulnerability Assessment:

Temperature Extremes:

Building faces increased temperatures during the hot season.

Mitigation: Installation of energy-efficient cooling systems and thermal insulation.

Earthquake:

Assessment for seismic activities' impact.

Mitigation: Reinforcement of foundation, walls, and roof for earthquake resilience.

Extreme Weather Events:

Exposure to cyclones and storms.

Mitigation: Evaluation for structural integrity, including reinforcements and improved roofing materials.

4.4 Building Resilience:

Structural Improvements:

Reinforcement of foundation, walls, and roof for resilience.

Utilization of advanced engineering techniques exceeding safety standards.

Drainage Systems:

Enhanced systems to manage excess water during heavy rainfall.

Integration of innovations like rain gardens and permeable pavements.

Emergency Preparedness:

Comprehensive emergency response plan development.

Communication to all staff and students for effective implementation.

4.5 Modern Facilities Integration:

Energy Efficiency:

Installation of energy-efficient lighting and HVAC systems.

Result: Reduction in energy consumption and greenhouse gas emissions.

Smart Building Technologies:

Incorporation of smart technologies.

Benefits: Efficient resource management, enhanced security, and streamlined maintenance.

Digital Learning Infrastructure:

Upgradation of IT infrastructure for digital learning.

Goal: Ensure access to cutting-edge learning resources for students.

Accessibility:

Ensuring accessibility for all students, including those with disabilities.

Measures: Installation of ramps, elevators, and other accommodations, promoting inclusivity.

The technical design systematically integrates these elements, ensuring the project's safety, sustainability, and long-term viability.

Fig. Site Model

4.5 Output plan:

The output plan for the Mohammadpur Government High School redevelopment project focuses on modernizing learning spaces, enhancing safety measures, incorporating sustainable facilities, improving accessibility, and implementing a robust digital learning infrastructure. The utilization rate is projected to meet the rising demand for quality education in the region. With the modernization of facilities and improved academic quality, it is anticipated that the school will experience increased enrollment. The utilization rate will be regularly monitored and adjusted to accommodate the growing demand, ensuring that the redeveloped school optimally serves the educational needs of the community.

This output plan aligns with the forecasted demand for upgraded educational facilities, meeting the expectations of students, parents, and the community.

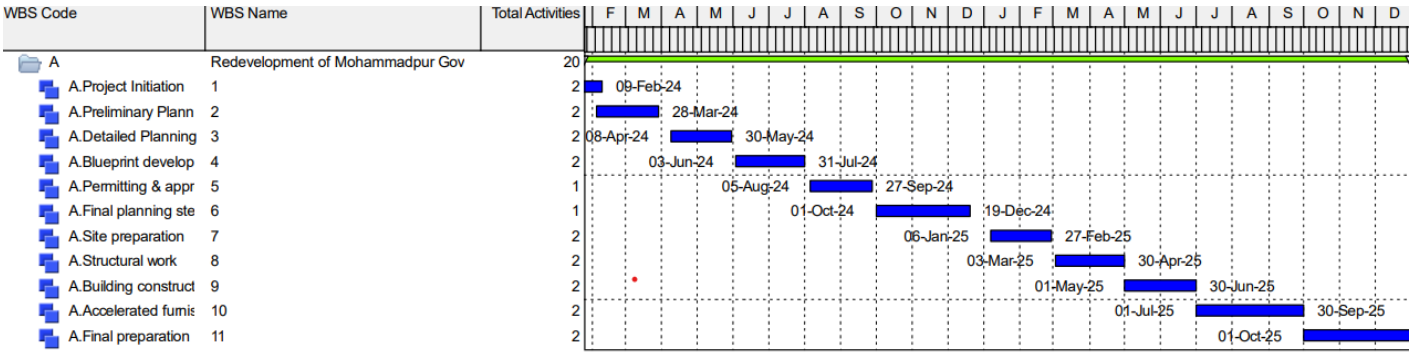
4.6 Cost estimates:

Total construction cost of the facility= 57 crore BDT

Components	Cost
Design cost	=(15% of construction cost) = 8,62,86,410 BDT = 863 lac BDT approx.
Operation & Maintenance cost (30 years)	= 2,59,90,00,000 BDT = 259 crore BDT approx.
Implementation cost	Project Management (10% of construction cost) = 57,524,273 BDT = 575 lac BDT approx. Legal and Permitting Costs (5% of construction cost)

	= 28,761,366 BDT=288 lac BDT approx. Technology and Software (5% of construction cost = 28,761,366 BDT=288 lac BDT approx. Total implementation cost = 1,1,50,47,005 BDT =11 crore BDT approx.

4.7 Implementation timeline:



Section 5: Environmental Sustainability, Climate Resilience, and Disaster Risk Analysis

5.1 Environmental, Climate Change, and Disaster Risk Analysis:

5.1.1 Baseline Environment:

PHYSIOCHEMICAL:

The baseline physicochemical environment evaluation in the Mohammadpur area provides essential insights into the prevailing environmental conditions. During the summer months (March to June), average temperatures range from around 30°C to 39°C. The monsoon season (June to October) is marked by moderate temperatures, with averages between 30°C and 34°C, alongside heavy rainfall. In winter (November to February), the climate becomes milder, with average

temperatures ranging from approximately 25°C to 29°C. Additionally, air quality data, characterized by an Air Quality Index (AQI) averaging 178, categorizes the air quality as 'unhealthy.' Elevated levels of particulate matter (PM2.5 and PM10) and noxious gases like NO2 and SO2 pose potential health risks. The soil in Mohammadpur is predominantly clayey, with varying pH levels ranging from slightly acidic to neutral. The presence of organic matter and nutrient content is within acceptable ranges. Soil compaction, permeability, and potential contaminants have also been evaluated. In terms of water quality, key parameters including pH, turbidity, Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) consistently fall within acceptable limits, indicating that the water resources in the area meet basic quality standards. The topography is generally uniform, with elevations close to sea level. There are no significant natural hills or prominent geological features in the immediate study area. The flat and low-lying topography of Mohammadpur and its surroundings has influenced land use patterns, urban development, and the management of water resources in the region.

ECOLOGICAL:

The baseline ecological environment assessment for the Mohammadpur area presents a comprehensive overview of the existing ecological conditions. This assessment documents a rich and diverse ecosystem, which includes numerous plant species, such as approximately 30 robust coconut trees and a variety of flowering trees. These findings emphasize the pronounced ecological significance of the region. Furthermore, the school's extensive green spaces and towering trees offer a conducive habitat for various avian and insect species, comprising a diverse bird population and a vibrant assortment of butterflies and other wildlife. This ecological baseline serves as a vital reference point for evaluating the potential impacts of the proposed project on the existing ecosystem.

SOCIO-ECONOMICAL:

The socio-economic environment assessment provides a critical perspective on the interplay between Mohammadpur Government High School and the local community. This assessment aims to comprehensively understand the social and economic dynamics surrounding the school and its redevelopment. The school functions as a significant employer, facilitating employment opportunities for a diverse range of individuals. This includes teaching staff, support personnel, assistants, and service staff, who hail from various socio-economic backgrounds. This diverse employment approach not only contributes to the economic stability and livelihoods of the community but also fosters inclusivity by extending opportunities to individuals from different classes and backgrounds. Additionally, the school's extensive staff, encompassing administrative personnel, kitchen and cafeteria workers, gardeners, and maintenance staff, actively participates in sustaining the local socio-economic ecosystem. These roles provide avenues for employment, skill development, and income generation for individuals residing within the community. While the redevelopment phase may necessitate the temporary relocation of students to the nearby

institution, Mohammadpur Kendriya College, the socio-economic impact on the community is expected to be minimal due to the proximity of these schools. However, it's essential to recognize the socio-economic context of Geneva Camp, a nearby settlement that houses Bihari refugees. The socio-economic well-being of this population is intricately linked to the school's activities, underscoring the significance of ensuring equitable access to education and fostering community engagement throughout the redevelopment process. This socio-economic assessment stands as a pivotal element in understanding the broader implications of the school's revitalization within its local context.

5.1.2 Identification and Assessment of Potential Impacts:

The identification and assessment of potential impacts are pivotal components of the Environmental Impact Assessment (EIA) process for the "Comprehensive Redevelopment Project for Mohammadpur Government High School: Enhancing Academic Infrastructure and Sustainability." This phase entails a systematic evaluation of the project's anticipated effects on the natural and human environment during both the construction and operational phases.

This assessment aims to understand and quantify potential positive and negative consequences on various environmental and socio-economic aspects, including air quality, water quality, noise, biodiversity, traffic, energy consumption, waste generation, and socio-cultural factors. Identifying these impacts early allows for proactive measures to mitigate adverse effects and enhance positive outcomes. The following sections provide a detailed assessment of the impacts of each project phase:

Pre-Construction Stage:

1. Land Clearing and Site Preparation:

- Potential disruption of existing ecosystems and habitats.
- Impact on local flora and fauna.
- Soil disturbance and potential erosion risks.

2. Vegetation Removal:

- Removal of trees and vegetation, affecting the local microclimate.
- Loss of green cover and potential impact on aesthetics.
- Impact on local wildlife, including birds and insects.

3. Site Grading and Excavation:

- Alteration of land topography and natural contours.

- Soil compaction and disruption of soil structure.
- Potential changes in groundwater flow and aquifer recharge rates.

Construction Phase:

1. Air Quality:

- Emission of dust and particulate matter from construction activities.
- Potential impact on air quality in the vicinity.
- Increased risk of respiratory health issues for nearby residents and workers

2. Noise Pollution:

- Noise generated by construction equipment and activities.
- Potential disturbance to the local community, especially during quiet hours.
- Impact on the psychological well-being of nearby residents.

3. Water Quality:

- Runoff of construction materials, chemicals, and sediment into nearby water bodies.
- Potential water pollution and contamination of local water sources.
- Adverse effects on aquatic ecosystems and aquatic life.

4. Hydrology and Drainage:

- Disturbance of natural drainage patterns during construction.
- Risk of localized flooding due to altered surface runoff pathways.
- Impact on soil erosion and sedimentation in nearby water bodies.

5. Biodiversity:

- Disruption of local flora and fauna due to site clearing and excavation.
- Potential harm to nesting birds, small mammals, and insects.
- Impact on local biodiversity and ecosystem balance.

Operational Phase:

1. Traffic Congestion:

- Increased traffic congestion during school hours.
- Impact on local road infrastructure and traffic flow.
- Potential safety concerns for students and commuters.

2. Air Quality:

- Emissions from school buses and increased vehicle traffic.
- Impact on local air quality and ambient pollution levels.
- Potential health risks for nearby residents due to exposure to pollutants.

3. Noise Pollution:

- Noise generated by school activities, transportation, and student interactions.
- Disruption of the surrounding environment and local neighborhoods.
- Impact on the quality of life for nearby residents.

4. Water Usage and Quality:

- Increased water demand for school facilities and sanitation.
- Potential overuse of local water resources.
- Proper management of wastewater and sewage to prevent contamination.

5. Energy Consumption:

- Increased energy usage for lighting, heating, and cooling of expanded school facilities.
- Impact on energy demand and potential strain on local power infrastructure.
- Opportunities for energy-efficient building design and renewable energy sources.

6. Waste Management:

- Generation of additional solid waste from school operations.
- Proper disposal and recycling facilities are needed to manage waste.
- Potential impact on landfill capacity and local waste management systems.

7. Socio-Cultural Impacts:

- Disruption to local communities and traditions due to school expansion.
- Changes in land use patterns, social dynamics, and community interactions.
- Impact on the cultural and social fabric of the area.

These potential impacts should be thoroughly assessed, and appropriate mitigation and management measures should be developed as part of your Environmental Impact Assessment (EIA) report. It's essential to consider the specific environmental regulations and conditions in the project area to ensure compliance and responsible development.

5.1.3 Mitigation Process for Identifies Impacts:

Throughout the different stages of the project, various mitigation measures will be employed to address potential impacts on the environment and the local community.

Pre-Construction Stage:

In the pre-construction stage, measures are taken to minimize potential impacts before actual construction begins.

1. Land Clearing and Site Preparation:

- Implement phased site clearing to minimize disruption to existing ecosystems.

- Impact on Different Types of Environments: Mitigates the impact on local flora, fauna, and soil.

2. Vegetation Removal:

- Offset vegetation loss by planting native trees and creating green buffers around the site.

- Impact on Different Types of Environments: Helps preserve local biodiversity and aesthetics.

3**. Site Grading and Excavation:**

- Implement erosion control measures like silt fences and sediment basins to prevent soil erosion.

- Impact on Different Types of Environments: Reduces soil disturbance and minimizes sedimentation in water bodies.

4. Archaeological and Cultural Heritage:

- Conduct thorough archaeological assessments before site preparation and preserve any discovered heritage sites.

- Impact on Different Types of Environments: Protects archaeological and cultural heritage.

5. Community Engagement:

- Actively engage with local communities, address concerns, and incorporate community feedback into project planning.

- Impact on Different Types of Environments: Promotes positive community relations and reduces potential conflicts.

Construction Phase:

During the construction phase, steps are taken to mitigate the environmental and social impacts of construction activities.

1. Air Quality:

- Employ dust control methods such as water spraying and dust screens.

- Impact on Different Types of Environments: Reduces airborne particulate matter and maintains air quality.

2. Noise Pollution:

- Schedule noisy construction activities during permissible hours and utilize noise barriers.

- Impact on Different Types of Environments: Minimizes noise disturbance to the local community.

3. Water Quality:

- Implement sedimentation ponds and erosion control measures to prevent runoff pollution.

- Impact on Different Types of Environments: Protects water bodies from contamination.

4. Hydrology and Drainage:

- Restore natural drainage patterns post-construction and install retention basins.

- Impact on Different Types of Environments: Reduces the risk of localized flooding and erosion.

5. Biodiversity:

- Develop a comprehensive biodiversity conservation plan, including reforestation and habitat restoration.

- Impact on Different Types of Environments: Preserves local flora and fauna.

Operational Phase:

In the operational phase, measures are put in place to manage and mitigate the ongoing impacts of the school's activities.

1. Traffic Congestion:

- Implement a traffic management plan with designated drop-off zones and alternative transportation options.

- Impact on Different Types of Environments: Reduces traffic-related congestion and disruptions.

2. Air Quality:

- Promote green transportation options and vehicle emission standards.

- Impact on Different Types of Environments: Improves local air quality.

3. Noise Pollution:

- Implement noise barriers, insulation, and soundproofing within the school premises.

- Impact on Different Types of Environments: Reduces noise impact on the community.

4. Water Usage and Quality:

- Implement water-efficient fixtures and wastewater treatment facilities.

- Impact on Different Types of Environments: Efficiently manages water resources and prevents contamination.

5. Energy Consumption:

- Incorporate energy-efficient building design and renewable energy sources.

- Impact on Different Types of Environments: Reduces energy demand and promotes sustainability.

6. Waste Management:

- Establish recycling and waste reduction programs within the school.

