Save the Children

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Booklet on:

Challenges and Opportunities in the Production and Purchase of Good Quality Blocks.

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Build earthquake-resistant houses
Change construction practices permanently

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INTRODUCTION:

Build Change and Save the Children have been working together to capacity train block (CMU- Concrete masonry unit) makers in the larger area of Port Au Prince since June of 2011.

After last year's pilot project of 9 block makers in Petionville and Canape Vert we have now extended our project to include over 36 additional block makers in Delmas, Martissant and Carrefour.

It has been a very interesting time for us in which we have seen block makers DRASTICALLY improve their capacity to produce quality blocks and in doing so, open the doors to a safer reconstruction process.

While there is still a long way to go, we believe the things we have learnt during this time may help agencies better SELECT quality blocks for their own permanent reconstruction projects, PROMOTE the use of quality blocks and REWARD those that produce them.

As such, there are two distinct aspects to this program in which agencies can have a positive impact. One relates to blocks being produced, the other to the producer making them. One is related to CONSTRUCTION, the other to INCOME GENERATION, EDUCATION and DISASTER RISK REDUCTION.

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Continued…

Part 1 of this booklet addresses the production process itself; providing general recommendations for all block makers and an insight into some of the research conducted by Build Change.

We hope this will provide you with the expertise necessary to identify good production yards and purchase good quality blocks.

Part 2 addresses how agencies can help promote the general use of good quality blocks by purchasing responsibly and supporting certified block makers.

Good quality blocks are difficult to find, and a market for good blocks needs to be created if production is to be sustainable.

We hope this booklet provides you with not only an important insight into the challenges facing Haitian block producers but also the means necessary to assist them in making better quality blocks.

We would also like to take this opportunity to encourage you to support the growing number of BUILD CHANGE CERTIFIED BLOCK MAKERS that with your help will help reconstruct a safer Haiti.

Thank you.

-The Build Change Team

PART 1.

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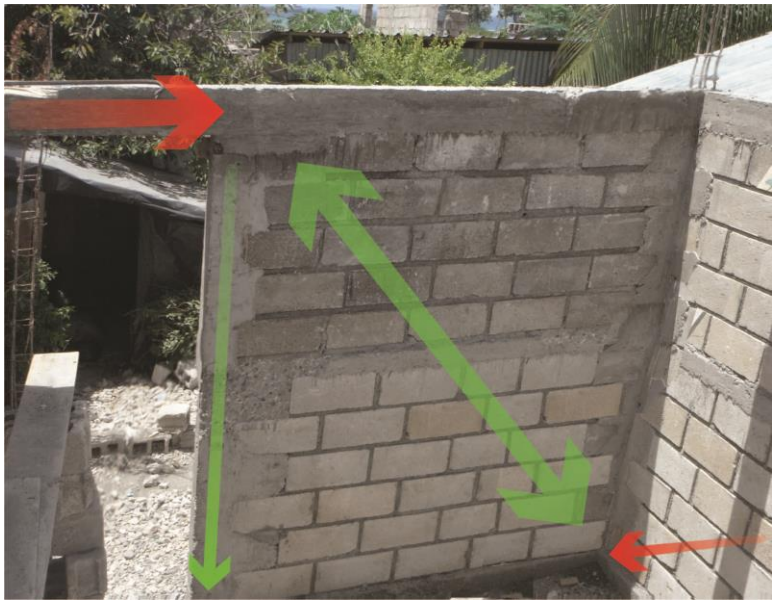
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PART 1a. Block Standards in Haiti and the Importance of Using Good Quality Blocks.

Earthquakes such as the one suffered in January 2010 can produce a high SEISMIC LOAD. These are horizontal forces (shown in red) that originate from the weight of the structure responding to the ground movement beneath.

In CONFINED MASONRY, it is the blocks together with the beams and columns that must resist or “push back” (shown in green).

When blocks break due to their lack of strength, this lateral force cannot effectively be resisted. This causes the walls to prematurely fail, followed shortly by the rest of the structure.



In many badly designed REINFORCED CONCRETE structures, the walls still carry much of the seismic load so the quality of the blocks used remains extremely important.

PART 1a. Block Standards in Haiti and the Importance of Using Good Quality Blocks.

