Handbook on Community Engagement

CSEB Green Buildings in Nepal

July 2012

Government of Nepal
Ministry of Education
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Actionaid International Nepal

CORD

Center of Resilient Development

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Hari Darshan Shrestha

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This manual is developed by

Centre of Resilience Development
(CoRD)

ACKNOWLEDGEMENT

This project is an outcome of the years of effort and dedication of many people from different walks of life. We would like to extend our deepest gratitude to the Action Aid International Nepal (AAIN) and Department of Education (DOE) for its continuous support throughout the project.

We greatly appreciate the participation of Mr. Sonam Wangchuk (Technical advisor), Mrs. Indra Gurung(Project execution in-charge), Mr. Suresh Thapa (H.S Coordinator) and Mr. Bhim Phunyal (Country Director) from Action Aid International Nepal (AAN), and Mr. Jhappar Singh Bishwakarma (Senior Division Engineer, DOE) for their contribution.

We indebted to Dr. Jishnu Subedi, Mr. Badri Rajbhandari and Ar. Sameer Bajracharya (Centre of Resilience Development, CoRD) for their technical expertise and contributions in the project. We would also like to thank the manual preparation team from Centre of Resilience Development (Cord), Dr. Santosh Shrestha, Raja Ram Thapa, Binod Shrestha, Anjali Manadhar, Sunil Khanal, Kanchana Nyaichyai and Rupesh Shrestha for their continuous effort.

It would not have been possible to continue the project without the support of the local people. We express immense gratitude to the following local partners for their participation: Nepal Muslim Samaj, Banke, Naari Bikash Sangha, Morang, Madan Bhandari Memorial Trust, Morang, SSDC, Kapilvastu and BASE-Bardiya. Our greatest appreciation goes to all the local people of the project areas for their interest and active participation in this green approach.

PREFACE

Education is the backbone of the development of any country. With the literacy rate less than 65 percent in this 21st century, Nepal still yearns for a basic education for her citizens, especially in the rural areas. As shown by various studies, the lack of child friendly environment and inappropriate indoor comfort level in the existing buildings are some of the major causes for the drop out and student's absenteeism in schools. Apart from this, the buildings are not built as per disaster responsive features, which make them more vulnerable during natural hazards like earthquake, flood, etc. The indoor climate- extreme hot in Terai and extreme cold in the mountains is the result of inappropriate planning and construction. The climate responsive and resilient design technology, though available, seems to be expensive needing sophisticated technology which cannot be applied in these rural areas with local skills.

To address these issues of non child friendly classroom environment and to impart quality education to children through Green School, Action Aid Internatonal Nepal (AAIN) and Department of Education, (DOE) with Technical Assistant of Center of Resilient Development (CoRD) have adopted the CSEB Green School building with two classrooms on construction of schools in Nepal. This building technology is based on analytical approach and follows requirements for obtaining earthquake resistant, hygiene, environmental friendly, climate responsive, cost effective, disaster risk reduction as well as child safety features in school building design. This approach also focuses on Community participation and empowerment. Currently the project covers 12 schools in three districts namely Banke, Morang and Dolakha.

With these model green school constructions, the basic idea of this project is to involve community participation so as to make them capable to design and construct green buildings in future on their own. This will help improve access to and quality of education through community involvement. As such, communities are expected to be engaged in decisions and participate in the planning, building and construction processes for any school building.The villagers are expected to establish the School Construction Committee (SMC) and take the responsibility of volunteer mobilization and organization as well as the arrangements for the visiting masons.

The manual explains the criteria for school selection and gives CSEB production process that acquaints the local masons about the technology. The detail construction process of t he Green building gives the technical knowhow.

However, there always exist some potential barriers during community involvement like the lack of understanding and involvement, resources, information and absence of young representation and certain community groups.

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CHAPTER I

INTRODUCTION

Schools provide the space to produce human resources which are required for betterment of the future of the country in all walks of life such as peace, safety, quality of living, technology, knowledge and philosophy. Activities in schools are the most contributing factors for children and their contributions are, in turn, reflected on the whole of the society. Schools facilities not only provide formal education or knowledge but also contribute to the social development, impartment of livelihood skills and nourishment of social norms. Schools should be like the field laboratory where children can see, explore, learn and implement. School is not only a provider of safer places for learning, but it also can act as a center to disseminate culture of safety and how to make environment friendly physical facilities to the communities.