- Impact on Different Types of Environments: Minimizes solid waste generation and landfill impact.

7. Socio-Cultural Impacts:

- Continuously engage with local communities and address social concerns through programs and outreach.

- Impact on Different Types of Environments: Fosters positive community relations and cultural preservation.

These measures are designed to address and mitigate potential impacts at each stage of the project, promoting responsible and sustainable development.

5.1.4 EMP-Environment Monitoring Plan:

The Environmental Monitoring Plan (EMP) is a meticulous strategy spanning the pre-construction, construction, and operation phases. It focuses on monitoring air and noise quality, water quality, waste management, and other environmental aspects. This proactive plan ensures compliance with regulations and fosters transparency, aiming to minimize adverse environmental impacts and enhance the overall quality of the project's surroundings.

Preliminary cost estimates for monitoring and mitigation activities during the pre-construction (Demolition) phase:

Parameter/Activity	**Frequency of activity**	**Cost in BDT (per month)**	**Cost in BDT (2 months)**
Particulate Matter (PM10, PM2.5)	Once every month	40,000/- per each set of PM_{10} and $PM_{2.5}$ measurement	80,000/-
Noise Level (Ambient and personal exposure)	Once every month (Day and night)	40,000/- (per set of measurements)	80,000/-
Surface water quality (Parameters: Turbidity, Total Suspended Solids, BOD_5, Dissolved Oxygen)	1 measurement before starting construction, then in each subsequent month	Tk. 10,000/- (Per set of measurement)	20,000/-
Providing safety gear packages like hand gloves, eye protection glasses, helmets, rubber shoes, light reflecting dress, etc. for 40 sets @ Tk. 10,000 for each set	-	Lump sum	40,000/-
Drinking water containers for workers including necessary ceramic filters for providing drinkable water	-	Lump sum	10,000/-
Temporary Sanitary Latrine/ Septic Tank/ Portable Toilet: 2 nos. (1 no of Toilet for female and 1 no of Toilet for male) @Tk. 50,000	-	Lump sum	10,000/-
Waste disposal charge from the site by outsourced cleaners	Daily or weekly collection of solid waste	20,000/-	40,000/-
Dust suppression measures like water sprinkling on aggregates/ unpaved roads, in and around the work site (Lump Sum). For road construction works cost of This item has been mentioned in the road section.	Daily or weekly activities	Lump sum	40,000/-

Health and safety warning sign	-	Lump sum	2,000/-
Appointment of an Environmental Health and Safety officer for Environmental and Social Management and Monitoring during construction (salaried position)	-	50,000/-	90,000/-
Total			4,12,000/-

Preliminary cost estimates for monitoring and mitigation activities during the construction phase:

Parameter/Activity	**Frequency of activity**	**Cost in BDT (per month)**	**Cost in BDT (48 months)**
Particulate Matter (PM10, PM2.5)	Once every month	40,000/- per each set of PM_{10} and $PM_{2.5}$ measurement	1,920,000/-
Noise Level (ambient and personal exposure)	Once every month (Day and night)	40,000/- (per set of measurements)	1,920,000/-
Surface water quality (Parameters: Turbidity, Total Suspended Solids, BOD_5, Dissolved Oxygen)	1 measurement before starting construction, then in each subsequent month	Tk. 10,000/- (Per set of measurement)	5,07,000/-
Drinking water quality testing: pH, color, turbidity, total hardness, chloride, Total and Fecal coliform, Total Dissolved Solids, Arsenic, Iron, Manganese, Electrical Conductivity (salinity), Free	Monthly	Tk. 12,000/- per set of measurement	5,76,000/-

Chlorine			
Soil Quality (Heavy metals Pb, Cr, Cd)	Monthly	Tk. 6,000/- per set of measurement	2,88,000/-
Site Cleaning and preparation including providing necessary protective fencing and safety measures with sign boards.	Periodic	Lump sum	1,3,33,000/-
Vegetation and tree plantation around the site including fencing/ conservation/ maintenance for 2 years. Trees need to be replanted around the periphery of the proposed site at an interval of 10 feet @ Tk. 1500 for each tree.	Periodic	Lump sum	5,33,000/-
Providing safety gear packages like hand gloves, eye protection glasses, helmets, rubber shoes, light reflecting dress, etc. for 40 sets @ Tk. 10,000 for each set	-	Lump sum	1,0,66,000/-
Drinking water containers for workers including necessary ceramic filters for providing drinkable water	-	Lump sum	2,66,000/-
Temporary Sanitary Latrine/ Septic Tank/ Portable Toilet: 2 nos. (1 no of Toilet for female and 1 no of Toilet for male) @Tk. 50,000	-	Lump sum	2,66,000/-
Waste disposal charge from the site by outsourced cleaners	Daily or weekly collection of solid waste	20,000/-	9,60,000/-

Dust suppression measures like water sprinkling on aggregates/ unpaved roads, in and around the work site (Lump Sum). For road construction works cost of this item has been mentioned in the road section.	Daily or weekly activities	Lump sum	9,60,000/-
Health and safety warning sign	-	Lump sum	53,000/-
Appointment of an Environmental Health and Safety officer for Environmental and Social Management and Monitoring during construction (salaried position)	-	50,000/-	2,4,00,000/-
Total			1,30,48,000/-

Notes: (1) The estimated costs for particular matter (PM) and noise level measurements as well as laboratory analysis for water samples are based on current rates charged by BRTC, BUET and the rates may vary. (2) During the construction phase, some monitoring may be carried out by the PMU through its staff and equipment, if available, or can be outsourced to a competent Contractor. Equipment for monitoring such as a digital camera, sound level meter, GPS, etc. may be purchased by the Administration.

Preliminary cost estimates for monitoring and mitigation activities during the construction phase:

Parameter/Activity	**Frequency of activity**	**Cost estimate (per month)**
CO, SO_X, NO_X, PM_{10}, SPM for generator stack emission	Monthly	Tk. 40,000/-
Treated water for drinking: pH, color, turbidity, total hardness, chloride, Total and Fecal coliform, Total Dissolved Solids, Arsenic, Iron, Manganese,	Monthly	Tk. 20,000/-

Electrical Conductivity (salinity), Free Chlorine		
Noise level monitoring at surrounding areas (nearby residential and college areas). Noise emissions from generators.	As and when required	Administration conducts monitoring and records positions by Cable Car Project-
		owned noise level meter and GPS (The cost of a standard noise level meter is 50,000/- and GPS is 10,000/-)
Solid waste management, recycling of wastes	Monthly	Tk. 10,000/-
Fire drills	Monthly	Contracted out to Fire Department or other competent contractors

Notes: The estimated costs for air emission and water quality analysis are based on current rates charged by BRTC, and BUET for analysis of the parameters, and the rates may vary. The monitoring may be outsourced to a competent Contractor. Equipment for monitoring such as digital camera, sound level meter, GPS, etc. may be purchased by administration.

5.1.5 Types of Assessment Required for The Project:

To comprehensively evaluate the project's environmental, climate change, and disaster risk aspects, a multifaceted approach involving various assessments is imperative. First and foremost, an Environmental Impact Assessment (EIA) is essential to scrutinize potential environmental consequences, encompassing effects on ecosystems, air and water quality, biodiversity, and human health. Additionally, a Disaster Impact Assessment (DIA) is crucial to understand the project's implications on disaster risks, covering events such as earthquakes, floods, and cyclones. A Climate Change Impact Assessment is imperative to gauge the project's vulnerability and resilience in the face of climate change, addressing both the project's impact on climate change and its susceptibility to climate-related shifts. Social Impact Assessment (SIA) is necessary to evaluate the project's effects on local communities, ensuring inclusivity and identifying potential

disruptions. Economic, Biodiversity, Health, and Resettlement Impact Assessments contribute essential dimensions to the overall evaluation, considering economic implications, biodiversity preservation, public health, and, if applicable, the impact on local populations necessitating resettlement. Integrating these assessments provides a holistic understanding, facilitating informed decision-making and the development of robust mitigation strategies.

5.1.6 Temporary Relocation of School:

In light of the impending construction phase of our project, a comprehensive strategy has been devised to facilitate the temporary relocation of our educational institution. Following extensive negotiations with the authorities of Mohammadpur Kedriyo College, we are pleased to announce the formalization of an agreement allowing the provisional utilization of their facilities. Mohammadpur Kedriyo College, distinguished for its ample spatial provisions and well-equipped amenities, aligns seamlessly with the requirements of our academic programs. This discerning decision has been orchestrated to mitigate any disruptions to the scholastic environment, ensuring an uninterrupted continuum of educational endeavors for our students and faculty. The transition to Mohammadpur Kedriyo College underscores our unwavering commitment to upholding the standard of education throughout the construction period, with paramount emphasis on a seamless and efficacious relocation process. We extend our gratitude to Mohammadpur Kedriyo College for their collaborative ethos in facilitating this transitional phase.

5.2 Assessment of Disaster Resilience of the Project:

5.2.1 Contingency Plan for Emergency Disaster Management:

In the bustling urban landscape of Dhaka, our project's Contingency Plan is a meticulous guide to managing emergencies. The table below outlines the potential disasters, corresponding impacts, and the proactive measures in place:

Disaster Type	Potential Impacts on Project	Proactive Measures
Fire	Structural damage, service disruption	Advanced fire suppression systems,
Earthquake	Structural damage, safety hazards	Seismic-resistant design, regular
Flood	Infrastructure damage,	Elevated construction, flood barriers

Cyclone	Structural damage, service disruption	Robust building codes, cyclone-proof

5.2.2 Business Continuity Plan:

The Business Continuity Plan for Dhaka City focuses on key response and recovery priorities. The table below illustrates utility services critical for the city's functioning, their potential impact during disasters, and strategies for maintaining continuity:

Utility Service	**Potential Impact during Disasters**	**Continuity Strategies**
Power Supply	Service disruption, power outages	Backup generators, decentralized power resources.
Water Supply	Contamination, service disruption	Water purification, alternative
Transportation	Infrastructure damage, road closures	Emergency transport routes,

5.2.3 Time of Recovery:

In the aftermath of disasters in Dhaka, understanding the time required for rehabilitation is vital. The following timeline outlines the stages of recovery, focusing on infrastructure, services, and overall project operations:

- Immediate Response (0-72 hours): Emergency services, safety assessment.
- Short-Term Recovery (1 week - 1 month): Initial repairs, service restoration.
- Medium-Term Recovery (1 month - 6 months): Infrastructure rehabilitation, system optimization.
- Long-Term Recovery (6 months and beyond): Full project functionality restoration.

5.2.4 Reporting of Residual Risks:

Dhaka's complex risks necessitate a transparent reporting mechanism for residual risks. Regular assessments will be conducted, and the residual risks, categorized by their nature and potential impact, will be communicated through detailed reports to ensure stakeholders are well-informed for ongoing risk management.

Section 6: Cost-Benefit Analysis

6.1 Economic and Financial Analysis:

For detailed analysis: (Statements have been attached for:)

1. Net Present Value (NPV)
2. Benefit Cost Ratio (BCR)
3. Internal Rate of Return (IRR)

Note: This Project is not directly related to productivity. As it is an Infrastructure Development Project, Financial feasibility is not considered here.

Assumptions:

1) Economic prices were derived from financial prices by using a standard conversion factor of 0.8, which are used for infrastructure projects in Bangladesh.
2) The discount rate for NPV calculation was assumed to be 12%.
3) A straight-line deprecation method is used to calculate the salvage value of investment at the end of the analysis period.
4) Residual value of 50% is assumed in the final year of the project period.
5) The Economic analysis was conducted for the initial 30 years.
6) The project lifetime was assumed to be 50 years.
7) All amounts stated in constant.

6.1.2 Expenditure Tentative Schedule:

Annual Estimated Expenditure				
Fiscal Year	**GOB (crore)**	**Organization's own money (crore)**	**Others (crore)**	**Total (crore)**
1	2	3	4	5
Finance Year 2023-2024	30.00			30.00
Finance Year 2024-2025	27.44			27.00

6.2 Financial Analysis:

6.2.1 Financial Cost Analysis:

1. **Construction Cost**
   Total construction cost of the facility= **575242730 Taka** Or 57 Crore 53 Lakh Taka

2. **Energy Efficiency (.5% of Construction Cost)**
   Implementation of energy-efficient lighting, HVAC systems, and insulation.

3. **Safety and Security (1% of Construction Cost)**
   Installation of safety features, fire alarm systems, and security cameras.

4. **Accessibility and Inclusivity (.1% of Construction Cost)**
   Ensuring the school is accessible to students with disabilities.

5. **Technology Integration (1.2% of Construction Cost)**
   Equipping classrooms with technology for enhanced teaching and learning.

6. **Furniture and Equipment (3% of Construction Cost)**
   Provision of desks, chairs, educational materials, and laboratory equipment.

7. **Sanitation Facilities (2% of Construction Cost)**
   Building clean and functional restrooms for students and staff.

8. **Water Supply (1% of Construction Cost)**
   Ensuring a reliable and safe water supply for drinking and sanitation**.**

9. **Waste Management (1% of Construction Cost)**
   Implementation of proper waste disposal and recycling systems.

10. **Playground and Sports Facilities (1% of Construction Cost)**
    Creation of spaces for physical education and recreation.

11. **Library Resources (.5% of Construction Cost)**
    Stocking the library with books and educational resources.
12. **Maintenance Fund (0.4% of Construction Cost)**
    Allocation of funds for ongoing maintenance and repairs.

13. **Safety Drills and Training (.01% of Construction Cost)**
    Conducting regular safety drills for students and staff.

14. **School Transport (.3% of Construction Cost)**
    Provision of safe transportation options for students.

15. **Cafeteria and Nutrition (2% of Construction Cost)**
    Establishment of a kitchen for nutritious meals.

16. **Disaster Preparedness (.01% of Construction Cost)**
    Development of a disaster preparedness plan for emergencies.

17. **Science and Computer Labs (1% of Construction Cost)**
    Equipping labs with modern technology**.**

18. **Monitoring and Evaluation (.01% of Construction Cost)**
19. **Administrative (10% of construction cost)**
    Total Maintenance Cost= 20% in 30 years

6.1.3 Financial Benefit Analysis:

Government high schools typically generate revenue through various sources to support their operations and provide quality education. Here are some common earning sources for government high schools:

1. **Government Funding**:(15%) (2876500 BDT per year)

   The primary source of income for government high schools is funding from the central or state government. This funding is allocated to cover various expenses, including teacher salaries, infrastructure development, and the purchase of educational materials.

2. **Student Fees:** (0.5%) (95884 BDT per year)

   In some cases, government high schools may charge nominal fees from students. These fees are usually quite low and are meant to cover a portion of operational costs, such as maintenance and utilities.

3. **Grants:** (2%) (11506000 BDT in 30 years)

   Government high schools can receive grants from government agencies, non-governmental organizations (NGOs), and other institutions. These grants can be project-specific or aimed at improving the overall quality of education.