Continued…

The MTPTC (Ministère des Travaux Publics, Transports et Communication) guideline for block compressive strength is **10 MPa.**

Over the past two years, Build Change has randomly selected and tested 129 blocks produced by local block makers in 43 locations over Port-Au-Prince. These have shown an AVERAGE compressive strength of **4.45 MPa.** (Less than half of MTPTC guidelines).

While both MTPTC and members of the international community are striving to improve standards throughout, the use of bad quality blocks still appears to be endemic in most types of construction.

That said, Build Change's experience in two years of training and block production shows that good blocks CAN be produced with little investment and made available to homeowners at a purchasable price.

These same block makers (now supported by Build Change) are today capable of regularly producing blocks over **7 MPa** (a 70% improvement) with over 20 of them now certified to produce blocks over **10 MPa.**

The following chapter highlights the training and production techniques used to achieve these results.

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PART 1b. Build Change Training Methodology.

A standard Build Change capacity building training for block makers is conducted over a 7 week period.

Week 1. Participants are surveyed and a site inspection is conducted. Blocks from each participant are then purchased and tested off-site as a reference for future improvements.

Week 2. If blocks do not reach MTPTC guidelines a list of materials and recommendations is provided to the block maker and a training day is scheduled.

Weeks 3-4. One to two days of on-site capacity training is provided for all employees. During this time an average of 250 improved blocks are produced and laid out to cure.

Over the following 7 days participants are assisted in curing with daily site visits.

Week 5. Blocks continue curing for a total of 18 days. Blocks are usually stacked during this period.







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Week 6. Compressive strength tests are conducted for blocks produced during training and a certification is prepared for block makers reaching a minimum resistance. Build Change assists block makers in calculating an adequate sale price for the new product. Final pricing remains at the discretion of the block maker.

Week 7. Certification is presented during a social marketing event conducted on-site for block maker clients. A presentation is given describing the importance of using good quality blocks and providing tips on how to identify them before purchase. Samples of good quality blocks are distributed to all interested parties.

Inspections. Build Change may conduct inspections whenever an NGO purchases through our network of block makers. If the quality of the blocks is more than 10% under the certified strength at the time of training, certification may be temporarily annulled. A block maker may have his certification returned with the production of another batch of quality blocks.





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PART 1b. Build Change Training Methodology.

Example of the BUILD CHANGE certificate given to block makers that reach MTPTC guidelines.

Build Change maintains an active database of all certified block makers for easy consultation by the international community.



Certificat de Qualité

Ce diplôme est décerné a:

Michel Constant

Pour avoir prouvé sa capacité à fabriquer des blocs d'une résistance de 10 Mpa.

24-Octobre-12

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Michael Collins
Build Change Construction Team Leader

Save the Children.

Ce diplôme est une indication de la capacité à produire de meilleurs blocs et ne garantit pas que tous les blocs vendus ont atteint ce niveau.
En cas de doute, s'il vous plaît n'hésitez pas à contacter Build Change pour faire un test avant l'achat.

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PART 1c. General Recommendations for Good Quality Block Making.

GENERAL RECOMMENDATIONS provided by Build Change have improved the compressive strength of all but two of the BLOCK MAKERS we have tested after training.

However, it can still be challenge for all SMALL AND MEDIUM size block makers with limited resources to reach 10 MPa (MTPTC Guidelines) on a regular basis without providing more INDIVIDUAL AND SPECIFIC support and guidance.

As with many other construction activities it is difficult to provide GLOBAL RECOMMENDATIONS that are effective for producing high quality blocks in every specific case.

The following pages will take this into account by presenting one Build Change general recommendation at a time, following it with additional recommendations that have assisted struggling block makers in reaching Build Change or MTPTC guidelines.

RECOMMENDATION 1. "An Adequate Ratio of Cement and Sand"

Cement is by far the most expensive part of block making. A 42.5 kg bag of cement costs (at the time of print) between 325 and 350 Gourdes (8-9$US).

All 45 of the block makers we are working with habitually used a very low ratio of cement to sand.

This consisted of 5 wheelbarrows for one bag of cement, which is a ratio of 1:12 (or less than 8% cement content) and permits the production of 50 to 55 blocks per bag of cement.

While some of the 1:8 and 1:9 tests conducted during trainings have shown a good comparable strength, Build Change's across the board recommendation is to use a mix of 1:7. That is, one part cement to 7 parts sand.

This produces 25 to 30 blocks per bag of cement and while more expensive, leads to all over better results.