Nepal is planning to build 50,000 classrooms by 2015 to meet the Million Development Goal-Education for All. This study shows most of the existing school buildings and construction technology in practice does not consider the indoor comfort level to make classroom child friendly- classrooms are very cold in winter, hot in summer and noisy during rainy season. One of the major factors behind the students' absenteeism in schools is the extreme indoor climate- extreme hot in Terai and extreme cold in the mountains that ultimately results into permanent drop- out of children from schools.

To address these issues of non child friendly classroom environment and to impart quality education to children through Green School, Action Aid International Nepal (AAIN) and Department of Education (DOE) in association with Center of Resilient Development (CoRD) as a Technical Partner have adopted Green and climate responsive building construction technology on construction of schools in Nepal. Currently the Green School Program (GSP) covers 12 schools in three districts namely Banke, Morang and Dolakha. This building technology is based on analytical approach and follows requirements for obtaining earthquake resistant, hygienic, environmental friendly, disaster risk resilient as well as child safety features in school building design.

The Green School Program (GSP) is designed to improve access to and quality of education through community involvement. As such, communities are expected to be engaged in decisions and participate in the planning, building and construction processes for any school building. Their participation is intended to lead toward their sense of ownership for their school and the education of their children. In the meantime, it also reduces the overall cost of construction. For this reason the process of this participatory school construction seeks to hold meetings, gatherings and orientation sessions with the community at various stages of construction

1.1 Community Participation

The construction technique of green school is labor intensive and it offers the possibility of creating employment for thousands of masons and skilled labor provided the project is implemented at a large scale. In this regard the school buildings later could inspire the local population to switch over from polluting and costly materials and that could generate thousands of green jobs for rural youth in their own regions. Due to the known material and technology, maintenance will not be a challenge to the local communities as in other types of constructions.

Figure 1 Prticipation of Community in Green School Project

The above flow diagram illustrates the participation of community and its importance in the project. It helps in creating awareness in community through its active participation for education. They learn to be responsible towards their environment and resources and also reduce overall cost through combined contribution. As they will be involved in construction, their sense of ownership is expected to encourage the community to participate in the management of the school thereby ensuring accountability in the education system itself.

For this reason the process of this participatory school construction involved meetings, gatherings and orientation sessions with the community at various stages of construction.

The engagement of the community is a key to this participatory school construction movement. Engaging community from the conceptualization and planning phase of the schools is essential for their sustainability. A review report of high performance school in the US suggests that

"community planning process has yielded an increased emphasis on sustainability that is evident in several new school buildings (Bernstein et al. 2003)." Although the prototype school building didn't require community participation, school planning process in real situation requires community participation. At least four formal meetings with the village leaders and communities is essential. In the first meeting, mainly village leaders and teachers are invited to present basic features of the green building and how it can be used to improve the educational status of the village. Usually this meeting is a bit challenging with many questions, doubts and sometimes misunderstandings as people are not aware about the CSEB and green construction technique. After convincing the village leaders and teachers, a second meeting has to be carried out to present the basic concept and benefit to the community and also discuss on plan, elevation, location and possible community participation

The third and fourth meetings to be carried out closer to the time of the construction; leader level meeting followed by a general public level meeting to discuss the design and the logistical and technical issues of construction. At this time the villagers should establish the School Construction Committee (SMC) and take the responsibility of volunteer mobilization and organization as well as the arrangements for the visiting masons.

1.2 The Role of the School Management Committee

The SMC directs the school's active involvement in the project and should be willing to commit at least 1-2 days per week to planning and overseeing the school build. Ideally, the committee includes teachers, non-teaching staff, management, and parents.

It is important to confirm the SMC's commitment to the project at the outset, when the needs are first identified. Only with the SSC's active involvement will the project be successful.

The SSC will take on various roles through the planning, designing and construction phases. They will analyze their community's needs, submit requests for approval to local authorities and nation Authority, make decisions regarding the design of the facilities to be built, shortlist contractors and evaluate bids, monitor construction, and maintain their new building. Training workshops will help build the SMC members' capacity to take on these roles.

The Green-Schools committee, as the driving force of the project, aims to direct and address all phases of the Green- Schools project. It is the.

