

# Construction Tool Kit

## Botswana

### Recommended equipment for the work site:

- Protective clothing
  - Goggles
  - Gloves
  - Steel capped boots
  - Dust masks
  - Hard hats

### General tips for health and safety on the work site:

- **Common sense will serve you well during your build**, for example: if a tool appears to be substandard it probably is and should not be used. If you feel uncomfortable performing any task, then please do not do it.
- **Think before you start something.** Do you have all of the required tools? Is there something that looks unsafe? Can I work in the shade rather than the sun?
- **A safe worksite is a tidy worksite.** Clean your area of anything that may pose a trip or other safety hazard such as bricks or timber. Cover or place tape around any holes. Check equipment before using and report any defects. Inspect the site for dangers, nails sticking out of wood, bars protruding from the walls etc and make them safe. Check materials such as block stacks for rodents, snakes or scorpions.
- If you **see anything that looks unsafe please call it to the attention of your** supervisor (Team Leader and Host Coordinator) as soon as possible.
- You may be working in hot and humid conditions. Try to **drink at least 3 liters of water** a day and take frequent breaks in the shade. Reapply sun cream often.
- Stretch before working.
- If you **feel at all ill, STOP** work and inform the Team Leader or Host Coordinator immediately.
- **Pace yourself.** Team members often try to work too hard on their first day and run out of energy early. Keep some reserves for the rest of the week.
- **Always wear steel capped boots** to protect your feet from falling objects, sharp objects (nails, broken glasses).
- Goggles will save your eyes from dust and eye injuries.
- **Gloves will save your hands** from blisters, cuts, splinters and cracking.
- Dust masks will save you from inhaling dust.
- Most injuries occur from **improper lifting.** Use your legs and not your back for leverage. Please review the proper lifting techniques found in this book. A demonstration will be given at the worksite.
- **Wear your hard hat at all times when in the work site.**
- **Treat any scratches immediately.** Clean the cut, apply and antiseptic wipe or lotion and cover the area. There is a first aid kit on all work sites.

- **Report any accidents**, however minor, to the team leader or host coordinator.
- **Check tools before using.**
- While working, **watch out for loose gravel** and slippery slopes.
- **Horseplay on the worksite can cause injuries** so please take care and watch out for others.
- **Stay away from dogs, cats and animals in general.**
- **Please don't smoke on the worksite.**
- **No alcohol on site.**

### **Cultural Norms for Botswana**

- ✓ When visiting the Chief, women are expected to put on knee-long dresses and not wear pants/shorts/trousers/tank tops/muscle tops.

### **Typical Habitat house in Botswana**



### **Basic building materials for the house**

- Bricks
- Iron sheets
- Mortar
- Timber
- Concrete

# Best Practices on the worksite

## Proper Lifting Techniques

- Stand close to the load with your feet shoulder width apart, one foot slightly in front of the other for balance.
- Squat down, bending at the knees and not the waist. Keep your chin in and your back as vertical as possible.
- Secure a firm grasp of the object before lifting.
- Begin slowly lifting with your legs by straightening them. Do not twist your body during this step. If you must turn, use your feet and not your torso.
- Once the lift is completed, keep the subject as close to the body as possible.
- To place the object below the level of your waist, follow the same procedures in reverse order. Remember to keep your back as vertical as possible and bend the knees. If the object is awkward or too heavy for you, please ask for help. Ensure there are no obstructions in your path before lifting any object; that you can see around the load when lifting it; and that there is adequate room to place the load after you moved it.

## Transporting Goods in a wheelbarrow

### Equipment:

- Wheelbarrow
- Gloves
- Steel capped boots

### Process:

1. Inspect wheelbarrow for defects, and report any problem to the site supervisor for correction.
2. Inspect the intended path of transport and remove any hazards.
3. Place wheelbarrow on flat surface facing in the direction you will be moving it and put material to be moved in the centre.
4. To transport: place feet shoulder-width apart, grasp handles firmly, keep back straight, bend at knees, and bring the handles upward, using the power in your legs. Maintain balance, steady the load, and walk forward in an upright position.
5. Stop and use legs to lower the wheelbarrow tires on an even, solid surface.
6. Take the material from the barrow taking care to maintain its balance.
7. When dumping the contents bring the wheelbarrow to a stop. Raise the handles using proper lifting techniques to the desired height and tip contents to the ground. Return it to the proper resting position with tires on the ground.

## Cement Block Passing Line

### Equipment:

- Gloves
- Cement Blocks
- Steel capped boots

### Process:

1. Form a line, alternating men and women whenever possible.
2. Clear loose gravel and other debris from the path.
3. The first person should pick up the block from the pile and dump out the dirt.
4. Each block weighs 15 kilos or 33 pounds so be prepared to accept it from your neighbor and to pass it on down the line - it is best to keep the momentum of the block going.
5. Minimize your movement - you must be close enough to each other so that you pass the block without twisting the upper body and without taking any steps.
6. When holding the block, place one hand on a top corner and the other on the opposite bottom corner.