RECOMMENDATION 1. "An Adequate Ratio of Cement and Sand"

Cement Ratio Strength Comparison	
Number of samples tested:	177
Production method:	Mechanical and manual
Aggregates tested:	White, river, crushed rock (*concassé)*
Ratios used:	1:5, 1:7, 1:8,
Average compressive strength for 1:5 river sand:	11.11 MPa
Average compressive strength for 1:7 river sand:	5.5 MPa
Average compressive strength for 1:7 white sand:	7.76 MPa
Average compressive strength for 1:8 white sand:	6.34 MPa
Average compressive strength for 1:7 crushed rock (*concassé):*	13.2 MPa
Best performance:	1:7 Crushed rock (*concassé)*

RECOMMENDATION 2. "A Careful Selection of Aggregates"

Just as important as the ratio of cement, the selection of aggregates can have a distinct effect on the compressive strength of a block.



River sand, quarry "white" sand and crushed rock (concassé) (with a higher quantity of 5mm particles) can all be used in the production of blocks. (MTPTC 9th Feb 2010, http://www.radiokiskeya.com/spip.php?article6520)

Our testing of blocks over the past year has shown distinct differences in compressive strength when using different aggregates and while results are still being compiled, crushed rock appears to perform best followed by quarry sand, then river sand.

These results align well with the better mechanical friction shown by aggregates with larger more angular particles such as those seen in crushed rock (concassé) .

RECOMMENDATION 2. "A Careful Selection of Aggregates"

Aggregate Strength Comparison	
Number of samples tested:	123
Production method:	Mechanical and manual
Aggregates tested:	Crushed rock (concassé), white sand, river sand
Ratio used:	1:7
Average compressive strength for crushed rock (concassé)	13.2 MPa
Average compressive strength for white sand	7.76 MPa
Average compressive strength for river sand	5.50 MPa
Best performance:	Crushed rock (concassé)

RECOMMENDATION 2. "A Careful Selection of Aggregates"



"Concassé" performs very well in block production. Rocks are hard and highly angular with low amounts of fine materials. Block makers can produce "Concassé" by carefully selecting rocks from the river or quarry and milling them onsite.



Quarry sand is mainly from two varieties of limestone. Larger particles are angular but can be soft and caked in dust. Washing is recommended. Despite a high percentage of finer particles good results can be achieved with this sand.



River sand must be washed and sieved to remove silts and organic debris. Particles are noticeably rounder from erosion.
If used unwashed, a higher amount of cement has shown to be necessary.

RECOMMENDATION 2. "A Careful Selection of Aggregates"

Granulometry testing (measuring the quantity of different size particles within an aggregate) shows that the amount of fine particles in an aggregate have a direct effect on the compressive strength.