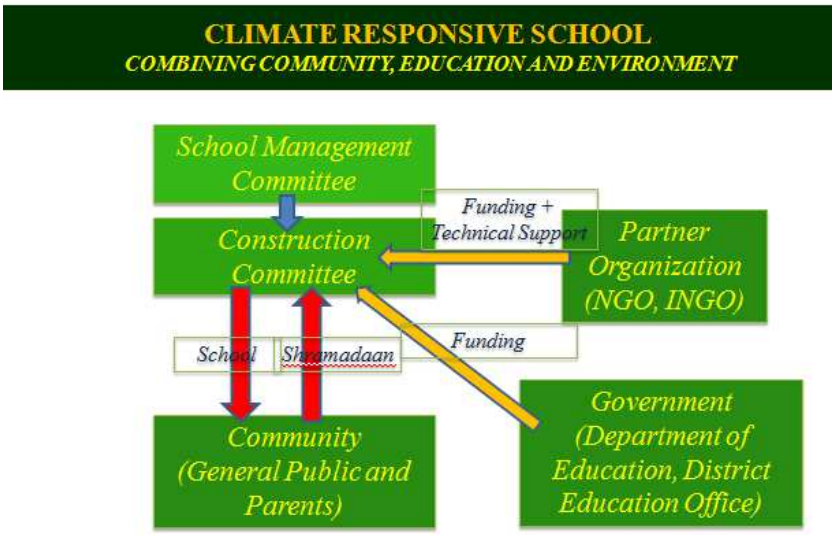


Figure 2 Various stakeholders involved

The basic roles of SMC are listed below :

- Perform as the representative of the whole school project during construction and after hand over.
- Have regular meetings to successfully keep up-to-date with the development of Green-Schools project.
- Record the minutes of each meeting.
- Disseminate the points and decisions of each meeting to the school.
- Informing and Involving of the Community
- Ensure that both the school and wider community are fully informed of the progress of your Green-Schools project
- Encourage greater numbers of the school and members of the community to get further involved in Green-Schools project

As with other components of GSP, the SMC is also responsible for communicating information to the community and coordinating community involvement.

Community's Contribution in SMC

There are no fixed rules for a community's contribution or participation, other than that it should engage as many community members as possible. The SMC is responsible for identifying what contribution the community will make to the project, and coordinating it. In general,

there are four ways that communities can contribute for the implementation of school development activities, including school build projects: their labor, time, material resources, or financial contributions.

1.2.1 Labor

Some communities may opt to donate laboras their resources. Community members may have special construction skillsthat they are willing to offer as opposed to paying the contractor to do them. Alternatively, they may volunteer their labor to enhance the school environment, perhaps by planting trees or flower gardens following completion of the project.

In addition to any labor resources that the community may volunteer, it is highly recommended that at least five community members be available to work at the construction site as manual laborers. Their participation offers the following advantages:

- Community members receive a source of income
- Community members gain skills for finding future work
- Community laborers can monitor the contractor and construction site and provide information to the School Management Committee and SCC

Should the SSC agree to this recommendation, an appropriate clause should be incorporated written into the *Conditions of Contract*.

1.2.2 Time

Communities may also opt to volunteer their time. The School Management Committee volunteers it's time to participate in planning, bidding and construction monitoring. Similarly, community members may volunteer their time to participate in a ground-breaking ceremony, the bid opening meeting, or the school opening ceremony.

1.2.3 Material Resources

Communities may have access to materials needed for construction, like wood or bamboo for temporary frameworks. They may opt to provide these as their contribution to the school build.

1.2.4 Financial Contributions

Community members will probably agree that they have the most ownership when they make financial contributions to a project. The School Management Committee may decide to ask parents and other village residents for voluntary monetary contributions toward the project. They may also seek funding from the local agencies, the Commune foundation, or other village sources.

School Management Committee should make money collection procedures as transparent as possible and should be prepared to provide advice to the SSC on how to do this.

1.3 *Community Recognition*

It is important that the community's ownership of the school facilities, both new and old, be reinforced from the start of the project. The SCC Chairperson can do his by using language that portrays a sense of ownership when speaking with community members and the School Support Committee; for example, “your school,” “your contractor,” etc.

To facilitate this sense of ownership, it is also important that the community receive recognition for their contributions. The community (with a logo designed by them) should be represented on any school sign or donor recognition plaque (along with SCC).

It is important that SCC communicate community ownership of the school to all stakeholders, including local authorities, so that they too can reinforce this sense of ownership in meetings and their speeches at the school's opening ceremony.

With an established sense of ownership, the community is more likely to maintain the building and take an interest in the education of their children

1.4 *Organization of Manual*

Green School Program (GSP) is a community based sustainable project with an aim to uplift the standard of education level in rural areas with the improved school buildings in an economical way. Accordingly, Chapter I gives an overview of the project with the role of community involvement in the project. The establishment of School Management Committee and its involvement is also discussed.