4. **Donations:(0.05%) (287650** BDT in 30 years)

   Some government high schools may accept voluntary donations from philanthropic individuals or organizations. These donations can be used for various purposes, such as purchasing books, equipment, or improving facilities.

5. **Income from School Assets**:(1.25%) (7191250 BDT in 30 years)

   Schools may generate income from assets they own, such as renting out school premises for community events, hosting workshops or seminars, or leasing land or facilities to third parties.

6. **Exam Fees:** (0.2%) (38353 BDT per year)

   High schools often charge fees for board exams or other standardized tests. While these fees are typically paid directly to examination boards, a portion may be retained by the school to cover administrative costs.

7. **Fundraising Activities:** (0.05%) (287650 BDT in 30 years)

   Schools may organize fundraising events, such as bake sales, charity drives, or cultural festivals, to generate additional income. The proceeds from these activities can be used to fund extracurricular programs or buy educational resources.

8. **Sponsored Programs:(0.4%) (2301200** BDT in 30 years)

Government high schools may partner with private companies or organizations for sponsored programs or initiatives. These sponsors may provide financial support or resources in exchange for branding or recognition.

9. **Investments: (0.25%) (1438250** BDT in 30 years)

   Schools may invest surplus funds in low-risk financial instruments or savings accounts to generate interest income. This income can be used for various school expenses.

10. **Tuition for Special Programs:(0.1%) (**20547 BDT per year, starting one year after the completion of the school building)

    Some government high schools offer specialized programs or courses that charge higher tuition fees. These programs may focus on areas such as vocational training, advanced coursework, or skill development.

11. **Rental of Facilities:(0.2%) (38353** BDT per year)

    Schools with extra facilities, like sports fields or auditoriums, can generate revenue by renting them out to external organizations for events, sports competitions, or other activities.

Economic Analysis (NPV, BCR, IRR)												
		Cost		Benefit		Undiscounted Total			Discounted Total			Discount rate
SL NO:	Year	Construction cost (lacs)	Operation and Maintanance cost (lacs)	Benefit (Economic value)	Salvage Value (lacs)	Total Cost (lacs)	Total Benefit (Economic Value) (lacs)	Discount Factor (12%)	Total Cost (lacs)	Total Benefit (lacs)	Net Cash flow (lacs)	0.12
0	2024	2876.5	61.39	0		2937.88667	0	1	2937.8867	0	-2937.89	
1	2025	2876.5	61.39	0		2937.88667	0	0.89286	2623.1131	0	-2623.11	
2	2026	0	61.39	69.036		61.3866667	69.036	0.79719	48.937075	55.03507653	-6.1	
3	2027	0	76.73	69.036		76.7333333	69.036	0.71178	54.617271	49.13846119	-5.47881	
4	2028	0	76.73	69.036		76.7333333	69.036	0.63552	48.765421	43.87362606	-4.89179	
5	2029	0	76.73	86.3		76.7333333	86.3	0.56743	43.540554	48.96893765	5.428384	
6	2030	0	76.73	86.3		76.7333333	86.3	0.50663	38.875495	43.72226576	4.846771	
7	2031	0	76.73	86.3		76.7333333	86.3	0.45235	34.710263	39.03773728	4.327474	
8	2032	0	76.73	86.3		76.7333333	86.3	0.40388	30.991306	34.85512257	3.863816	
9	2033	0	76.73	86.3		76.7333333	86.3	0.36061	27.670809	31.12064516	3.449836	
10	2034	0	76.73	86.3		76.7333333	86.3	0.32197	24.70608	27.78629032	3.080211	
11	2035	0	76.73	86.3		76.7333333	86.3	0.28748	22.059	24.80918778	2.750188	
12	2036	0	76.73	86.3		76.7333333	86.3	0.25668	19.695535	22.15106052	2.455525	
13	2037	0	76.73	86.3		76.7333333	86.3	0.22917	17.5853	19.77773261	2.192433	
14	2038	0	76.73	86.3		76.7333333	86.3	0.20462	15.70116	17.65868983	1.95753	
15	2039	0	76.73	86.3		76.7333333	86.3	0.1827	14.018893	15.76668735	1.747794	
16	2040	0	76.73	86.3		76.7333333	86.3	0.16312	12.516869	14.07739942	1.560531	
17	2041	0	76.73	86.3		76.7333333	86.3	0.14564	11.175776	12.56910662	1.393331	
18	2042	0	76.73	86.3		76.7333333	86.3	0.13004	9.9783712	11.22241663	1.244045	
19	2043	0	76.73	86.3		76.7333333	86.3	0.11611	8.90926	10.02001485	1.110755	
20	2044	0	76.73	86.3		76.7333333	86.3	0.10367	7.9546964	8.946441826	0.991745	
21	2045	0	76.73	86.3		76.7333333	86.3	0.09256	7.1024075	7.987894488	0.885487	
22	2046	0	76.73	86.3		76.7333333	86.3	0.08264	6.3414353	7.13204865	0.790613	
23	2047	0	76.73	86.3		76.7333333	86.3	0.07379	5.6619958	6.36790058	0.705905	
24	2048	0	76.73	86.3		76.7333333	86.3	0.06588	5.0553534	5.685625518	0.630272	
25	2049	0	76.73	86.3		76.7333333	86.3	0.05882	4.5137084	5.076451355	0.562743	
26	2050	0	76.73	86.3		76.7333333	86.3	0.05252	4.0300968	4.532545853	0.502449	
27	2051	0	76.73	86.3		76.7333333	86.3	0.04689	3.5983007	4.04691594	0.448615	
28	2052	0	76.73	86.3		76.7333333	86.3	0.04187	3.2127685	3.613317804	0.400549	
29	2053	0	76.73	86.3		76.7333333	86.3	0.03738	2.8685433	3.226176611	0.357633	
30	2054	0	76.73	86.3		76.7333333	86.3	0.03338	2.5611994	2.880514831	0.319315	
	Total:								6098.3547	581.0862916	-5529.47	
			NPV at 12% Discount=			-5557.33						
			BCR at 12% Discount rate=			0.10						

Result:

NPV at 12% discount = -5557.33 Lakh Taka

BCR at 12% discount rate = 0.1

Here IRR value is irrelevant, cause the initial cost is quite higher than the benefit later.

Though the project is not financially feasible, it is economically feasible. Thus calculating IRR gives and math error.

6.3 Economic Analysis

6.3.1 Economic Analysis Cost Analysis:

Construction and maintenance cost:

➢ We used shadow prices to obtain construction and maintenance costs for economic analysis. We

used a conversion factor of 0.8

to covert the financial cost into economic cost of

construction. From financial analysis, construction

cost per year = 2876.5 lacs So, construction cost for

economic analysis

= 2876.5 * 0.8

= 2301.44 lacs per year

Similarly for maintenance cost of year 3,

= 862.95*.08

=690.36 lac

6.3.2 Economic Benefit Analysis

1. Increased Tax Revenue

As property values rise due to the school's redevelopment, local tax revenue also increases. This additional revenue can be allocated to fund essential public services, infrastructure projects, and community development initiatives. These investments bolster the local economy and improve residents' overall quality of life.

- Increased Property Value: As the school project enhances the neighborhood's appeal, property values surge, further boosting property tax revenue. The attractiveness of the area due to improved educational facilities can attract new residents and investors, driving economic growth.
- Economic Growth: The injection of funds into local public services and infrastructure through increased tax revenue can stimulate economic growth. It creates a conducive environment for businesses to thrive, potentially leading to new business ventures and job opportunities within the community.

- Utility and Service Fees: With increased economic activity in the area, utility and service fees, such as water and sewage charges, can also experience growth. These fees contribute to the municipality's revenue stream, which can be reinvested in improving services and facilities for the community

2. Job Opportunities:

The project generates a range of employment opportunities, from construction workers and educators to administrative staff, support personnel, and maintenance workers. These jobs inject money directly into the local job market. The salaries earned by these employees are spent within the community, stimulating local businesses and services. This increased economic activity strengthens the economic backbone of the region.

3. Enhanced Academic Quality:

Investing in top-notch educational facilities directly impacts academic quality. A well-equipped learning environment attracts more students, which can result in higher tuition revenue for the school. Beyond the school itself, a better-educated population contributes to the economy by fostering innovation, productivity, and competitiveness in the workforce. This, in turn, can drive economic growth and prosperity.

4. Long-Term Savings:

The incorporation of energy-efficient technologies and sustainable practices in the project leads to significant long-term savings. Reduced energy consumption results in lower utility bills for the school, allowing it to allocate resources to other critical educational initiatives. Furthermore, these energy-efficient practices contribute to overall energy conservation, potentially stabilizing energy prices for the community. These savings contribute to a more sustainable local economy.

5. Community Development:

The school serves as a central community hub, hosting various events and activities that foster community engagement. Strengthened community bonds can lead to local economic development initiatives, as residents who feel connected to their community are more likely to invest in local businesses and initiatives. This, in turn, supports economic growth and resilience.

6. Ecological Consideration:

Implementing ecological considerations, such as sustainable landscaping and ecosystem preservation, positions the project as environmentally responsible. Such practices may attract eco- conscious individuals and businesses, leading to increased local tourism and the growth of eco- friendly enterprises. This not only enriches the community but also contributes to economic diversification

7. Geohazard Risk Elimination:

Eliminating geohazard risks enhances overall safety within the community. Reduced risks of property damage and displacement can make the area more attractive to residents and businesses alike. This can lead to increased property values, business investment, and local economic activity.

8. Fire Safety Enhancement:

Improved fire safety measures reduce the risk of costly fire incidents. Preventing property damage and potential economic losses for both the school and the community ensures that resources remain available for other economic activities and development initiatives

Economic Analysis

Year	Construction Cost (lacs)	Maintenance Cost (lacs)	Ecological Consideration 5% of Total Cost (lacs)	Geohazard Risk Elimination 10% of Total Cost (lacs)	Fire Safety Enhancement (Per Building) 10% of construction Cost (lacs)	Enhanced Academic Quality 10% (lacs)	Job Opportunities(lacs)	Long-Term Savings: .35 Kwh/sqft(lacs)	Increased Tax Revenue (lacs)	Improved waste managemnet(lacs)	Community Development (lacs)	Total Benefit (lacs)	Net Cash Flow (Undiscounted) (lacs)	NPV (At 13% Discount Rate) (lacs)	IRR
2024	2301.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2301.44		
2025	2301.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2301.44		
2026	0.00	690.36	287.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-690.36		
2027	0.00	690.36	287.62	575.24	71.91	575.24	24.46	73.71	5.00	1.60	1.55	1656.33	925.97		
2028	0.00	690.36	287.62	575.24	71.91	575.24	24.46	73.71	5.00	1.60	1.55	1656.33	925.97		
2029	0.00	920.48	287.62	575.24	71.91	575.24	24.46	73.71	5.00	1.60	1.55	1656.33	695.85		
2030	0.00	920.48	287.62	575.24	71.91	575.24	24.46	73.71	5.00	1.60	1.55	1656.33	695.85		
2031	0.00	920.48	310.63	575.24	71.91	575.24	24.46	73.71	5.00	1.60	1.55	1639.34	718.86		
2032	0.00	920.48	310.63	621.26	77.66	621.26	26.41	79.61	5.40	1.73	1.67	1745.63	825.15		
2033	0.00	920.48	310.63	621.26	77.66	621.26	26.41	79.61	5.40	1.73	1.67	1745.63	825.15		
2034	0.00	920.48	310.63	621.26	77.66	621.26	26.41	79.61	5.40	1.73	1.67	1745.63	825.15		
2035	0.00	920.48	310.63	621.26	77.66	621.26	26.41	79.61	5.40	1.73	1.67	1745.63	825.15		
2036	0.00	920.48	335.48	621.26	77.66	621.26	26.41	79.61	5.40	1.73	1.67	1770.48	850.00		
2037	0.00	920.48	335.48	670.96	83.87	670.96	28.52	85.98	5.83	1.87	1.81	1885.28	964.80		
2038	0.00	920.48	335.48	670.96	83.87	670.96	28.52	85.98	5.83	1.87	1.81	1885.28	964.80		
2039	0.00	920.48	335.48	670.96	83.87	670.96	28.52	85.98	5.83	1.87	1.81	1885.28	964.80	268.21	13.69%
2040	0.00	920.48	335.48	670.96	83.87	670.96	28.52	85.98	5.83	1.87	1.81	1885.28	964.80		
2041	0.00	920.48	362.32	670.96	83.87	670.96	28.52	85.98	5.83	1.87	1.81	1912.12	991.64		
2042	0.00	920.48	362.32	724.64	90.58	724.64	30.81	92.85	6.30	2.02	1.95	2036.11	1115.63		
2043	0.00	920.48	362.32	724.64	90.58	724.64	30.81	92.85	6.30	2.02	1.95	2036.11	1115.63		
2044	0.00	920.48	362.32	724.64	90.58	724.64	30.81	92.85	6.30	2.02	1.95	2036.11	1115.63		
2045	0.00	920.48	362.32	724.64	90.58	724.64	30.81	92.85	6.30	2.02	1.95	2036.11	1115.63		
2046	0.00	920.48	391.31	724.64	90.58	724.64	30.81	92.85	6.30	2.02	1.95	2065.09	1144.61		
2047	0.00	920.48	391.31	782.61	97.83	782.61	33.27	100.28	6.80	2.18	2.11	2199.00	1278.52		
2048	0.00	920.48	391.31	782.61	97.83	782.61	35.93	100.28	6.80	2.18	2.11	2201.66	1281.18		
2049	0.00	920.48	391.31	782.61	97.83	782.61	38.81	100.28	6.80	2.18	2.11	2204.53	1284.05		
2050	0.00	920.48	391.31	782.61	97.83	782.61	41.91	100.28	6.80	2.18	2.11	2207.64	1287.16		
2051	0.00	920.48	422.61	782.61	97.83	782.61	45.26	100.28	6.80	2.18	2.11	2242.29	1321.81		
2052	0.00	920.48	422.61	845.22	105.65	845.22	48.89	108.30	7.35	2.35	2.28	2387.87	1467.39		
2053	0.00	920.48	422.61	845.22	105.65	845.22	48.89	108.30	7.35	2.54	2.28	2388.06	1467.58		
2054	0.00	920.48	422.61	845.22	105.65	845.22	48.89	108.30	7.35	2.74	2.28	2388.26	1467.78		

Net cash flow out	30606.4	Net cash flow in	54739.7
	Benefit-Cost ratio		1.79
		IRR	14%

Section 7: Human Resources and Administrative Support Analysis

7.1 Manpower Requirement During Project Timeline:

Building a high school project in Mohammadpur under the funding of the Government of Bangladesh (Ministry of Education) requires a comprehensive approach involving various human resources and administrative support. The implementation time for the project is around two years. So, it will engage a number of people at different stages with the necessary skills. Here are some key roles and support functions needed for the successful execution of this project:

Project Manager:

Responsible for overseeing the entire project, including planning, execution, budget management, resource allocation, and reporting to the government authorities.