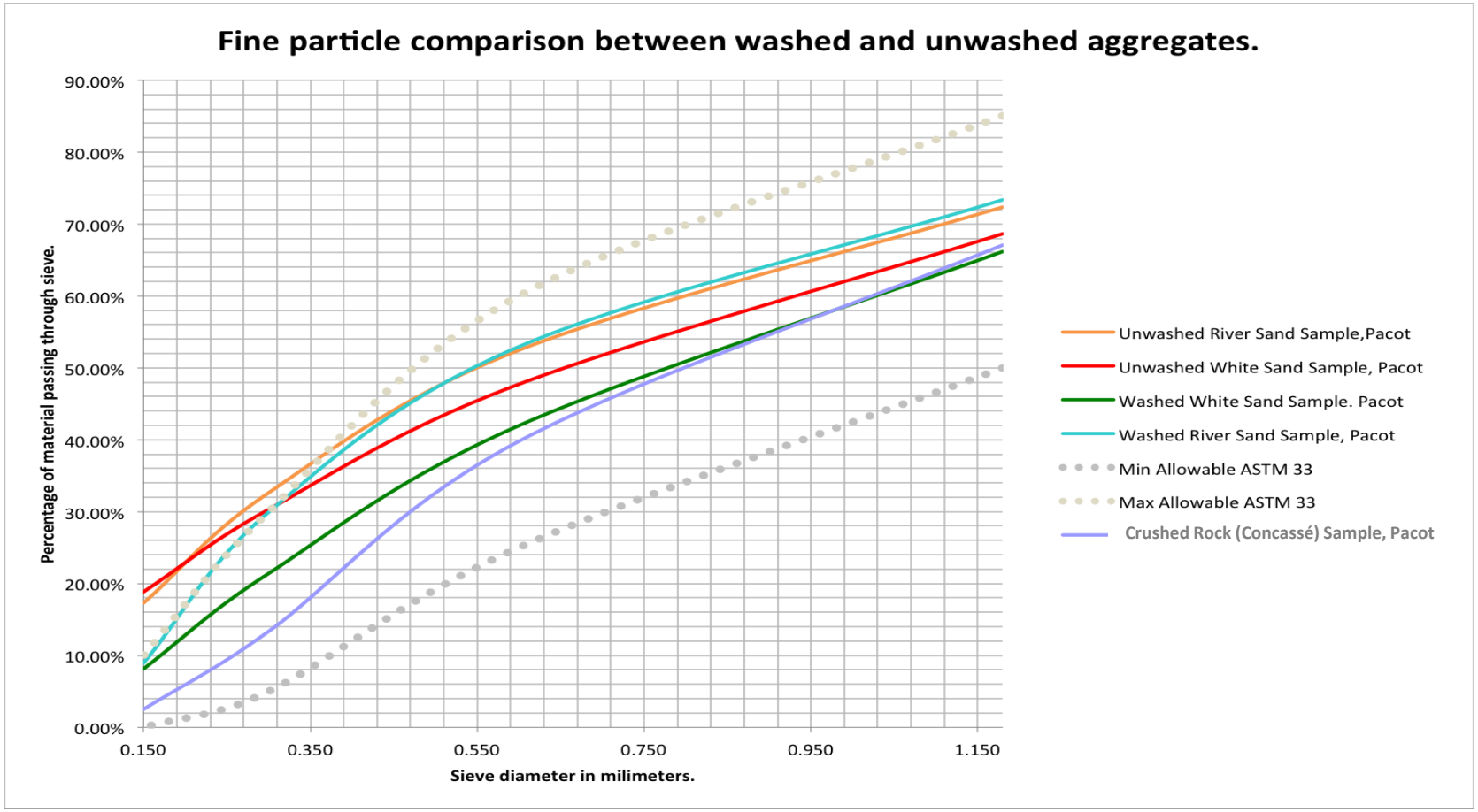
Unwashed samples of both river sand and quarry sand can have a similarly high fine particle content.

Washing and rinsing of aggregates has shown both the expected reduction in fine particles and a distinct increase in MPa.

Please see the following chart and table for specific results.



RECOMMENDATION 2. "A Careful Selection of Aggregates"



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RECOMMENDATION 2. "A Careful Selection of Aggregates"

Washing Strength Comparison		
Number of samples tested:	48	
Production method:	Mechanical	
Aggregates tested:	White/ river sand washed and unwashed	
Ratio used:	1:7 and 1:5	
Av. compressive strength for river sand 1:7:	Washed: 4.18 MPa	Unwashed: 1.48 MPa
Av. compressive strength for river sand 1:5:	Washed: 9.19 MPa	Unwashed: 5.06 MPa
Av. compressive strength for white sand 1:7:	Washed: 8.16 MPa	Unwashed: 4.80 MPa
Best performance:	Washed aggregates perform better.	

RECOMMENDATION 3. "Sufficient Mixing and Compaction"

Block makers generally mix large quantities of material at one time and mixing is hardly ever adequate.

The lack of mixing can lead to weak points in the block. These will be the first to break in a compression test and once compromised, the rest of the block will follow shortly.

Our general recommendation is similar to that used in other areas of construction, and involves passing the dry mix from one side to another until the whole mix is a UNIFORM COLOR. Only then should water be added.



RECOMMENDATION 3. "Sufficient Mixing and Compaction "





A block is only as strong as it's weakest part, so an even and regular mix is extremely important. This block maker does not mix well enough, leading to a substandard block (4MPa).

RECOMMENDATION 3. "Sufficient Mixing and Compaction"



Shifting the pile from side to side at least three times will help ensure the UNIFORM COLOR of the mix.

RECOMMENDATION 3. "Sufficient Mixing and Compaction"

Compaction ability while producing blocks may vary greatly from place to place, depending on the use of manual or mechanical compactors.