The introduction to the Green School and its features are discussed in the following chapter while it also clarifies on the criteria for the site selection like being centrally located, etc. It further explains how the CSEB production and required arrangement of the raw material for it is possible at the local level with community participation. It consists of collection of soil, soil testing, soil screening, measuring sand and soil proportion, well mixing with cement and water, block production and carrying-storing and curing CSEB.

The construction part, divided into foundation and super structure is included into chapter III. With an addition of pictorial explanations, the steps to construct the rammed earth foundation is explained followed by the super structure construction.

The manual concludes with concept of community mobilization through shramada, the benefits if the community involvement and its major challenges.

CHAPTER II

Communities Engagement in Green school Program

Figure 3 A complete overview of Green School Project

2.1 *Introduction of Green School*

A green school is one that demonstrates respect for the Earth by conserving natural resources, and learns from the Earth by bringing nature into the classroom and the classroom into nature. A green school uses the "natural environment as the integrating context" for all learning. It is built with cost-effective and locally available materials like earth and sand. In order to counter the issues of strength and water resistance the local earth is stabilized by mixing just 5 to 6 % of cement. Then the blocks/ bricks are produced using a labor intensive technique called Compressed Stabilized Earth Block or CSEB technology resulting in blocks that are comparable in strength to country fired bricks but use very little energy and cause very little pollution. The roof has been made using Ferro cement channels another cost effective, labor intensive yet modern technique. Due to the choice of materials and techniques, the cost of the buildings comes out comparable to conventional schools built with fired bricks and tin roof, even as the classrooms are much better on many parameters.

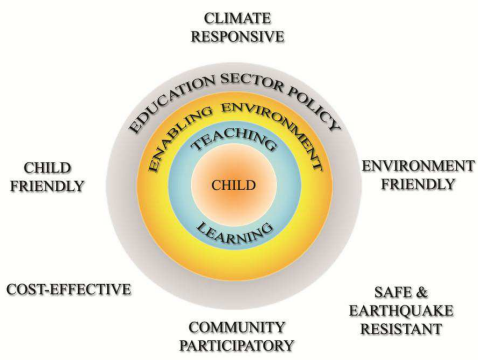
The main criteria that incorporated in design and construction of green and climate responsive buildings are :-

- Use of material & technology that is indigenous, has less embodied energy, & environment friendly.
- Architectural design that assures comfort and human health with utilization of natural forces such as use of passive solar features and less use of active energy system such as HVAC.
- Healthy indoor air quality through use of healthy constructional material and proper natural ventilation.

Features of Green School

2.1.1 Climate Responsive

- Comfortable indoor climate provide through passive heating and cooling
- Earth berming to cash warmth and cool of underlying earth
- Humidity optimization through soil surfaces



2.1.2 Environment Friendly

- Use of CSEB materials having low embodied energy
- Resource efficient material/ construction technology

2.1.3 Safe and earthquake resistant

- Design assuring box effect
- Base isolated foundation
- Integrated horizontal and vertical bands
- Proper connection between roof system and buildings

2.1.4 Cost effective

- Use of local materials with optimum use of local natural resources with least use of transport system
- 100% local human resource- skilled and semi-skilled

2.1.5 Community participatory

- Mobilization of community through shramadaan, right from the preparation of compressed blocks to construction of the building.

2.1.6 Child Friendly

A School should essentially be child friendly and so is this model of the green school. The single storey building is as excellent design for the small children to reduce accidents in stairs. This is further simplified by the provision of ramp in the exterior. The classroom sizes comply with the standards specified. Due to the use of CSEB and innovative roof technology, the indoor comfort level is enhanced by maintaining a temperature difference of at least 3-4 degree centigrade from outside. In the interior, the board along the lower wall gives children a spaces to draw.

2.2 *School and Site Selection Process for GSP:*

2.2.1 Criteria for school selection

As green school is a model concept for every other schools and communities so it should be selected on ideal location. It should be centrally located so that many of others can learn from this model concept of green technology. Also those schools should have achieved the DoE's budget for construction of two class rooms.

Figure 4 Green School front view

Figure 5 Green School back view

2.2.2 Introduction of Green Technology with school team and local people

Orientation and presentations are conducted to aware local interested people about green technology and about Green School Project, the village leaders, teachers and other general people are invited in the program and any misunderstanding, doubts, issues and questions, if any, are been discussed during the session.