Architects and Engineers:

Needed to design and plan the school's infrastructure, including buildings, classrooms, laboratories, libraries, and other necessary facilities.

Construction Workers and Contractors:

Skilled labour and construction firms to carry out the physical construction of the school according to the approved plans and specifications.

Administrative Staff:

Administrative personnel to handle paperwork, documentation, and compliance with government regulations. This includes office managers, clerks, and administrative assistants.

Educational Consultants:

Education specialists or consultants to provide guidance on educational requirements, curriculum development, and school administration.

Finance and Budgeting Personnel:

Accountants and financial experts to manage the project's finances, track expenditures, and ensure proper utilization of funds allocated by the government.

Procurement and Supply Chain Management:

Professionals responsible for sourcing materials, equipment, and supplies required for construction and ongoing operations of the school.

Legal and Regulatory Compliance Officers:

Legal advisors and compliance officers to ensure that the project adheres to local laws, regulations, and government policies.

Community Engagement and Public Relations:

Personnel to engage with the local community, manage public relations, and foster positive relationships with stakeholders, including residents, parents, and local authorities.

Health and Safety Experts:

Professionals focused on implementing health and safety measures at the construction site and ensuring compliance with safety standards.

IT Support and Infrastructure:

IT specialists to set up necessary technological infrastructure, including internet connectivity, computers, and other educational tools.

Maintenance and Facility Management:

Staff to oversee ongoing maintenance and facility management after the construction phase, ensuring the school operates smoothly.

These roles and support functions constitute a diverse team necessary for the successful planning, construction, and operation of our project. Collaboration among these professionals is crucial for achieving the project goals within budget and on schedule.

7.2 Feasibility of Providing of Managerial and Skilled Workforce:

Most of the stuffs mentioned earlier will be outsourced for the project during the operation period. As School Management Committee (SMC), Board of education don't have enough manpower, construction work will be handed over to a construction company through a procurement process. Procurement process will be based on merit and price.

7.3. Institutional Management:

1. For supervision of the project implementation, there will be a Project Steering Committee (PSC) for overall guidance and a Project Implementation Unit (PIU) for overall supervision. The PSC may be chaired by the Chief Engineer and the Project Director (PD) may be the member secretary.

2. During the operation phase, the necessary manpower for the maintenance services may be outsourced. The financial package of the technical unit and the outsourced staffs will be as per government scale and public procurement rules, respectively.

The timing of this project is consistent with organizational capacity.

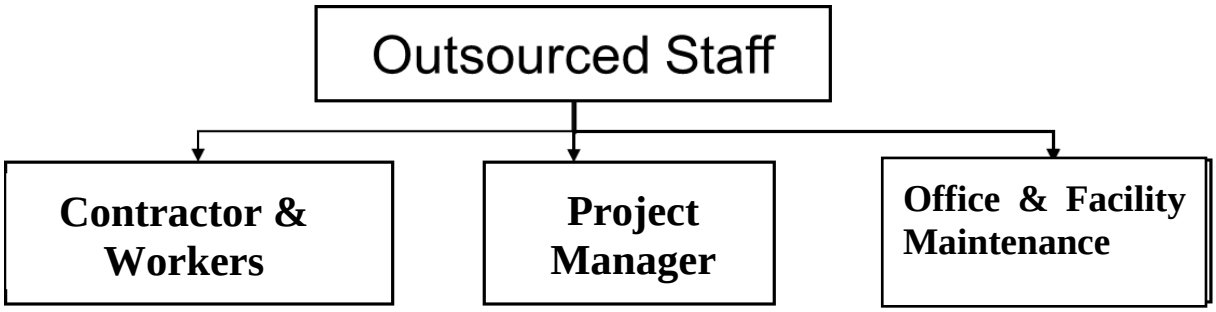


Figure Error! No text of specified style in document.**-1: Required manpower to be outsourced for the project during operation**

7.4. Funding Management and Project Outputs:

The project will be funded by GOB (Government of Bangladesh), under the authorization of Ministry of Infrastructure Development and Ministry of Education. There will also be small

number of contributions from local figures, NGOs and school committee. This project is intended to improve the overall scenario and quality of education in Mohammadpur. Two thousand students will be able to attend classes in a day. A sound infrastructure and learning environment will be ensured.

7.5. Eligibility for Getting Compensation/ Assistance:

The project has been proved economically feasible in feasibility study. Thus, it is eligible for getting compensation/ fund from education and infrastructure sector.

Section 8: Institutional and Legal Analysis

The Comprehensive Redevelopment Project for Mohammadpur Government High School aims to transform academic infrastructure, promoting sustainability and inclusivity. Aligned with social welfare objectives, it prioritizes creating an inclusive learning environment, complying with Bangladesh's legal landscape, including disability rights, building codes, and labor laws. Collaborating with key institutions, the project emphasizes regular legal consultations and stakeholder engagement to ensure sustained compliance and success in line with established legal frameworks.

- The Comprehensive Redevelopment Project for Mohammadpur Government High School aligns with the mandates of the Ministry of Social Welfare, which oversees social welfare initiatives. The project's focus on enhancing academic infrastructure and sustainability is well within the social welfare framework.
- The Public Works Department, responsible for overseeing construction and infrastructure projects, should ensure that its capabilities and facilities are efficiently utilized during the implementation of the redevelopment project. Proper coordination between the project entity and the Public Works Department is crucial.
- Regular review and adaptation to legal and institutional changes are recommended to maintain ongoing compliance. However, specific adjustments would depend on any changes in disability rights laws, building codes, or other relevant regulations.
- Before implementation, it is essential to ensure that the project complies with the Rights and Protection of Persons with Disabilities Act of Bangladesh, the National Building Code of Bangladesh, and the Bangladesh Labor Act. Any necessary adjustments should be made to align with these legal requirements.

- Capacity building measures, as recommended in the Institutional Framework, should be implemented to ensure that the institutions involved have the necessary skills and capacity to meet the project requirements. This includes training for staff on disability rights and inclusivity.
- It is important to establish clear incentives for timely and within-budget project delivery. Regular monitoring and evaluation mechanisms should be in place, and adherence to these criteria should be linked to project outcomes and potential future funding.
- The coordination and collaboration between the Ministry of Social Welfare, the National Disabled Development Foundation, and the Public Works Department are critical governance issues that may impact implementation. Ensuring effective communication and cooperation among these entities is essential.
- Cross-cutting issues such as accessibility and inclusivity require a proactive approach. Incorporating universal design principles and equal opportunity employment policies, as recommended in the Institutional Framework, can serve as mitigation strategies for addressing these challenges.
- Regular legal consultations, stakeholder engagement with disability rights organizations, and exploration of grants from international organizations or donors, as suggested in the Institutional Framework, should be ongoing activities to address any emerging legal or institutional issues and to ensure sustained project compliance and success.

Section 9: Risk and Sensitivity Analysis

9.1 Risk Management at Construction Project:

Risk management is a critical aspect of any large-scale development project, and the Comprehensive Redevelopment Project for Mohammadpur Government High School, with a focus on enhancing academic infrastructure and sustainability, is no exception. Drawing insights from risk management principles applied in road projects, we can formulate a robust strategy tailored to the specific needs and challenges of the school redevelopment endeavor.

Infrastructure projects, as a rule, are linked to various hazards. Risk arises from an unpredictable circumstance that is exceedingly difficult to anticipate with a high level of precision. Effective risk management is essential from the outset of the construction project in order to mitigate the potential impact of risks. The fifth edition of the PMBOK Guide (2013) covers the stages of risk management, which include risk identification, analysis, reaction, monitoring, and control. Construction projects require multiple parties who assume the risk. Nevertheless, there are more stakeholders participating in the project. Usually, risks are assessed solely from the viewpoints of the owner and contractors.

9.1.1 Major Risks During Construction of School Building:

Budget Overruns: The unanticipated increase in costs associated with building materials, manpower, or other expenditures related to construction.

Schedule Delays: Construction delays that were not anticipated due to adverse weather conditions, difficulties in obtaining permits, or unanticipated difficulties on the site.

Quality Control Issues: Construction quality that has been compromised, which may result in safety problems or the requirement of expensive rework.

Supply Chain Disruptions: There have been delays or limitations in the supply of materials meant for construction.

Community and Stakeholder Relations: Opposition or discontentment from the inhabitants of the local community or the stakeholders.

9.1.2 Minor Risks During Construction of School Building:

Weather Conditions: The building activities that take place outside are experiencing brief delays due to minor weather fluctuations.

Minor Design Changes: Small modifications to the design that might be necessary during the building phase of the project.

Security Concerns: Concerns regarding the building site's security, such as unauthorized access, are rather minor.

The Comprehensive Redevelopment Project for Mohammadpur Government High School faces significant challenges, particularly concerning implementation delays, academic infrastructure interruptions, educational impact, and sustainability goal setbacks. The risk of implementation delays poses a serious threat, potentially hindering the timely realization of academic enhancements and sustainability initiatives. Concurrently, unforeseen technical challenges leading to interruptions in academic infrastructure projects may impede the school's ability to provide an optimal learning environment for students. This, in turn, has a direct educational impact, potentially disrupting the planned trajectory of student learning and development. Furthermore, setbacks in achieving sustainability goals may not only compromise the project's environmental and energy efficiency objectives but also risk reputational damage. Navigating these challenges requires a meticulous risk management approach, emphasizing proactive measures to mitigate delays, address technical hurdles, safeguard educational objectives, and ensure the successful realization of sustainability goals.

9.2 Risk Identification:

The identification of risks is an essential part of risk management. The identification and documentation of all potential dangers is a key step in the process of analyzing and determining the best response. In the process of making decisions, the identification of risks is given higher priority than the study of such risks. The procedures involved in the identification process include document inspection, information gathering, checklist analysis, assumption investigation, and diagram engineering.

Modernizing academic infrastructure: The Comprehensive Redevelopment Project for Mohammadpur Government High School would establish a five-story school with modern labs and classrooms.

Strategic location: The school is strategically located in Mohammadpur near the Geneva Camp to provide the best environment for kids, teachers, and parents.

Traffic management integration: The project uses effective traffic management measures, such as a well-designed route for easy entry and exit, to reduce school congestion and ensure smooth flow.

Finding the different types of risk for the Comprehensive Redevelopment Project for Mohammadpur Government High School needs a complex method that takes into account the different points of view of those working in the project. As contractors focus on the building process, they stress the risks that come from the site's conditions and the supply of resources. Financial risks, like not knowing if the project will get funded or if it will be delayed, are the ones that owners worry about the most. The people in the area are worried about more than just the building site. They are worried about social and environmental risks like noise, traffic jams, and damage to the environment. Design consultants focus on the risks that come with complex engineering and project design, while supervisory consultants look at the risks that come with overseeing building and making sure that contractors do their best work and follow all safety rules. Including these different points of view improves the process of finding risks, making the project more resilient and allowing for a more thorough risk management plan that is specifically designed for improving and sustaining academic infrastructure.

9.3 Risk Analysis:

After identifying potential risks, a thorough analysis is essential to understand their potential impact and likelihood of occurrence. In the context of school redevelopment, this might involve assessing the sensitivity of academic schedules to construction delays, budgetary implications of design changes, and environmental factors affecting the sustainability goals.

Analysing risks often involves assessing how likely they are to happen and what impact they could have. To do this, we estimate the chance of a risk occurring and understand how it might affect project goals like time, quality, cost, and scope, considering both positive and negative outcomes. Combining these aspects helps determine the risk level, calculated by multiplying the probability and impact. This risk level is crucial for project managers and stakeholders to prioritize and deal with risks effectively, enabling informed decision-making and the implementation of mitigation strategies throughout the project.

9.4 Risk Mitigation:

Mitigation measures may encompass the implementation of robust risk management strategies tailored to academic development, establishing contingency plans for potential budget and schedule overruns, conducting regular risk assessments during the project lifecycle, and fostering open communication channels among stakeholders to promptly address emerging challenges in the context of academic infrastructure enhancement and sustainability.

Planning how to deal with risks is a crucial part of managing uncertainties in a project or organization. During this phase, teams make plans to either (1) avoid, (2) reduce the impact of, (3) transfer, or (4) accept identified risks. This helps organizations handle uncertainties better and protect their project goals. The aim is to make the most of opportunities, decrease threats, and make the project more resilient overall. However, in government projects, transferring risks is limited by legal and budget constraints. So, for this project, risks will be dealt with by accepting low risks, reducing moderate risks, and avoiding high risks.

9.5 Sensitivity Analysis:

In conducting sensitivity analysis for economic projections, the assumption of a constant 30-year project lifespan forms the basis of the evaluation, providing a standardized timeframe for cost-benefit assessments. The analysis depends on the assumption of a stable technical environment, allowing for adaptability to unforeseen technological changes and innovations. Additionally, it presupposes limited unexpected objections, foreseeing effective mitigation strategies to navigate potential disruptions, alongside the incorporation of predictable construction material costs into the assessment. This ensures the project's economic viability in the face of fluctuating market conditions. Ultimately, the assumption of a resilient economic return, with an Economic Internal Rate of Return (EIRR) nearing or around 15%, serves as a foundational element, affirming the project's ability to weather uncertainties and deliver sustained financial benefits.