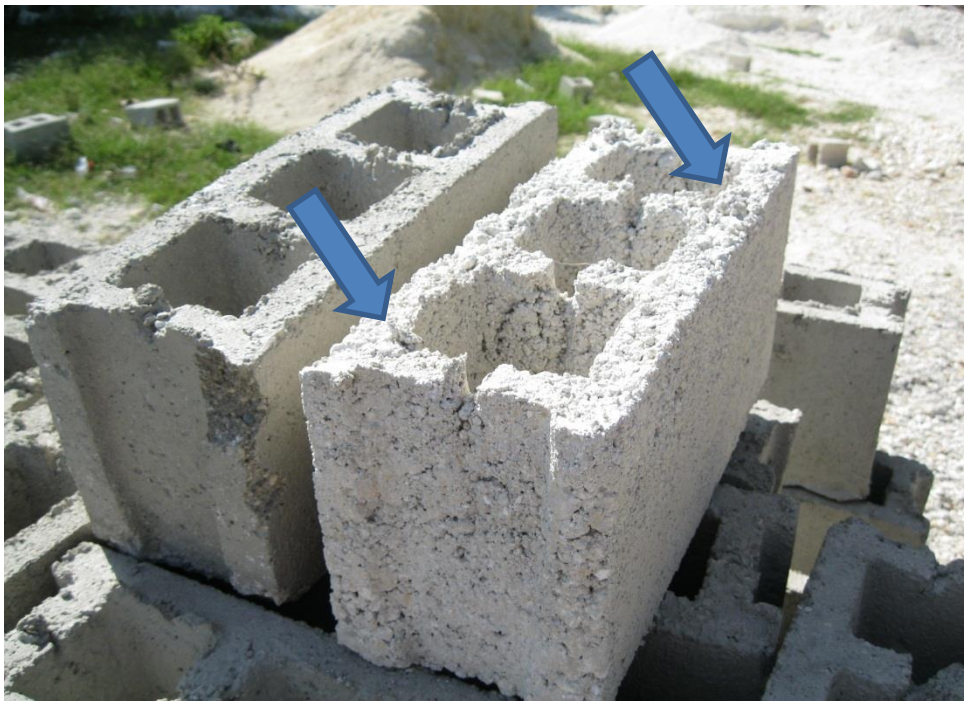
It is generally found that mechanical vibrators perform better, though block makers with manual molds are also capable of reaching the MTPTC guideline of 10 MPa.

It has been observed that certain block makers working mechanically reduce vibrating time as much as possible by releasing the matrix (the weight that presses on the blocks) before the mix has had a chance to settle adequately.



This reduces the material needed for each block and increases daily production. Though research is still being conducted on this practice, it is believed to have a large negative impact on the final compressive strength of the block.

RECOMMENDATION 3. "Sufficient Mixing and Compaction"



A rough finish on the top and sides of the block (RIGHT) is an indication of insufficient general compaction.



"Bands" of different smoothness indicate a mix of compacted and non compacted areas. A block is only as strong as it's weakest point!

RECOMMENDATION 3. "Sufficient Mixing and Compaction"





A smooth and regular finish on the top and sides shows good compaction throughout the block.

RECOMMENDATION 3. "Sufficient Mixing and Compaction"

Mechanical Vs. Manual Compaction Comparison	
Number of samples tested:	150
Production method:	Mechanical and manual
Aggregates tested:	White sand, river sand, crushed rock (concassé)
Ratio used:	1:7
Av. manual compressive strength before training:	2.79 MPa
Av. manual compressive strength after training:	7.15 MPa
Av. mechanical compressive strength before training:	4.63 MPa
Av. mechanical compressive strength after training:	8.38 MPa

RECOMMENDATION 4. "Adequate Curing"

As in any product made out of cement, curing is extremely important. At 18 days blocks have reached 90% of their strength and are adequate to sell.

Blocks sold before this time may still be susceptible to shrinking and may easily be damaged during transport.

Blocks should be wet for 7 days after production (once in the morning and once in the evening) so the cement has an opportunity to dry as slowly as possible (the longer cement takes to cure, the higher compressive strength it finally has).

Other methods should also be used to avoid moisture loss, such as covering blocks with plastic when they are first made and keeping them under the shade for the whole 18 day period.



RECOMMENDATION 4. "Adequate Curing"



The common practice of leaving the blocks in the sun to dry severely affects the proper curing of the block and is reflected in a lower final compressive strength.

RECOMMENDATION 4. "Adequate Curing"





The longer blocks are allowed to retain their moisture the stronger the final compressive strength will be.