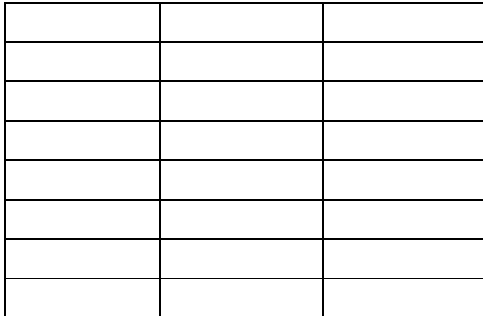
Your hands



Next person's hands

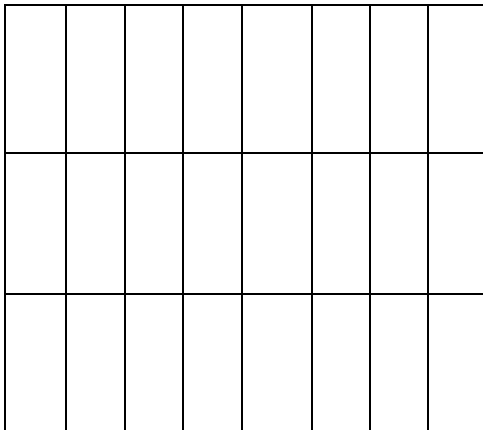


Stack the blocks flat side up in layers of 8 blocks by 3 blocks, alternating 3x8 and 8x3



3 x 8

First layer



8 x 3

Second layer



### Mixing Mortar / Concrete

Concrete is a mixture of sand, cement, water and small aggregate stone. This mixture is placed in excavated foundations and tamped down to allow foundation walls to be built on the top.

#### Equipment:

- Gloves
- Goggles
- Pans
- Tamping tool
- Steel capped boots

- Buckets
- Cement, Sand and Water
- Shovels

**Process:**

1. Two or more people will work at this station with a Habitat staff member.
2. Please keep shovels in the water barrels when not in use so people do not trip on them.
3. The cement bags weigh 50 kilos or 110 lbs each and need at least two people, and preferably a wheel barrel, to move.
4. Dump 18 buckets of sand on the mixing platform, creating a mound of sand.
5. Place a bag of cement on top of the mound and open it with the corner of your shovel.
6. Slowly pour the cement on top of the mound of sand.



7. Mix the sand and cement together by moving the mound to one side, making a new mound, and then back to its original position.
8. Open the mound, moving the mixture away from the center to create a volcano.
9. Fill the crater of the volcano with 5 buckets of water.



10. Take a 5 minute break while the mortar soaks up the water.
11. After 5 minutes, slowly move the mortar from the inside edge of the volcano walls towards the center of the crater to absorb the water.



12. Take care not to break a wall, allowing water to escape.
13. Once the water is mostly absorbed, mix in the mortar from the outside edges of the volcano.
14. A properly mixed batch of mortar is the consistency of cake batter.
15. Depending on weather conditions, different amounts of water may need to be added to the mixture to maintain the proper consistency (An experienced HFH staff member will help with this judgment).
16. The mortar will be moved to the construction area with the buckets or wheel barrows.
17. Only fill the buckets half-way because a full bucket is difficult to carry due to its weight.



### Using a saw to cut wood

#### Equipment:

- Gloves
- Saw
- Marking pencil

#### Process:

1. Use pencil to indicate desired cut, and clearly mark.
2. Pick up the saw with the blade facing downward.
3. Grasp the handle and place blade in line with pencil marking. Use your other hand to help position the saw blade if necessary.

4. Draw the saw towards you with enough pressure on the blade to ensure initial cut, then push away keeping the blade on the pencil line and keep pushing and pulling the blade in a straight line.
5. To prevent the wood from binding, keep it level at all times. Continue with steady downward strokes until wood is cut clean through.

### **Using a claw hammer for nailing**

#### **Equipment:**

- Gloves
- Claw hammer
- Nails

#### **Process:**

1. Grasp the hammer with the hand that is most comfortable with and face the circular head of the hammer downward.
2. Position the nail in the desired location with the other hand. Bring hammer upward and strike the nail head with a light force, ensuring nail is slightly embedded in the wood.
3. Repeat downward stroke with adequate force to ensure nail is driven into desired depth.

### **Handling iron sheets**

#### **Equipment:**

- Gloves
- Hard hat
- Trousers
- Steel capped boots

#### **Process:**

1. Plan your route of transport
2. Using the proper lifting techniques, grasp one end of the iron sheet with both gloved hands, and lift upward to comfortable height for carrying.
3. Take care as gusts of wind could disrupt the balance of weight.
4. To handle the sheet to the construction supervisor or construction worker on the roof, place sheet on ground, one end skyward. Grasp both sides of sheet with both hands and use legs to power lift the sheet to the construction supervisor or construction worker the construction supervisor or construction worker. Ensure the construction supervisor or construction worker has secure grip on sheet before releasing.
5. Keep an eye on the sheet as you move away from the area.