Table 9-1: Sensitivity of Economic Analysis (EIRR)

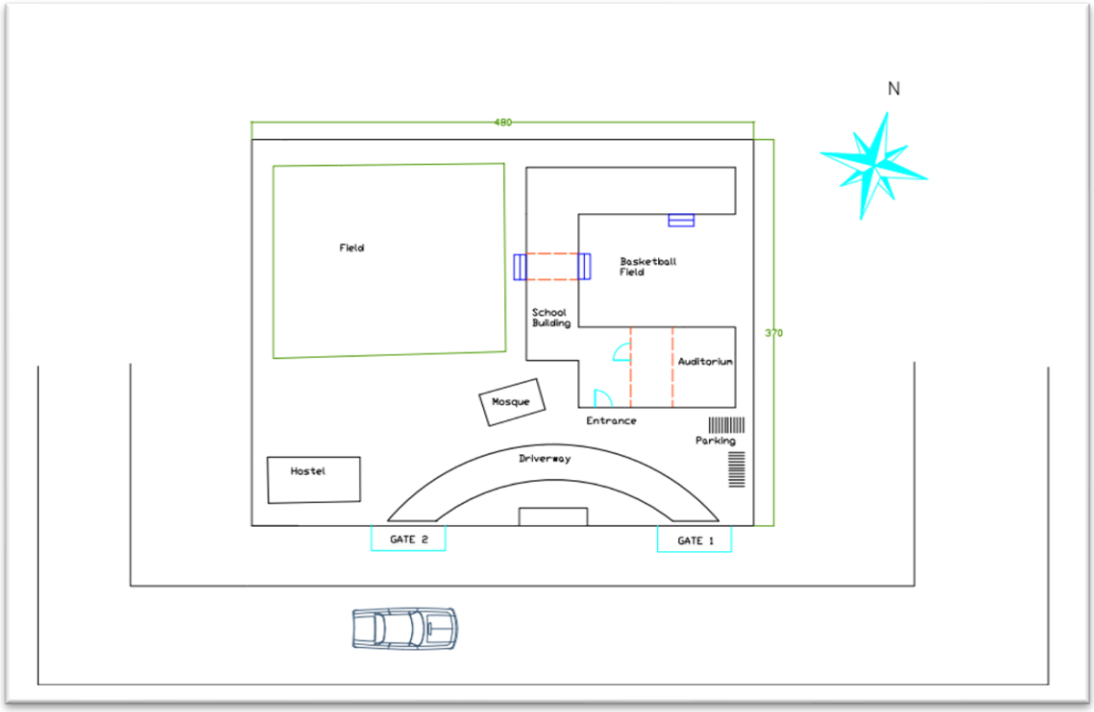
		Project Cost				
		20% Decrease	*10% Decrease*	*Base Case*	*10% Increase*	*20% Increase*
Project Benefit	*20% Increase*	13.44%	15.12%	16.80%	18.48%	20.16%
	10% Increase	12.32%	13.86%	15.40%	16.94%	18.48%
	Base Case	11.20%	12.60%	14.00%	15.40%	16.80%
	10% Decrease	10.08%	11.34%	12.60%	13.86%	15.12%
	20% Decrease	8.96%	10.08%	11.2%	12.32%	13.44%

Table 9-2: Sensitivity of Economic Analysis (EBCR)

		Project Cost				
		20% Decrease	*10% Decrease*	*Base Case*	*10% Increase*	*20% Increase*
Project Benefit	20% Increase	1.718	1.933	2.148	2.363	2.578
	10% Increase	1.575	1.772	1.969	2.166	2.363
	Base Case	1.432	1.611	1.79	1.969	2.148
	10% Decrease	1.289	1.449	1.611	1.772	1.933
	20% Decrease	1.146	1.289	1.432	1.575	1.718

Section 10: Alternative/Options Analysis

10.1 Why Not Choose Plan-1?



1. Position of Field:

Aesthetic Appeal: The location of the field can contribute to the overall aesthetic appeal of the school campus. A well-designed field can enhance the visual appeal of the school and create an inviting environment for students and visitors. As the building is backward to the field it is very

Recreation and Physical Education: School fields are essential for physical education classes, sports, and recreational activities. Placing the field in a central location can make it more convenient for scheduled physical education classes and extracurricular sports programs.

Accessibility: The field should be easily accessible to students, staff, and visitors. It should be integrated into the school's layout to allow convenient access to classrooms and other facilities. This accessibility encourages physical activity and outdoor learning opportunities.

Community Use: School fields are often used by the community for recreational purposes outside of school hours. The location should be accessible to the public while still ensuring security and supervision. This promotes community engagement and enhances the school's role as a community asset.

Noise and Disturbance: Consideration should be given to potential noise and disturbance issues. Placing the field away from classrooms or areas where quiet study is required can help minimize disruptions to the learning environment.

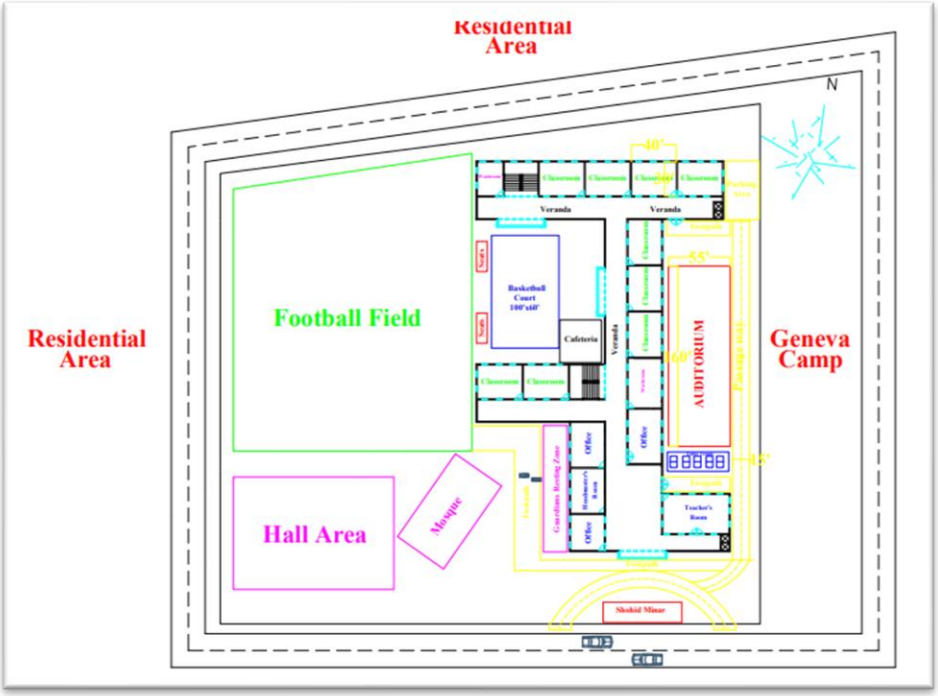
2. Natural Light and Ventilation: The shape of the building can impact the distribution of natural light and ventilation. Properly designed building shapes with strategically placed windows and openings can reduce the need for artificial lighting and mechanical ventilation, creating a more sustainable and comfortable environment. Due to the C shape the building faces towards the Ganeva camp bazar. Which is very much unattractive for school buildings. And it is the resistance to natural light.

3. Traffic Flow: The layout and shape of the building can impact the flow of pedestrian and vehicular traffic on the school campus. Properly designed entrances and pathways can improve safety and efficiency. Here in the plan-1 traffic flow, there is no smooth traffic flow which can create problems with school and student continuity.

4. Community Integration: The shape and design of a school building can also impact its integration into the surrounding community. A school building that complements the neighborhood can foster a sense of community pride and involvement. In the surroundings of the school, there are residential areas and the C-shaped school is facing too words Ganeva camp which is problematic for community integration.

5. Efficient Use of Space: The shape of the building can affect the efficient use of space within the school. A well-planned layout can maximize the use of available land, providing adequate space for classrooms, common areas, administrative offices, and recreational areas. Here for C C-shaped buildings the available space is decreasing relatively as most of the area wastes in an unplanned garden system.

10.2 Why Not Choose Plan 2?



1. Parking position and Facility:

Traffic Flow: Well-planned parking areas help control the flow of traffic on the school campus. Marked lanes, designated drop-off zones, and organized parking spaces can prevent congestion and chaos during peak arrival and dismissal times. In the plan-2 traffic lane and parking space are beside the classroom. As the lanes are too long it takes too many times for traffic flow.

Efficiency: Efficiently designed parking areas optimize the use of available space, reducing the need for excessive land use and minimizing construction costs. This can also result in shorter wait times and less idling, contributing to environmental sustainability.

Parent and Guest Experience: A well-organized parking area provides a positive experience for parents and visitors. They should be able to easily find parking spots, drop off their children, and access the school without undue inconvenience. As the parking area is behind the auditorium it is difficult to find parking space for the Guests.

Parking spacing: In plan 2 it reduces the available parking space. And in the plan parking spacing is not visible.

Accessibility: Adequate parking should be accessible to all, including students, staff, parents, and visitors with disabilities. Designated accessible parking spaces and accessible pathways to the school entrance are essential to comply with accessibility regulations.

2. Position of Teachers Room:

Space Constraints: If the teachers' room is located in a strategic part of the existing school building, it can limit available space for expansion. Extending the building in that direction may require relocating or significantly downsizing the teachers' room. In plan-2 the school building is extended only due to the teacher's room. Which creates a problematic situation for the redevelopment project.

Cost Considerations: Due to the extension in the building it increases the cost of the project.

Parking Facilities: For the extended portion it creates problems in parking facilities. And traffic lanes become congested due to the extended portion.

Architectural Integration: The design of the expansion must integrate seamlessly with the existing building, including the relocated or modified teachers' room. Ensuring architectural consistency can be more complex when the plan needs to be adapted.

3. Stair's Position:

Locating stairs near the entrance of a school building is important for several reasons, primarily related to safety, accessibility, and efficient traffic flow. In plan-2 the stair is not near to the entrance. Which will cause several problems for Students and Teachers. locating stairs beside the entrance in a school building is a strategic and practical decision that enhances safety, accessibility, traffic flow, and the overall functionality of the facility. It contributes to a positive and efficient school environment while also ensuring compliance with safety and accessibility standards.

4. Auditorium Orientation:

The orientation of an auditorium can significantly impact its seating capacity. Orientation changes increase the number of available seats. In this auditorium, as the available sites are low it needs to increase. By changing in auditorium orientation and size we ensure more capacity. The existing architectural design and structural constraints of the auditorium can limit the feasibility of changing its orientation. Structural modifications or significant alterations may be needed to accommodate changes, potentially impacting seating capacity based on available space and budget constraints. Auditorium orientation plays a crucial role in determining seating capacity. Any modifications to orientation must consider factors like stage configuration, sightlines, accessibility, safety regulations, and the existing building design. These factors collectively influence the seating capacity of the auditorium, and changes should be carefully planned to align with the specific goals and needs of the space. That is why plan-2 auditorium needs modification.

5. Greenery:

The reduction of greenery on a school campus can have wide-ranging impacts on the environment, student well-being, and the overall educational experience. Schools should carefully consider the value of green spaces and seek to balance development needs with the preservation of greenery to create a healthy, vibrant, and sustainable learning environment**.** In plan 2 due to a passageway, it decreases available space as well as available green area. With some modification, we can create a green area for the welfare of the school environment.

6. Washroom Orientation:

The orientation and design of washrooms in a school are essential to ensure the well-being, safety, and convenience of students and staff. Properly oriented washrooms contribute to a positive and functional school environment, promoting inclusivity, hygiene, and compliance with regulations. Collaboration between architects, school administrators, and facilities management teams is key to achieving an optimal washroom design for a school. In plan 2 the washroom open space is too large. Which reduces the individual toilet number and creates a loss in area. So, adding more washrooms and reducing the open space can help to avoid such kinds of problems.

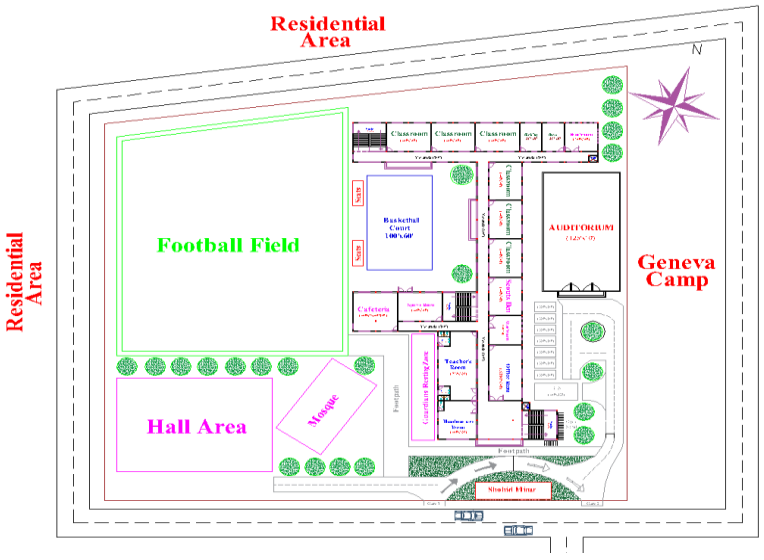
10.3 The Final Layout & Reasons Behind Choosing It:

1. Enhanced Student Capacity and Facilities:

The chosen school building plan was predicated on the imperative of accommodating a greater number of students while ensuring the provision of adequate facilities.

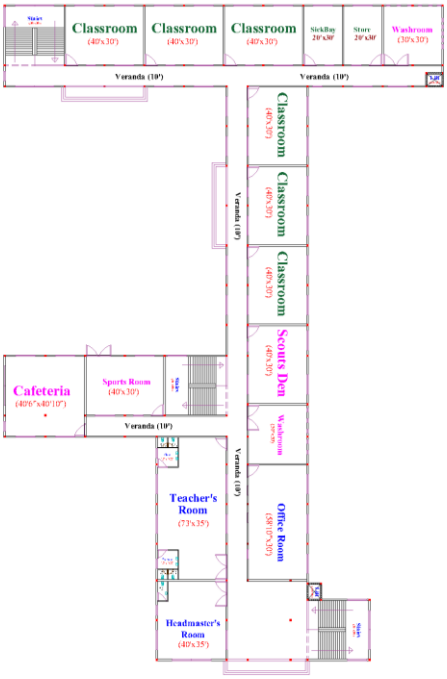
2. Aesthetic Considerations and View Optimization:

The architectural design prioritized aesthetic aspects by featuring a prominent front view of the basketball field and playground. Additionally, strategic placement of classrooms was undertaken to mitigate the visibility of the Geneva Camp Bazar. The rear elevation of the building was thoughtfully concealed by the inclusion of a garden area, which serves as a rejuvenating space for students.



3. Improved Utilization of Ground Floor:

The ground floor allocation was meticulously devised to encompass essential areas such as classrooms, a cafeteria, a Scouts den, a sports room, and an office space. This configuration addressed prior deficiencies by harmonizing these spaces in a synchronized manner.

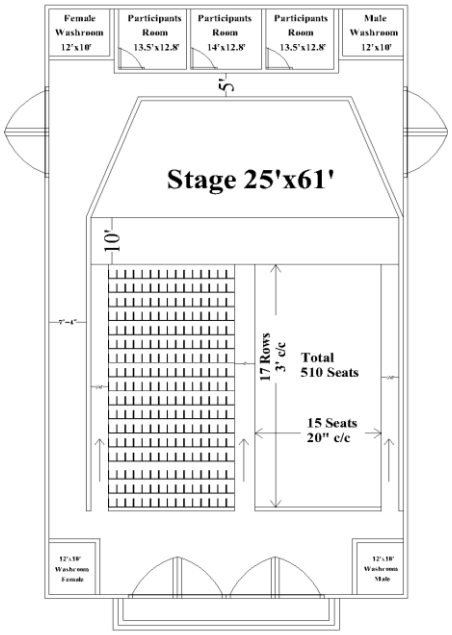


4. Enhanced Classroom and Laboratory Facilities:

On the upper floors, the primary focus was on the provisioning of well-designed classrooms and laboratories. This rectified the inadequacies present in the previous setup.

5. Amplified Auditorium Capacity:

The new plan incorporated a significantly enlarged auditorium, almost doubling its seating capacity compared to the existing one. This upgrade vastly improved the school's ability to host events and assemblies.