Summary of Recommendations:

BUILD CHANGE GLOBAL RECOMMENDATIONS	BUILD CHANGE SPECIFIC RECOMMENDATIONS
Use a ratio of 1 cement to 7 sand.	Ratios must vary according to the quality of aggregate used. A higher ratio of cement (1:5) is usually needed when using unwashed river sand. A standard ratio (1:7) produces good results for white sand and crushed rock. A variety of mixes can be made and tested before establishing the best ratio for a selected aggregate.
Used washed aggregate of less than 10mm in diameter.	Aggregates of various types can be used in block making, though crushed rock (which is angular with a variety of grain sizes) consistently provides good results in compressive strength.
Mix until a uniform color and compact well.	Mechanical compaction is recommended but not necessary to reach MTPTC guidelines. A vibration of 4 to 5 seconds is considered the minimum time needed to produce good quality blocks with these means. If compacting manually, ensure all faces are not excessively porous and have a similar smoothness throughout.
Wet cure blocks for 7 days and store for another 10 in the shade before sale.	The correct curing is essential in any cement product. Haiti's tropical climate causes fast evaporation so in addition to wetting blocks (at least twice a day, morning and night) additional measures should be taken to avoid moisture loss such as covering them with plastic or tarpaulins during the wet cure period.

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PART 2.

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PART 2a. “Purchasing Responsibly. The Role of NGO’s in Promoting Quality Block Making”

Producing good quality blocks in Haiti is still expensive. Quality blocks CURRENTLY need to be sold at between 35 and 40 Gourdes each. This is 40% to 60% higher than the 25 Gourdes for a bad quality block.

Homeowners with low resources are still largely unaware of the dangers of purchasing bad quality blocks and those who do many times lack the resources for their purchase.

Because of this low demand for quality blocks, many TRAINED block makers with the capacity to make better blocks choose not to do so for the fear of not being able to sell them.

This concern was present in last year’s pilot project and is still the main worry for all of the block makers Build Change is working with today.

It is because of this limitation, that a large portion of this year’s program is dedicated to the promotion of those block makers that show a capacity and willingness to produce high quality blocks.

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Continued…

Build Change has been raising awareness of the use of quality construction materials in Haiti for the past two years.

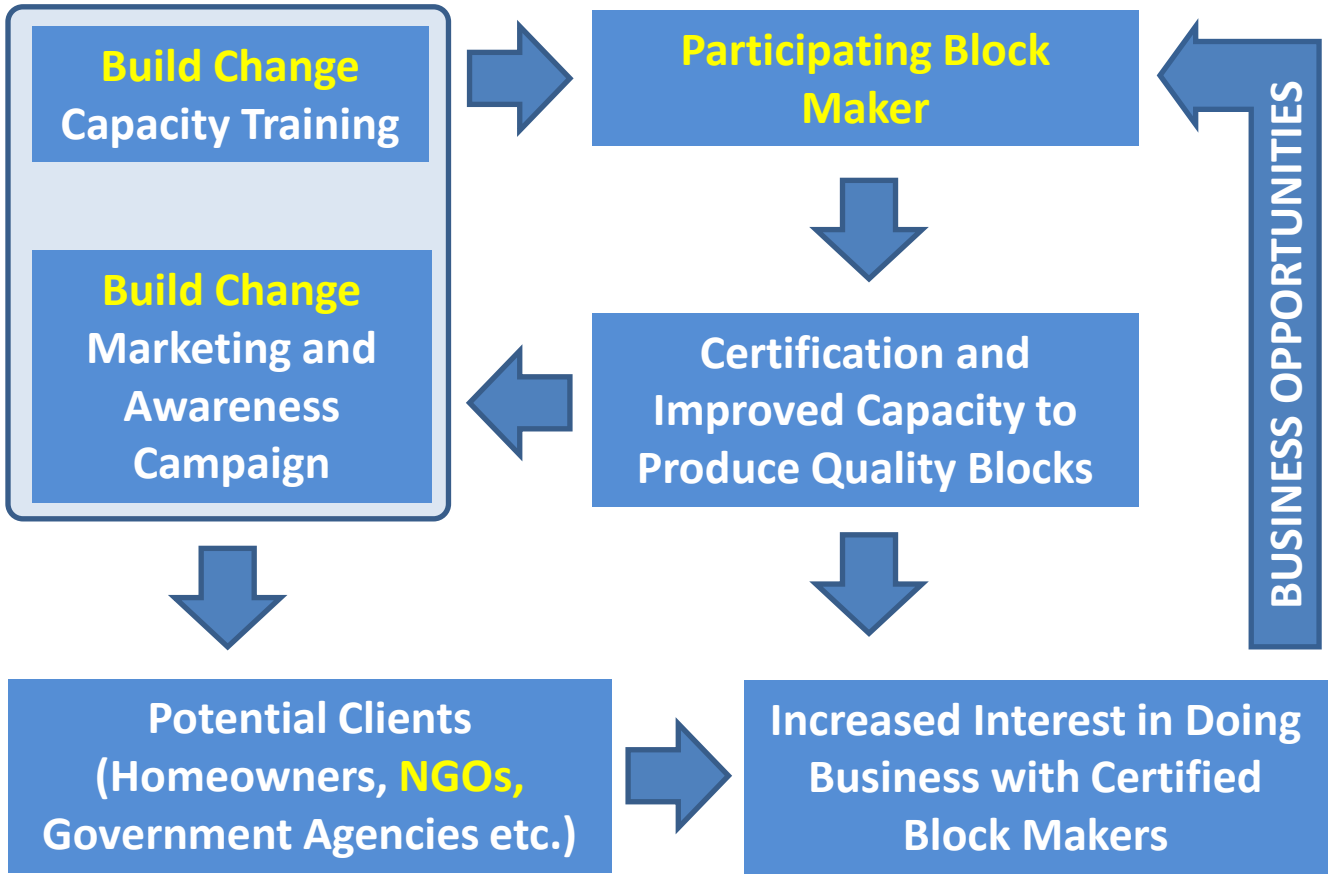
This year's block making program includes marketing and awareness events, conducted for each certified block maker where clients and neighboring homeowners can learn about the importance of using good quality blocks, and the costs and benefits of purchasing them.

