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engineers
without borders
SWEDEN

Engineers Without Border and Build Up Nepal

Intro

Engineers without Borders in Sweden is an NGO focused on engineering solutions and sustainable technology at the heart of the green transition. EWB is partner of Build up Nepal, collaborating to research innovative ways to replace part of the cement content in CCB with rice husk ash and other waste materials and alternative stabilizers. EWB coordinates volunteers from both industry and academia. EWB has been working on research into CSEB technology alongside Build up Nepal since last 5 years.

Build up Nepal was established following the 2015 earthquake in Kathmandu, and has brought proven resilient CCB technology to Nepal. Build up Nepal has supported more than 300 Micro-, Small, Medium-sized Enterprises, MSMEs, to produce *Compressed Concrete Blocks (CCBs)*, for over 10,000 houses in Nepal.

CCBs are highly disaster-resistant bricks that interlock like that interlock like LEGO and have reinforcement placed through the holes, making them resistant to earthquakes. These blocks are composed of 90% local materials and industry waste that are stabilized with cement, industrial ashes, and other binders. Mobile crushing units crush stone, debris, and bricks into sand and aggregate to make new, resilient bricks with the same lifespan as concrete (50-70 years).

Social Enterprise Build up Nepal is introducing CCB into the market. Since 2015, Build up Nepal has supported more than 300 MSMEs to build 10,000 homes, reducing 101,000-ton CO_2 and generating 2,232 full-time jobs, with 26% of employees being women.

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Work with EWB

What EWB offer: During your thesis writing with EWB-SWE you will get concrete experience in how international development projects are run. We have experts within different competence areas who will support you throughout the process. EWB-SWE does not offer any additional funds.

Requirement: We want everyone who does their bachelor's or master's thesis with us to commit to providing EWB-SWE with a project report in addition to the academic report that you provide the university. We also expect the students to be active as volunteers before and after their field visit to ensure that they are well integrated with other volunteers and our systems. From experience, we know that this is most efficient.

Support for Bachelor's and Master's Thesis Planning Within Current Areas of Interest

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1. Further development of building materials

Improving Current Performance with ordinary cement – process improvement

- Optimizing water addition to minimize weight of cement per brick while maintaining strength.
- Introducing quality control measures using basic equipment such as scales and a cylinder compactor to assess bulk density.
- Investigating the effects of varying bulk density on bricks.
- Implementing quality assurance procedures based on data collected from enterprises.
- Optimizing performance specifically for Compressed Stabilized Earth Bricks (CSEB).

Red Brick Dust as alternative binder for partial replacement of cement

- Finding information on use of brick dust as pozzolanic material generally and specifically in bricks.
- Information of the rate of cement substitution that has been achieved using brick dust (as a rule of thumb pozzolanic materials could be expected to have about 30% of the strength performance when compared to ordinary Portland Cement).
- Any problems with the use of brick dust such as effects on durability.
- Examples of where brick dust has been used with references and contacts if available.

Rice Husk Ash (RHA) as partial replacement of cement in bricks

- Experimenting with RHA, a byproduct from rice husk combustion typically used in firing, readily available in Kathmandu.
- Investigating controlled temperature burning of rice husks to produce hydraulically active ash for potential applications.
- Studying the optimal particle size range of RHA to maximize its interaction in cementitious mixtures, and determining the maximum substitution level of cement it can achieve effectively.

2024-06-21

Jute Fibers as an additive for partial replacement of cement

- Search for general information or any existing studies, research papers, or articles on the use of natural fibers in bricks, with a focus on jute fibers.
- Look for data or experiments that quantify the reduction in cement content achievable through the incorporation of jute fibers.
- Investigate the extent to which jute fibers can replace cement in bricks.
- Search for information on the long-term durability and stability of bricks containing jute fibers.
- Identify any potential challenges or drawbacks associated with the use of jute fibers in bricks, such as susceptibility to moisture or pests.

Plasticizers to reduce water addition with enhanced compaction - which increases strength

- Search for general information on plasticizers and their role in construction materials, particularly in compressed cement-based bricks and bricks.
- Explore studies or experiments that have tested the effectiveness of different plasticizers in improving the workability of the mixture.
- Investigate the extent to which plasticizers can reduce water content in compressed brick production while maintaining desired workability.
- Identify any potential challenges or drawbacks associated with the use of plasticizers in compressed brick, such as effects on long-term durability or environmental impact.
- Assess approximately the economic viability of using plasticizers - value added per cost.

Shrinkage in CCB/CSEB: Analysis and Remedies

- Investigating shrinkage in bricks: identifying causes, factors that contribute to shrinkage, and strategies for effective control.

Cracks in CSEB/CCB Houses: Causes and Solutions

2. Mechanical engineering

Further mechanical development of the machines used for manufacturing the bricks

- Enhance the existing prototype to increase the compressive force of the manual brick-making equipment, requiring further improvements and finalization.
- Develop a mechanism where bricks are placed onto plates immediately upon production, thereby replacing the current manual method of lifting and placing them on the plates, which is hindered by the need for specific wet strength and constraints on water addition.