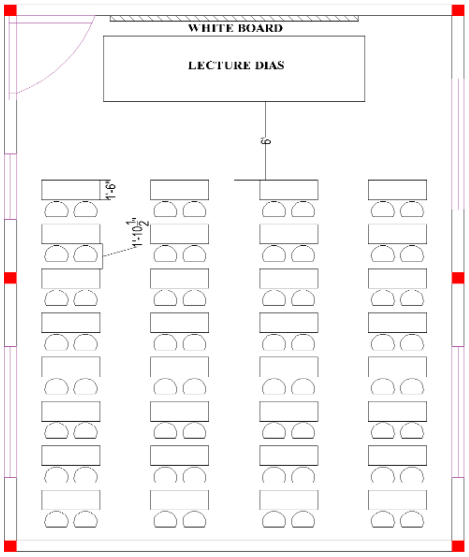


AUDITORIUM

(125'x70')

6. Upgraded Classroom Amenities:

Efforts were made to rectify the deficiencies in classroom facilities. Sound systems and fans were systematically installed in each classroom, transforming them into multimedia-equipped learning spaces.

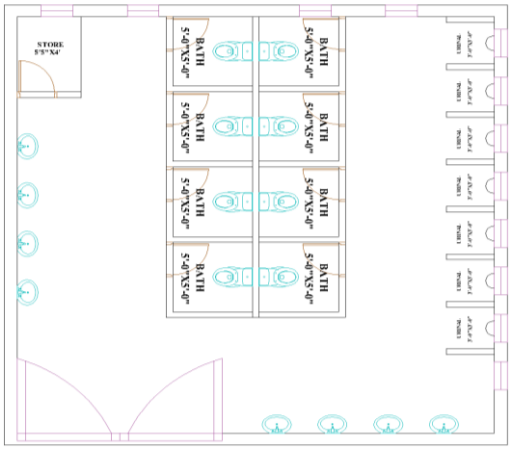


Classroom

(40'x30')

7. Hygienic and Ample Washroom Facilities:

The restroom facilities provided were characterized by their increased capacity and stringent hygiene standards. Essential amenities were installed to ensure the sanitary well-being of the students.



10.4 Foundation Selection Based on Site Conditions and Cost Efficiency:

We use a shallow foundation for our Building. Here we use square, rectangular, and combined footings. For the A1 and A8 columns we use rectangular footing because of load is not too high and its corner column. Again, in the B and C columns we use combined footings because the spacing between two columns is 10 ft. In A2,3,4,5, &6 we use square footing as there is a high load and that column is a middle column. We designed the foundation for the soil strata which are located 10 ft below ground level. We categorize the column by the force acting on the column. Here are some reasons why we use shallow footings:

Stable Soil Conditions: Shallow footings are ideal when the soil near the surface is stable and capable of supporting the load of the structure. In areas with competent and strong soils, deep foundations may not be necessary. In our location, the soil SPT value is too high which indicates the soil is steeper. Also, soil bearing capacity is too high.

Suitable Bearing Capacity: Shallow footings are appropriate when the bearing capacity of the soil near the surface is sufficient to support the applied loads. As it meets the structural requirements, shallow footings become a practical choice.

Consistent Soil Properties: When the soil properties remain relatively consistent at shallow depths, shallow footings can be used effectively. Deep foundations may not be necessary if there are no significant variations or problematic soil layers at deeper levels. In our case, the soil profile is constant as there is silty clay and clay particles in the obtained layer.

Low Settlement Tolerance: If the structure has a low tolerance for settlement, shallow footings are preferred. Shallow foundations distribute the load over a larger area, resulting in

minimal settlement compared to deep foundations, which can experience greater differential settlement. As our structure has low settlement tolerance we can use the shallow foundation.

Previous structure: Due to the previous structure the soil is too compacted. So, soil stability becomes very high. For that, we can use a shallow foundation.

Cost-Effective: Shallow foundations are generally more cost-effective than deep foundations. They require less excavation, fewer materials, and less labor, making them an economical choice for many building projects.

Construction Speed: Shallow footings can be constructed more quickly than deep foundations. This can lead to shorter construction schedules and reduced labor costs. As our project is a school project the building needs to build as early as possible.

10.5 Structural Material Choice for Multifaceted Advantages:

The selection of a Reinforced Concrete (RCC) structure over a steel structure was driven by a careful consideration of various factors. Steel structures are known for their higher costs, susceptibility to temperature fluctuations, limited fire resistance, potential material availability issues, reduced seismic resilience, and diminished sound insulation and vibration control capabilities. In contrast, RCC structures were chosen to address these shortcomings and offer a more balanced set of advantages, aligning with the school building's functional requirements and long-term sustainability goals.

These strategic decisions in the school building plan were made to enhance cost-effectiveness, structural stability, and the overall performance of the building while effectively mitigating the challenges associated with alternative construction approaches.

Section 11: Recommendation and Conclusion

In conclusion, the Comprehensive Renovation Project for Mohammadpur Government High School emerges as a pivotal initiative poised to transform the educational landscape. The project's multifaceted approach, informed by comprehensive surveys and alternative analyses, ensures alignment with the diverse needs of stakeholders. The chosen redevelopment option, emphasizing academic infrastructure enhancement and sustainability, reflects a judicious balance of modernization and safety, meeting green building principles and stringent seismic resilience standards.

Recommendations for successful project implementation include a continued emphasis on sustainable practices, periodic assessments of climate change impacts, and vigilant adherence

to safety protocols during construction. Integration of smart building technologies and digital learning infrastructure should be accompanied by ongoing training for educators and staff to maximize the benefits of these advancements.

The economic viability, as evidenced by a robust Economic Benefit-Cost Ratio and Economic Internal Rate of Return, underlines the financial prudence of the venture. However, ongoing financial monitoring and periodic reassessment of economic indicators are advised to ensure sustained fiscal health.

As the project progresses, regular communication with the school community, including teachers, guardians, and students, should be maintained to address any emerging concerns and foster a sense of ownership. Additionally, a transparent reporting mechanism for construction milestones and financial expenditures will contribute to accountability and stakeholder confidence.

In conclusion, the Comprehensive Renovation Project presents a transformative opportunity to create a secure, environmentally responsible, and technologically advanced educational infrastructure. The commitment to sustainability, safety, and stakeholder engagement positions this project as a model for future educational redevelopment endeavors. Through careful implementation of the recommendations outlined, the Mohammadpur Government High School is poised to emerge as a beacon of modern education, contributing to the academic and holistic development of future generations.