However, we recognize that changing HOMEOWNERS' perceptions about investing in good quality material is a long-term project, and not one that is going to create the market for good quality blocks that we need right now.

While we are continuing to work with homeowners, there is another potential client that will help kick start the quality block economy. These are the organizations currently preparing their permanent reconstruction projects in Haiti.

Build Change's priority is to link organizations that understand the extensive benefits of purchasing good quality blocks with the Build Change certified SME (Small and Medium Enterprise) block makers that can produce them.

PART 2a. "Purchasing Responsibly. The Role of NGO's in Promoting Quality Block Making"



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FIVE Benefits of Purchasing Quality Blocks.

1. Purchasing from a certified block maker will **INCREASE THE EARTHQUAKE RESISTANCE OF YOUR STRUCTURES**. This is important in all construction, but especially for family homes and public buildings such as schools, orphanages, clinics etc.

2. Purchasing from a selected certified block maker will ensure **YOUR BLOCKS WILL MEET MTPTC GUIDELINES**, giving you peace of mind and facilitating your procurement process.

3. Purchasing from a certified block maker will **GIVE NEW OPPORTUNITIES TO SMALL BUSINESSES** that have decided to be responsible for the quality of the products they produce.

4. Purchasing from a certified block maker will **EXPAND THE INTEREST IN PRODUCING GOOD QUALITY BLOCKS** to other block makers. This in turn will increase the availability of good blocks to homeowners who are willing to make the right choice for their own homes.

5. Promoting the fact that you are purchasing from a certified block maker will **RAISE FURTHER AWARENESS** in the international community so the market for good blocks can continue to expand and competition between makers can bring prices down.

FIVE Benefits of Purchasing Quality Blocks Continued...

In addition to these extensive benefits for the purchaser, interest in good quality blocks would allow certified block makers to invest more money back into their business, employ more people and continue to improve the quality of their blocks.

Organizations that are contracting out services can also help support certified block makers by including language in their contracts that will ensure contractors either buy from a certified block maker or are required to reach a certain level of quality.

With multiple testing facilities available and a list of people capable of producing quality blocks organizations no longer have to be afraid of enforcing their contracts and contractors have no excuse not to respect them.

PART 2b. What Do I Need To Do? Getting Involved, A Step by Step Guide.

Getting involved is easy. Build Change is currently working alongside 20 certified block makers that can now produce blocks over 10 MPa blocks.