## **Breaking stone**

### **Equipment:**

- Gloves
- Goggles
- Long trousers
- Steel capped boots
- Sledgehammer

### **Materials:**

- Selected stone for foundation, plastering or floor work

### **Process:**

1. Choose a site away from other people. Using proper lifting techniques select 2-3 large stones and arrange them in a close triangle.
2. Select stone to be broken and place on top of the three larger stones. It should make contact with these three stones and form a steady platform.
3. Wear goggles and face away from other people, stand with feet shoulder width apart, and grasp handle with both hands. Hammerhead should be pointed downward or resting on the ground.
4. With two hands, bring the sledgehammer up over head, while maintaining balance. Aiming for the stone allow for the sledgehammer to fall forward and bring both arms forward in a forceful manner making contact with the hammer head and stone. Repeat until the stone breaks.
5. Secure the stone again or select a new stone and repeat process.

## **Handling Cement**

Cement bags weigh 50kgs and must be carried by two people using proper lifting techniques.

- Place one end of the bag on the ground. Wearing a dust mask and goggles cut open the top of the bag, keeping the blade turned away from you.
- Use the builder's trowels or other suitable tool to remove cement from the bag.
- If cement makes contact with skin wash off immediately with water.

## **Shifting Stone**

### **Equipment:**

- Gloves
- Steel capped boots

### **Process:**

1. Inspect the ground for uneven terrain and potential hazards. Clear as necessary.
2. Select desired stone from pile and grasp with two hands and place feet shoulder-width apart.
3. With firm footing, lift stone to waist level, using the muscles in your legs and turn your body away from the pile, using your feet to rotate, not your torso. Walk slowly away from pile.
4. To place stone on the ground, hold it securely with two hands and lower it to the designated spot while keeping the back straight. Keep feet shoulder width apart.

## **Digging foundations**

This is a strenuous activity that requires frequent rest and water intake.

### **Equipment:**

- Shovel or spade
- Breaking bar
- Tape measure
- Gloves
- Steel capped boots
- Hard hat
- Goggles

### **Process:**

1. Check the depth of the foundations with your supervisor before you begin and dig in between the designated lines.
2. Maintain consistency in depth and width throughout the excavation, if you remove too much material it can be costly to fill it up again.
3. Remove soil, stones, etc using proper lifting techniques.
4. Avoid side collapsing by distributing soil over a wider area on top.
5. Use assistance when entering or exiting the hole.

## Building walls

### Equipment:

- Gloves
- Trowel and a Bucket of Mortar
- Hammer
- Measuring Tape
- Stringlines/builder's line
- Cement Blocks

### Process:

1. A Habitat staff member will walk through the design of the house, showing you where windows and doors will be located and the block layout for off centered windows and doorways.
2. First, you must retrieve a bucket of mortar from the mortar mixing station.
3. Starting next to a column or previous block, use your trowel to spread a layer of mortar on top of the previous row of blocks.
4. The mortar bed should be around 3cm thick and should be spread for approx. 45 cm, just past where the new block will end.



5. With the trowel, create a trough running the length the mortar bed to help fill the holes in the bottom of the block.
6. Two string lines are set at 7cm and 18cm above the top of the previous row to help you line up the outside edge of the new block with the outside edge of the wall.
7. The block should be placed 2mm from these string lines.
8. Use the wooden block to space bricks properly.
9. Remove the block once you have placed two bricks side by side.
10. Using a trowel, fill the gap with cement.



11. When setting the block on top of the fresh mortar, hold the block the same way as when you were passing the blocks and set (do not drop) the block gently on top of the mortar.



12. Tap the block into place with the heel of a trowel or hammer and check to make sure it is 2mm from the string lines and level on top.
13. You may have to fill in some spaces between the blocks with more mortar- if you feel unsure of the spacing, please consult HFH staff.
14. Scrape off any excess mortar from both sides of the new block and mix it back in with the mortar in your bucket.
15. Always check to make sure the tops of your blocks are flat and at the same level as the previous block.
16. After you have laid your first few blocks, have an expert inspect your work to make sure you are on the right track.



#### **Half blocks:**

1. Half blocks are used at the beginning of every other row.
2. Partial blocks are used to fill the gap remaining at the end of most rows.
3. To make a partial block, measure the size of the hole and take 3cm off to allow for the mortar.
4. Measure that length on a new block and draw a line with the hammer across the block where you want it to break.
5. Holding the hammer head at an angle, tap along the line until the block starts to crack.
6. Continue to tap until the block breaks.
7. The broken side of the brick should be placed against the wall.



## Flat iron sheets roof

### Equipment:

- Gloves
- Assembled rafters
- Wire and Wire Cutters
- Iron sheets
- Roofing nails
- Claw hammer

### Process:

1. Lift iron sheets, place and level them to the rafters.
2. Iron sheets will be nailed to the rafter frame using a claw hammer and roofing nails.
3. Use your left hand to hold the nail and the right hand to hit the nail with a claw hammer.