Annexes

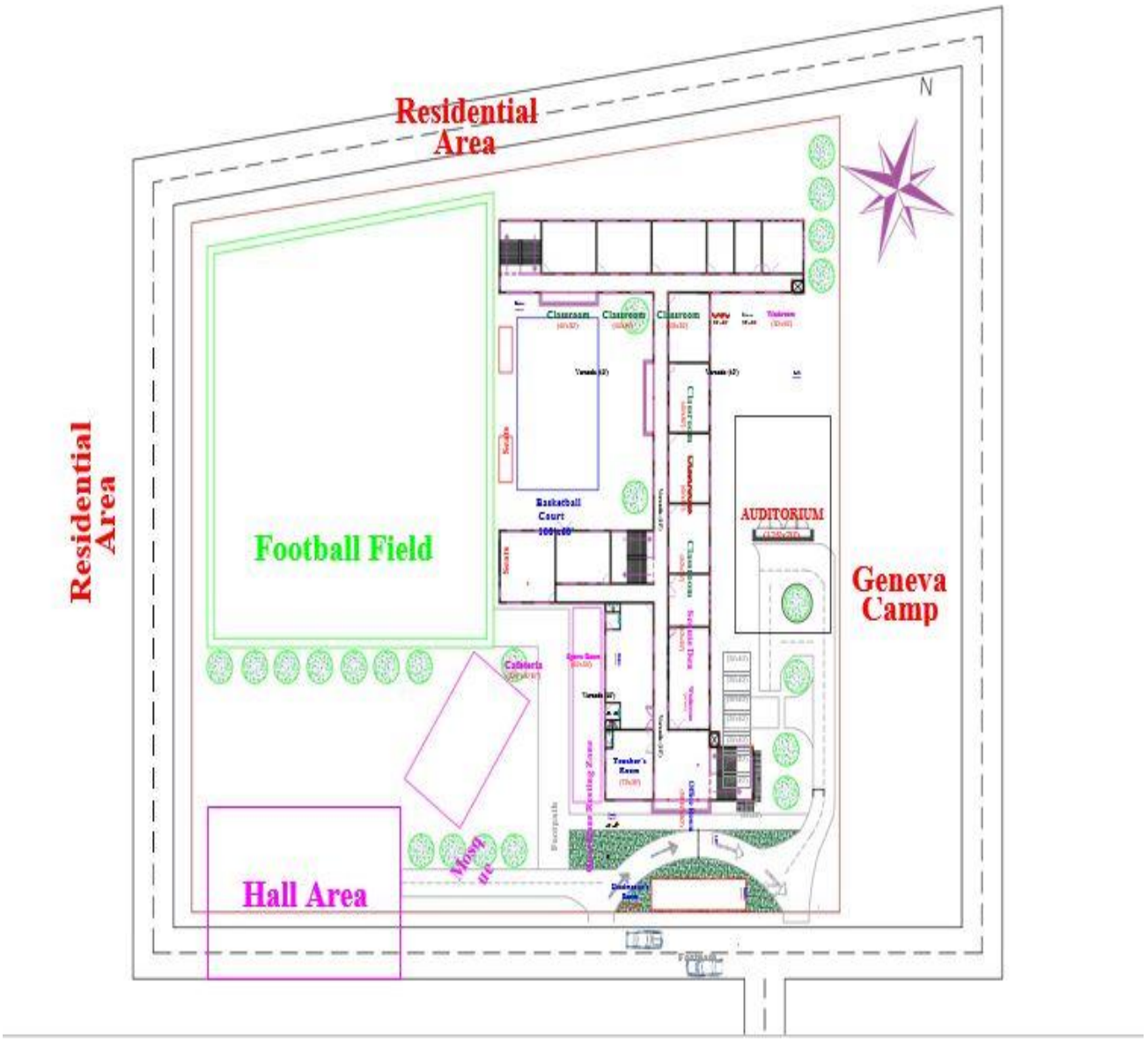


Figure: Layout of Plan Area

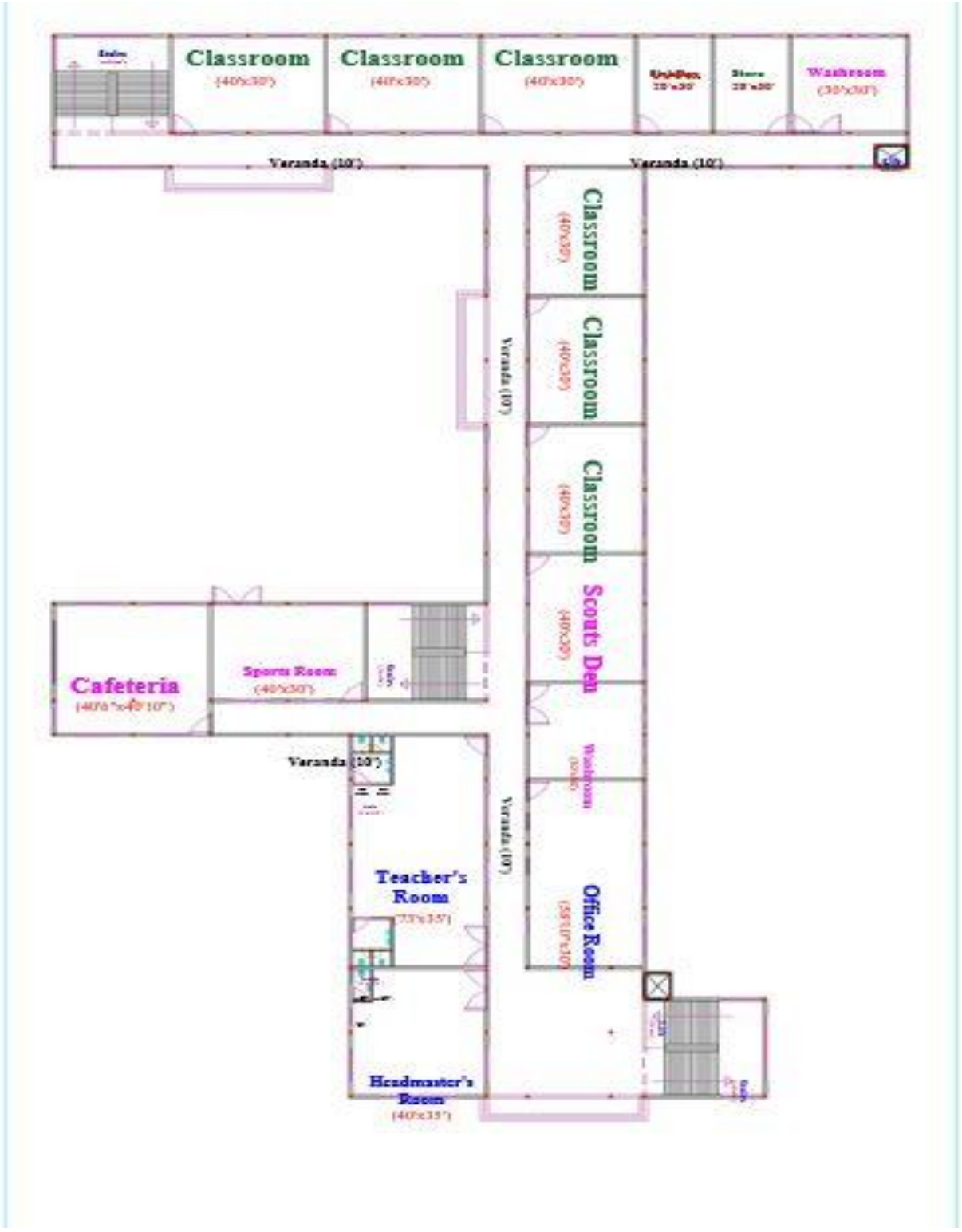


Figure: Ground Floor Plan

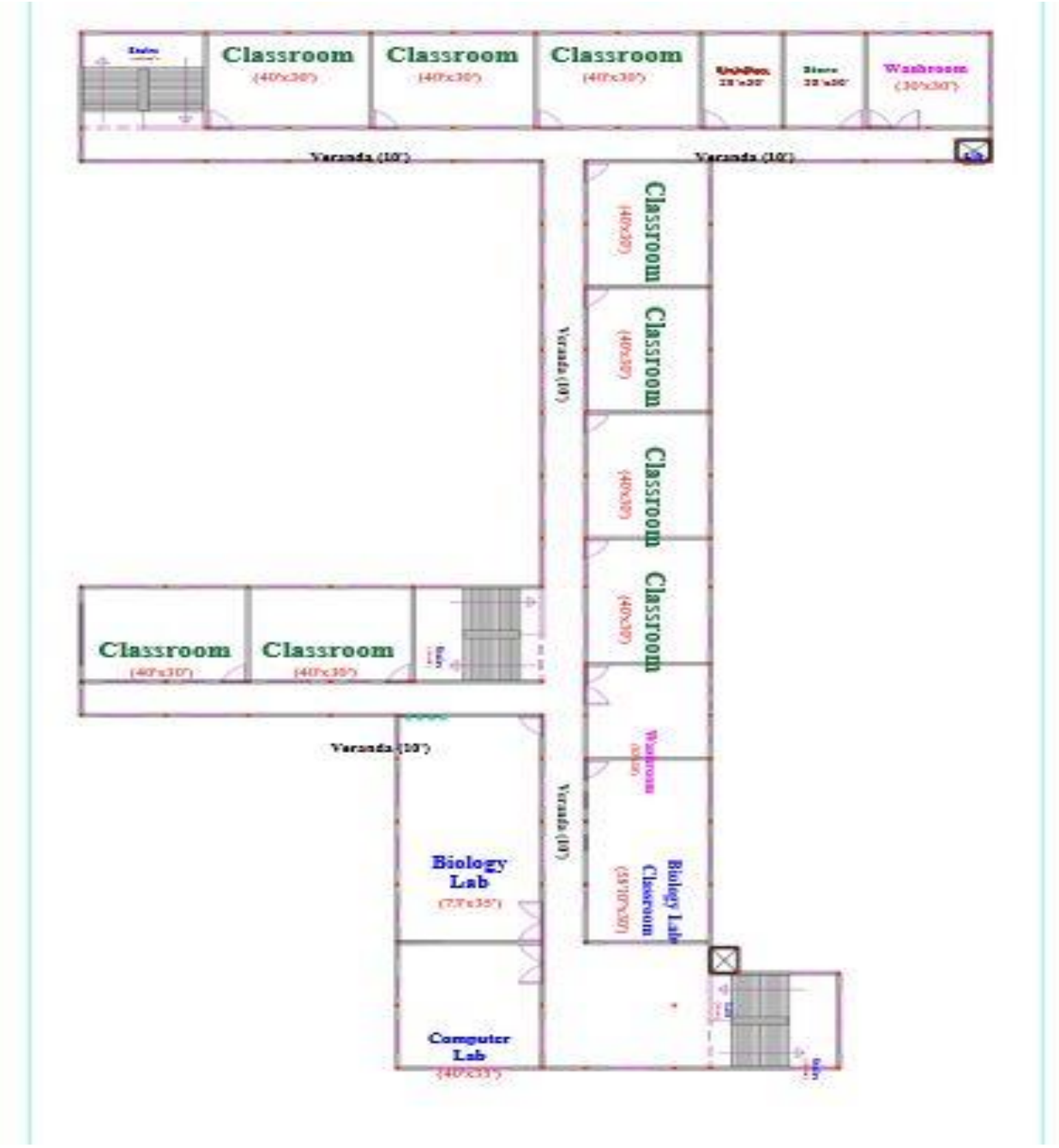


Figure: 1st Floor Plan

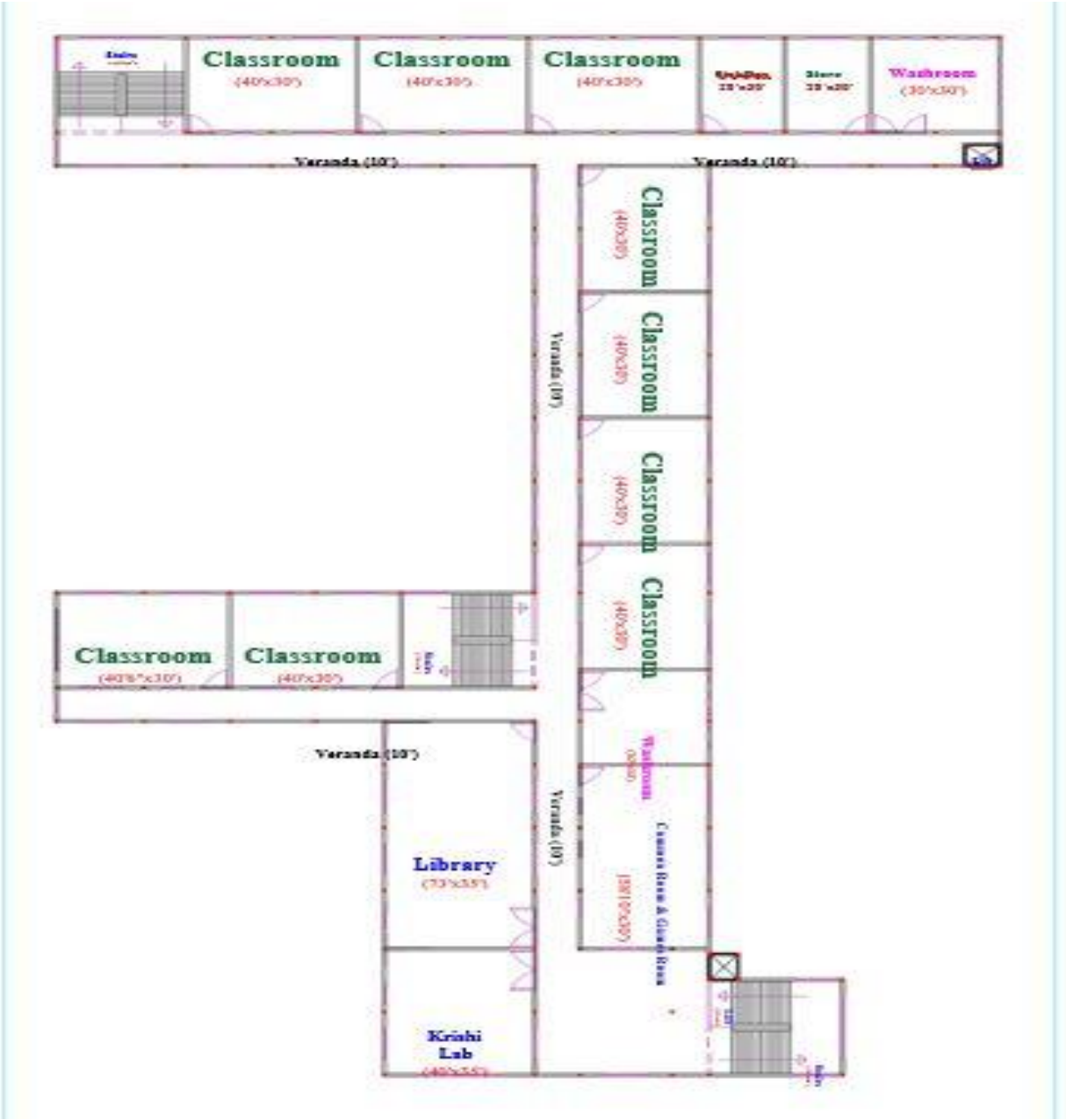


Figure: 2nd Floor Plan

Figure: 3rd Floor Plan

Figure: 4th Floor Plan

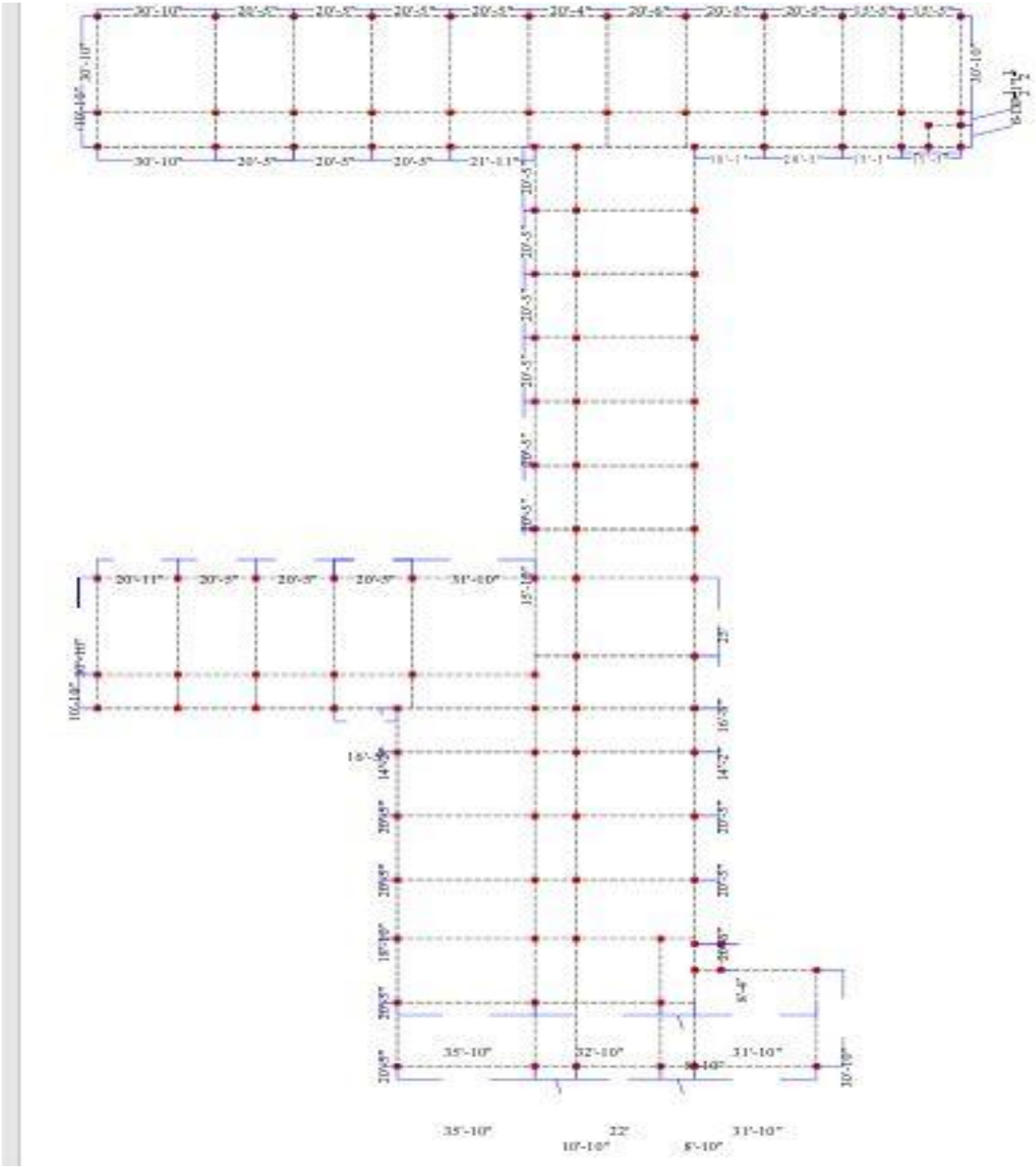


Figure: Column Layout Plan

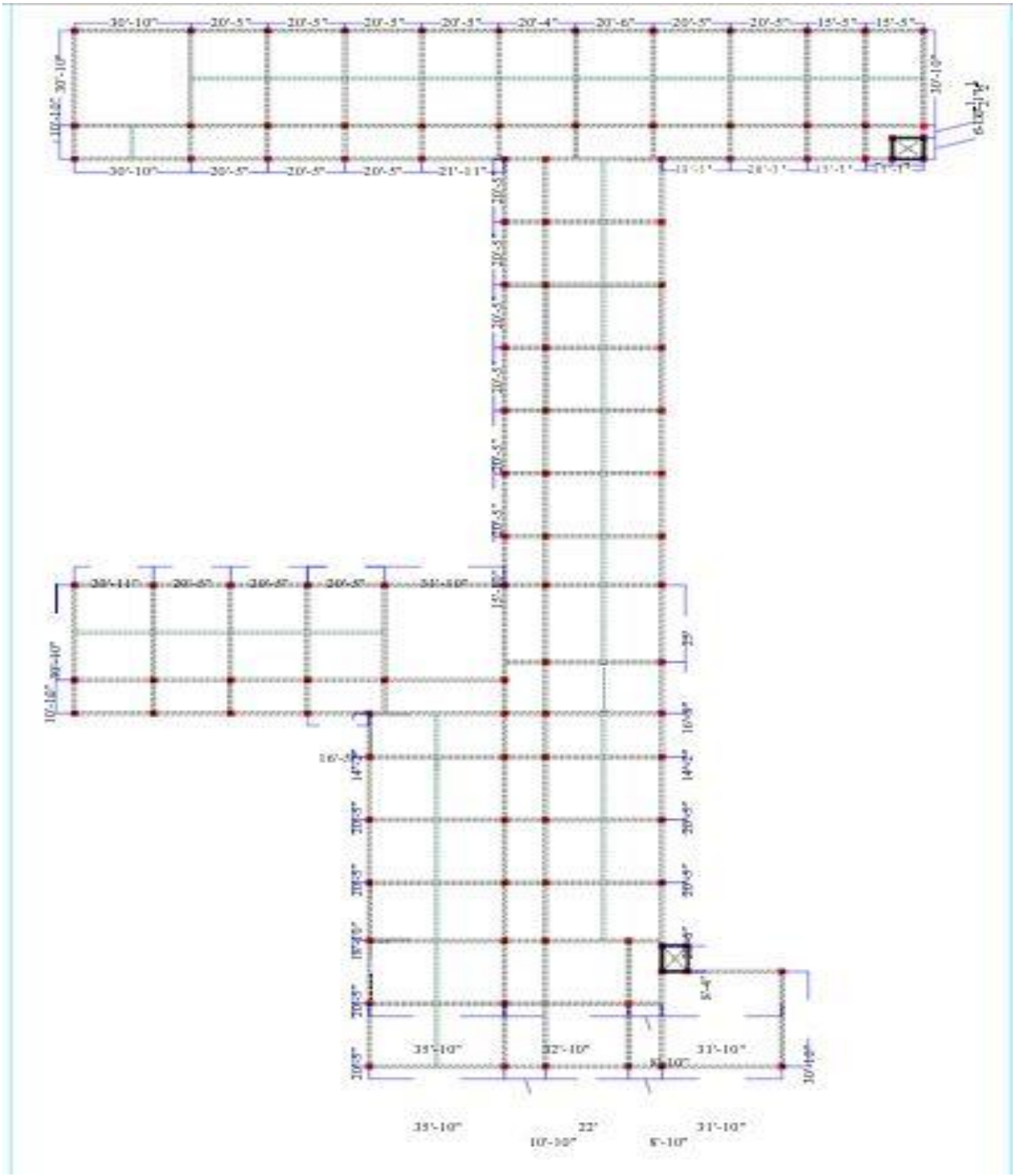


Figure: Beam Layout Plan