Figure 6 Orientation and presentation program of GSP at Dolakha district

2.2.3 Site selection for Green School:

Site selected for the green school must not be a filled land area. The school should not be in or near the restricted are such as high-tension area, disasters prone areas. Also there must be sufficient land available for ramp construction.

Figure 7 Site selection at Dolaka district

2.3 *CSEB production process:*

2.3.1 Collection of soil:

Top soil should be removed as it contains organic matters. Soil below the top soil is collected in large quantity as per required and transferred to the site. Collection of soil can be done manually or with the help of excavator and tractor. Manually collection requires more than 10 human resources for couples of day while using excavator and tractor completes the work by a day.

Figure 8 : Collection of soil at Morang district by excavator and tractor

2.3.2 Soil testing:

Good soil for CSEB consists of 15% gravel, 50% sand, 15% silt and 20% clay. Soil testing is done in order to find out the proportion of gravel, sand, silt and clay. Among many tests, Jar sedimentation test is the exact and easy process of test. It requires one skilled human resource and can be completed within a period of one hour.

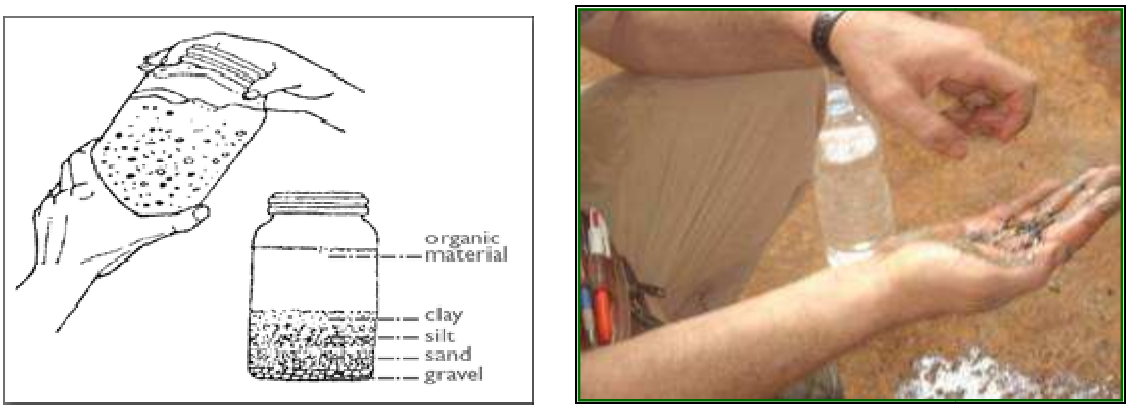


Figure 9 sedimentation test carried at Morang district

2.3.3 Soil screening:

Soil should be screened in order to remove large size materials and also to get the soil of uniform size which helps for well mixing with sand and cement. Generally screening can be done with 10mm size mesh wire net but done with 2mm size mesh wire net for better performance while mixing. It requires three human resources for running one machines.

Figure 10 Soil screening at Morang district

2.3.4 Measuring sand and soil proportion:

Soil at collection may not contain balanced proportion of gravel, sand, silt and clay to be good soil for CSEB. So sedimentation test suggest which materials should be added and which should be removed. Generally all soil consists of silt and a little or more sand, so proportioning can be done with sand containing gravel. This works requires two human resources for all the working days till the block production finished.

Figure 11 Measuring sand and soil proportion at Morang district

2.3.5 Well mixing with cement and water:

For stabilizing purpose 6% cement is added which helps to bind the gravel, sand, silt and clay together. Generally cement is mixed separately with soil and sand is mixed with water and later on they are mixed together. This works requires four human resources for all the working days till the block production finished.

Figure 12 soil and cement mixing, sand and water mixing, and together mixing at Morang district

2.3.6 Block production:

Soil, well mixed is poured into the machine and machine is used to give a compression of 15 ton for the production of a CSEB. This work requires four persons for all the working days till the block production is finished.

Figure 13 Pouring mixed soil, handling machine and CSEB production at Morang district

2.3.7 Carrying and storing and curing CSEB:

The produced CSEB should be properly carried to the site for storing and curing. It requires one person if the storing site is near the producing machine and requires two if it's far. The site selected for storing should be well leveled ground. It is done till the CSEB production completes. The curing should be done with portable water for a period of three weeks. It requires two human resources.