This list is continually expanding and will soon include all those block makers we are working with that are already producing blocks above Build Change standards of 7 MPa.

By filling out a pledge form (see last page) or contacting Build Change we will introduce you to the certified block maker of your choice and join you in a site visit to his or her production yard.

We will be happy to lead you through the whole production process in detail and to answer any questions you may have.

Build Change does not get involved in any price negotiation for the purchase of blocks. That will be left exclusively to the purchaser and the block maker.

Build Change is also very happy to provide testing services for agencies requiring further proof of the quality of the batch they are planning to purchase.

PART 2c. Acknowledgements.

The reconstruction and rehabilitation projects currently undertaken by the government and the international community are designed not only to ensure earthquake resistant homes but develop local businesses and tackle unemployment.

We would like to encourage you to continue this work by using BUILD CHANGE CERTIFIED BLOCK MAKERS for your block purchasing necessities.

Together, we can make blocks following MTPTC guidelines widely available to the general public at an affordable price by providing business opportunities for those willing to make a positive change.

We would like to take this opportunity to thank MTPTC for their extensive work in promoting the use of better quality blocks and also those agencies that have already taken an interest in this project and whom we are working with to establish block makers' first business networks.

Build Change management would also like to thank Hugh Bregazzi and Chiara McKenney for their continuing research on this project and above all the Build Change team (you know who you are!) responsible for training and mentoring block maker's on a daily basis.

A very special thanks also to Save The Children for their belief and support in this project. We look forward to future successes together.

PART 2c. Contact Details.

Build Change and Save the Children are currently supporting over 45 Block makers in communities throughout Port Au Prince by improving their capacity to produce high quality blocks for construction.

Build Change also supports 15 additional block makers in other areas such as Croix de Bouquets, Kanaan and Jacmel with the aim of improving the earthquake resistance of reconstruction projects across Haiti.

Please feel free to contact any of the following Build Change staff for queries regarding our training services or the purchase of good quality blocks.

Gilles Loret	**Block Making Program Manager**	**gilles@buildchange.org** **+(509) 48 90 26 88**
Michael Collins	**Construction Training Team Leader**	**michael@buildchange.org** **+(509) 31 70 52 95**
Kate Landry	**Fund Development Officer**	**kate@buildchange.org** **+(509) 31 70 27 87**

Are YOU willing to make a statement?

Our Statement: *"Stronger concrete blocks make for safer buildings"*

- In construction, a good concrete block provides support for roofs and strength for walls.
- Most blocks produced in Haiti don't reach the recommended compressive strength of 10 Megapascals, reaching only 3-5. That's less than half!
- Bad concrete blocks used for construction throughout Haiti were a major contributing factor to building collapse and the large death toll in the January 12th 2010 earthquake.

Our Statement: *"With the right kind of support every block maker can make a better block"*

- Block makers supported by Build Change in Haiti have shown that compressive block strength can be doubled with proper mixing and curing, even when blocks are made by hand!
- Better blocks require more cement to be made and more working capital to cure. Block makers selling better blocks are usually undercut by a large market of cheaply made bad blocks.
- A market can be opened by increasing awareness of the need for better blocks and supporting and promoting block makers that currently produce them.

Our Statement: *"Purchasing good blocks is best for safety, best for business, best for Haiti"*

- International organizations can improve the earthquake safety of their reconstruction projects by ensuring to buy good quality blocks from a certified block maker.
- NGO building projects lead the current reconstruction efforts in Haiti, potentially requiring millions of concrete blocks. NGO purchases can make a life changing difference to responsible small and medium block making businesses in Haiti.
- By purchasing carefully and raising awareness, the overall production of good quality blocks in Haiti can be increased in a sustainable way.

Please take our survey and commit to purchasing better blocks today!

1. Does your organization/do your sub-contractors purchase blocks for reconstruction projects? Yes / No
2. Do the blocks used meet MTPTC guidelines for construction in earthquake zones? Yes / No / I don't know
3. Where is the project (s) located? _____

We, _____ pledge to buy good quality blocks by:

Organization

☐ Seeking Build Change's services to build the capacity of our current supplier, and/or

☐ Purchasing blocks from Build Change-certified suppliers

Contact Name: _____

Contact Telephone: _____

Contact Email: _____

Please return this pledge form or send electronically to gilles@buildchange.org.

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With Support from:

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

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