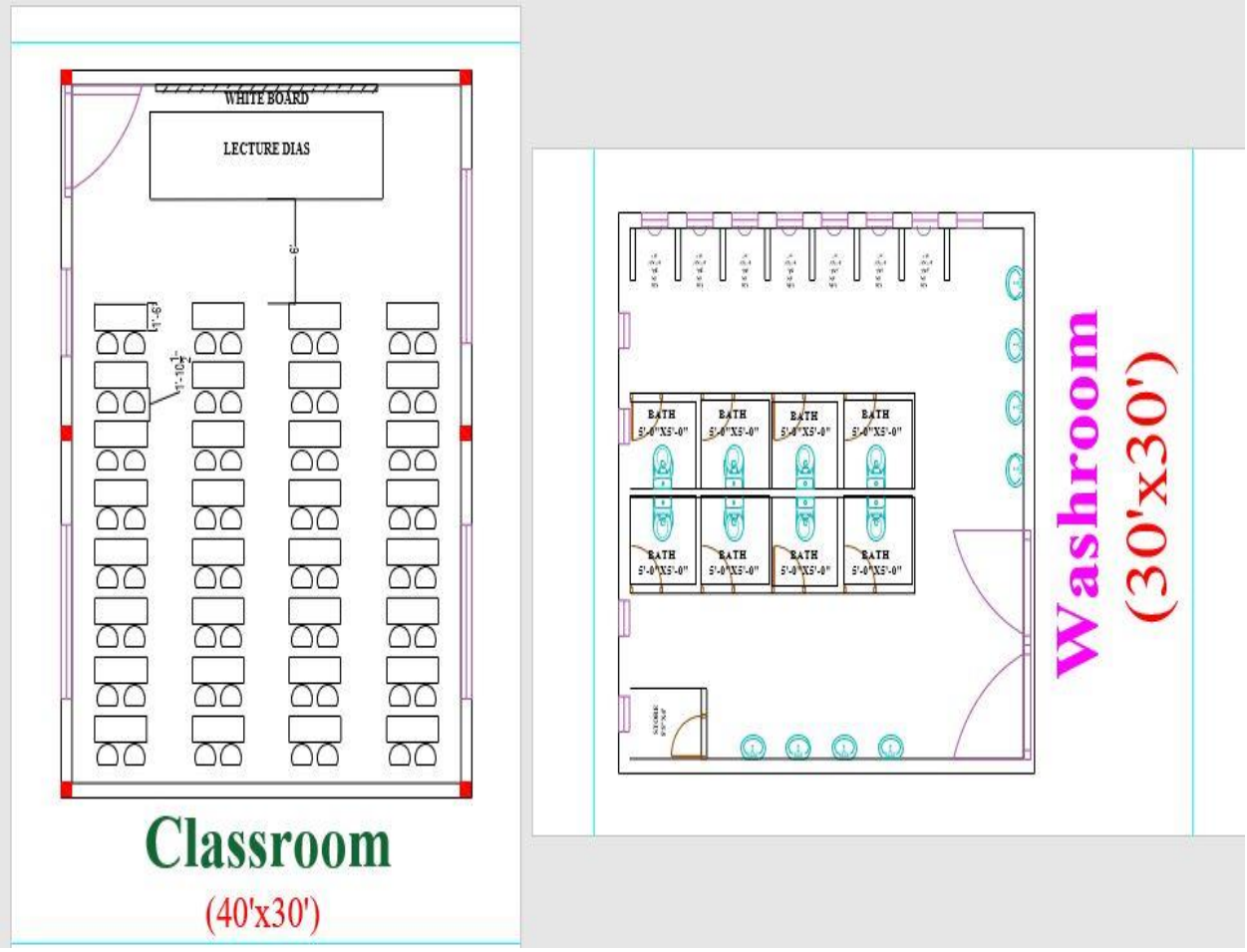


Figure: Classroom & Washroom Layout

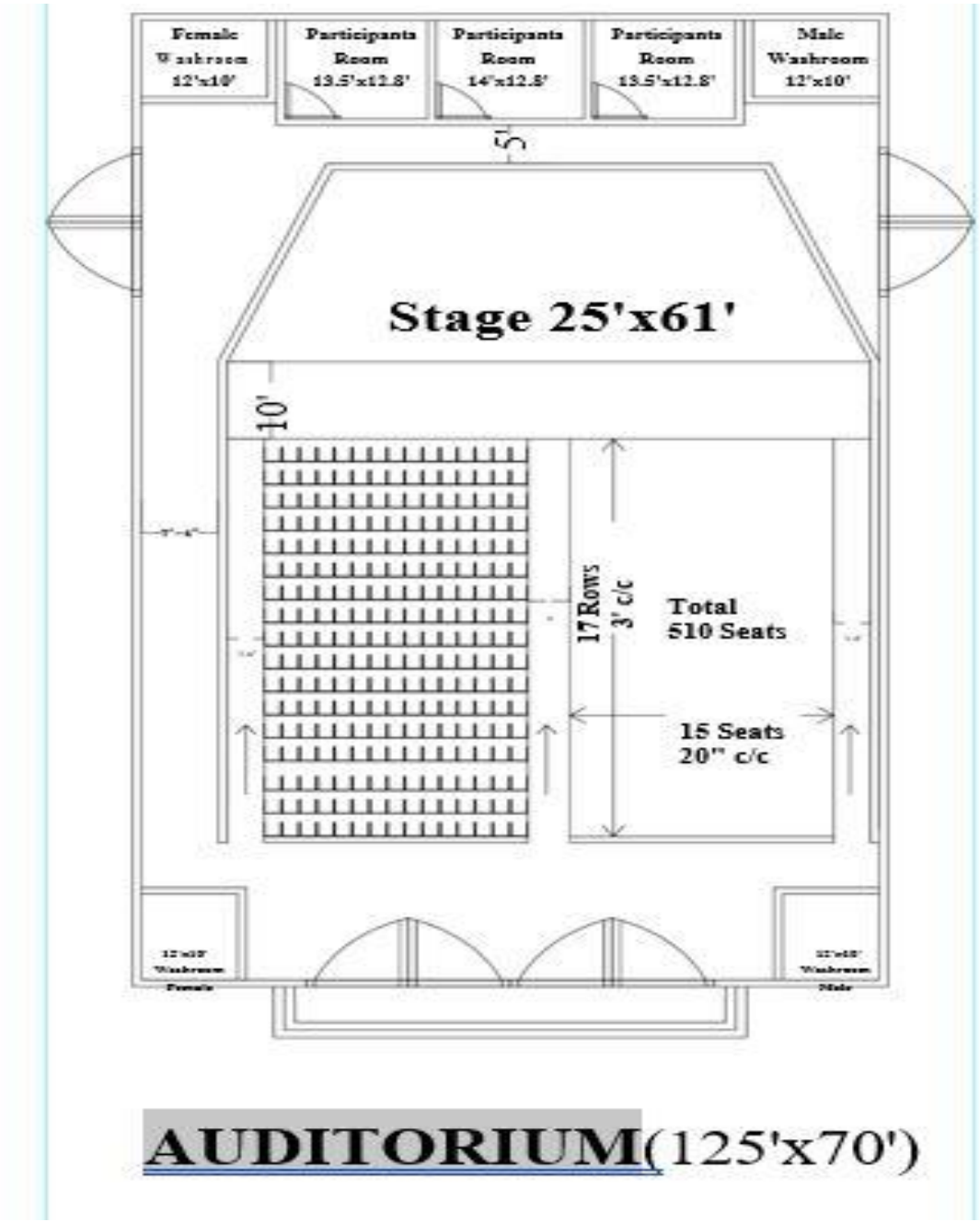


Figure: Auditorium Layout

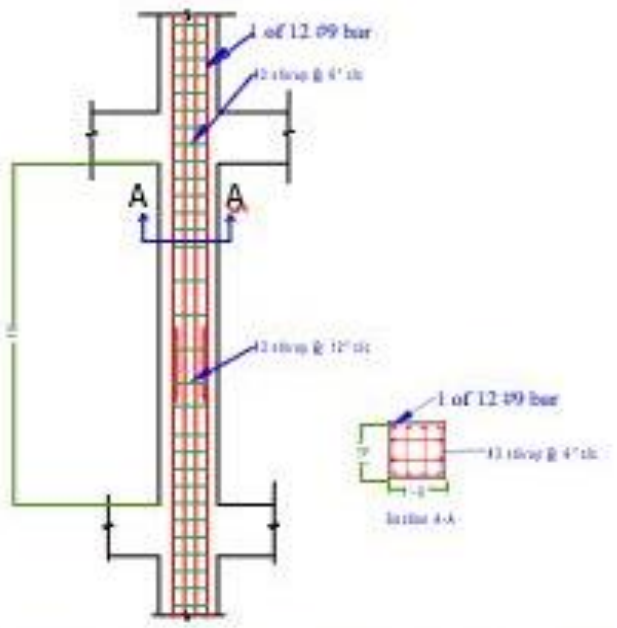


Figure: Reinforcement Detailing of Column (Longitudinal Bar)

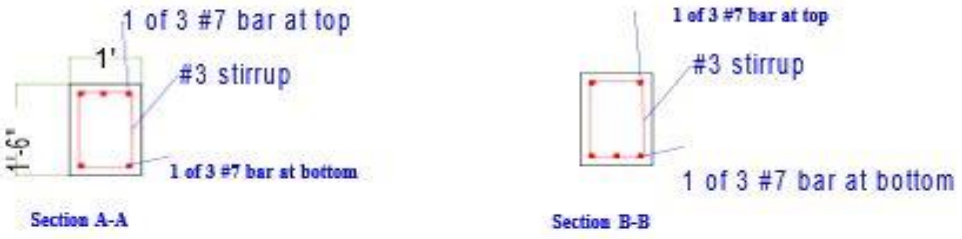


Figure: Cross Section of Beam

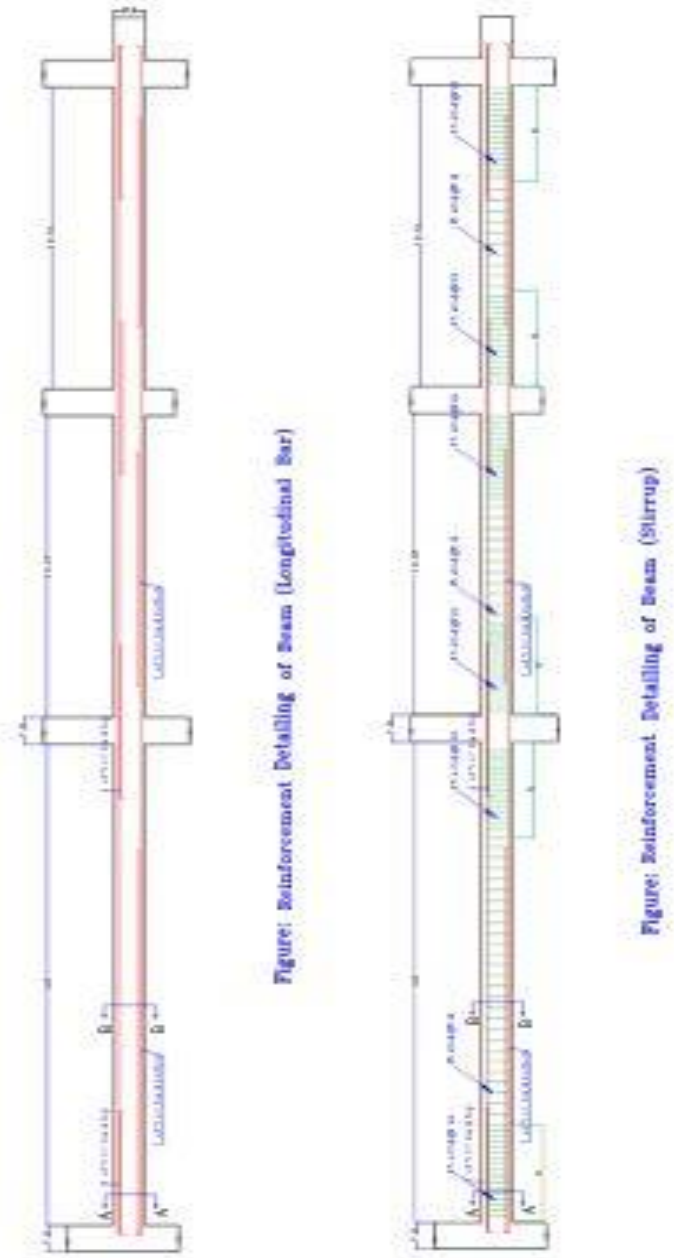


Figure: Reinforcement Detailing

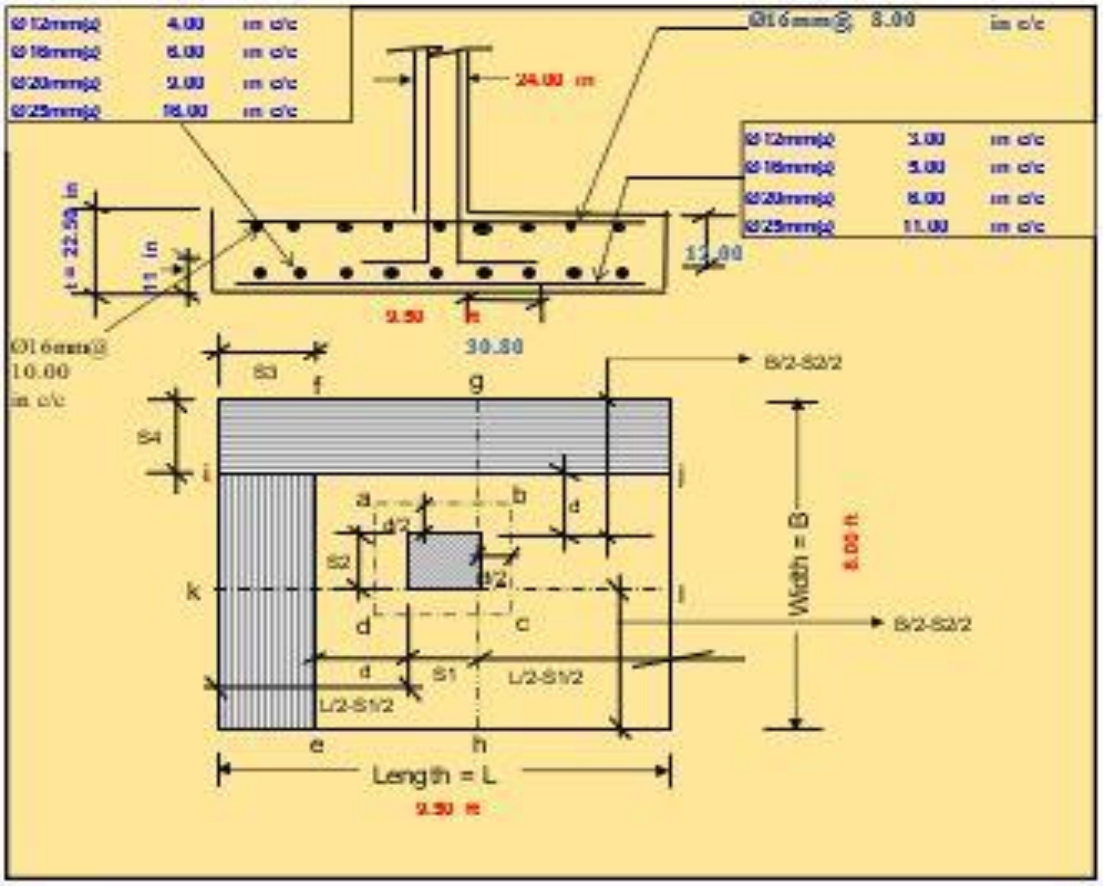


Figure: Foundation Design