Figure 14 Carrying, storing and water curing of CSEB

2.4 *Rammed Earth Foundation Process:*

2.4.1 Layout for foundation excavation

As green school construction works requires high accuracy , proper layout must be done. Estimates, working drawings all are fixed so before excavation for foundation and proper layout must be done. It requires one skilled and one unskilled human resource. It's a work of one day.

Figure 15 layout for excavation of foundation at Morang district

2.4.2 Excavation of foundation:

Excavation of foundation must be done as per drawings. It requires six human resources and one skilled supervisor. It completes within three days. Excavation of foundation must be done parallel to block production work.

Figure 16 excavation of foundation at Morang district

2.4.3 Rammed earth foundation:

The material used for rammed earth foundation is same mixed soil as used for CSEB production. Here mixed soil is rammed with the help of rammer making each a layer of 10 cm. It requires ten human resources for a period of 3 days.

Figure 17 rammed earth foundation at Morang district

CHAPTER III

SUPERSTRUCTURE PROCESS

At first foundation ring beam is constructed which is of size 35cm width and 10 cm height. Vertical reinforcement starts from foundation ring beam. Three layers above the foundation ring beam, plinth ring beam is casted in U – Blocks. Doors are installed at the plinth level while windows are installed at the sill level. Sill ring beam is casted in U- blocks at six layers above the plinth ring beam. Lintels above the doors and windows are cast separately and installed at the lintel ring beam. Lintel ring beam is cast in U-Blocks at 8 layers above the sill level. Horizontal reinforcement are provided in each ring beams. Construction of superstructure requires six skilled human resources and 5 unskilled human resources. It can be completed within 10 to 12 days depending upon the speed of working.

Figure 18 Framing and arranging reinforcement for concreting of foundation ring beam

Figure 19 arrangement of vertical reinforcement and concreting of foundation ring beam

Figure 20 Completion of foundation ring beam

Figure 21 Starting of block work at first layer

Figure 22 Block work at second layer and laying of U-block for plinth ring beam

Figure 23 arrangement of reinforcement and concreting of plinth ring beam

Figure 24 installation of door at plinth level

Figure 25 sixth layer from plinth level and arrangement of U-Block for sill ring beam

Figure 26 arrangement of reinforcement and concreting of sill ring beam

Figure 27 installation of windows above the sill ring beam

Figure 28 block work at corner tie and preparation of lintel

Figure 29 completion of lintel ring beam

3.1 *Roofing work process:*

Till now two types of roofing system have been applied to the green school. Ferro cement channel roofing system and CGI sheet roofing system are the two different types. CGI sheet system of roofing is on under construction.

Figure 30 Ferro Cement Channel roofing system at bake district

CHAPTER IV

Community Participation in form of *Shramadaan*

The aim of the Green-Schools project is to move from environmental awareness and social mobilization in the school and wider community. A green school incorporates the community in the process, so that the school becomes a place for the whole community to learn and contribute to — in this way, students and school management committee develop stronger ties to their community. Community itself also felt the school as their own asset.

Figure 31 Community Participation

Green school project is designed basically to engage, mobilize the community and transfer CSEB green technology to the corresponding community.

4.1 *Community mobilization through shramadaan involves:*

1. Community meeting
2. Preparation of Soil for Block Production
3. Transferring block to curing site
4. Preparation of soil for rammed earth foundation
5. Digging and ramming foundation
6. Sieving sand for mortar preparation for building construction
7. Transferring Ferro cement channels from the curing site to the installation site
8. Community handover

Figure 32 On-site works

4.2 *Benefits of community involvement in Green School Project*

- It enhances social cohesion because communities recognize the value of working in partnership with each other and with statutory agencies.

- It adds economic value through the mobilization of voluntary contributions to deliver the community benefit and through skill development, which enhances the opportunities for employment and an increase in community wealth.
  It gives residents the opportunity to develop the skills and networks that are needed to address social exclusion.

- It promotes sustainability because community members have ownership of their communities and can develop the confidence and skills to sustain developments.
- Community participation motivates people to work together- people feel a sense of community and recognize the benefits of their involvement

- Social, religious or traditional obligations for mutual help

4.3 *Key Challenges during Community involvement*

As noted above, individuals and community organizations face many potential

Barriers and

(1) Lack of understanding of the involvement

(2) Lack of community resources

(4) Lack of access to information

(5) Absence of young representation and certain community groups.