



RETROFIT PICTURE GUIDE

Visual Aid in the Execution of Seismic Retrofits

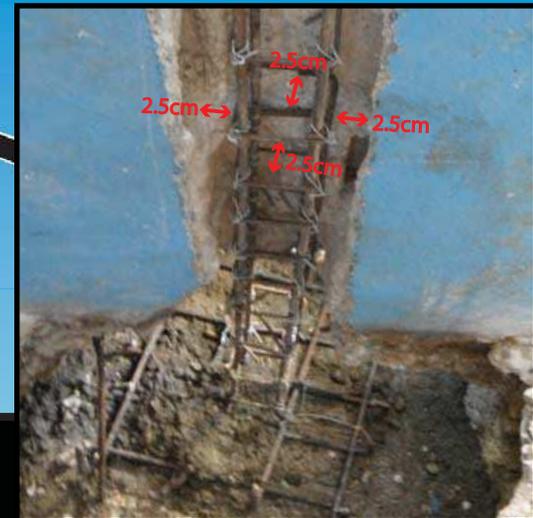
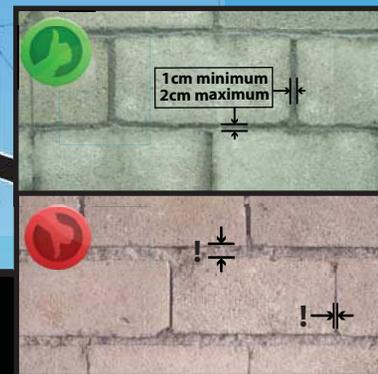
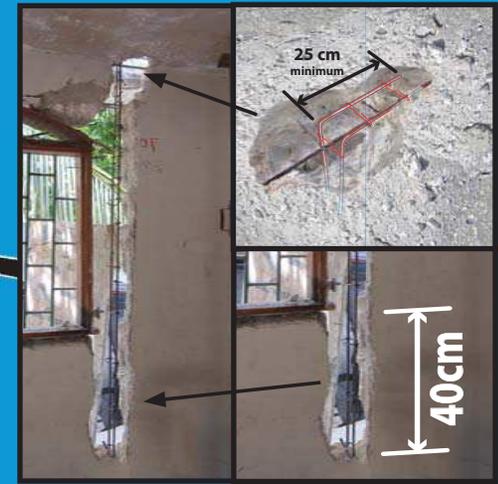




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DISCLAIMER:

These construction guidelines are intended for use by qualified engineers only. Use of these materials is inappropriate without due regard for the assumptions, limitations and disclaimers set forth in the materials, and the use of selected information in these materials is inappropriate absent due consideration of the context in which some select information occurs. Build Change does not accept any liability for damages or injuries resulting from the use of these guidelines.

These are guidelines for execution and do not substitute for a site-specific retrofit assessment and design by a qualified engineer. Procedures for site-specific assessment and retrofit design can be found in the following document:



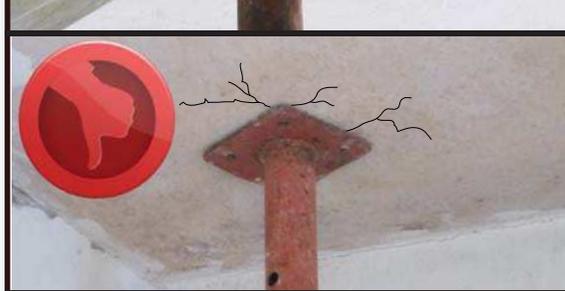
*Evaluation Sismique et Manuel de Renforcement,
Build Change & Degenkolb Engineers, 2011*



Shoring of Concrete Slabs



1. Only use the intended prop key. Do not use undersized pieces.



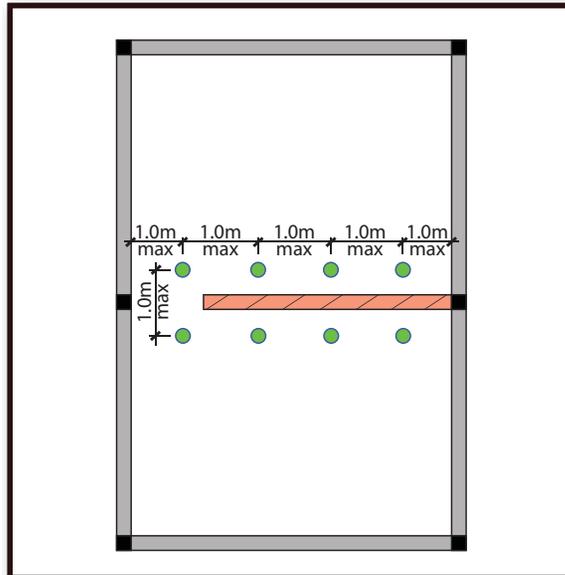
2. Attach a flat piece of lumber (2x4 minimum) to either end of the shoring prop. Do NOT place the prop directly touching the slab above.



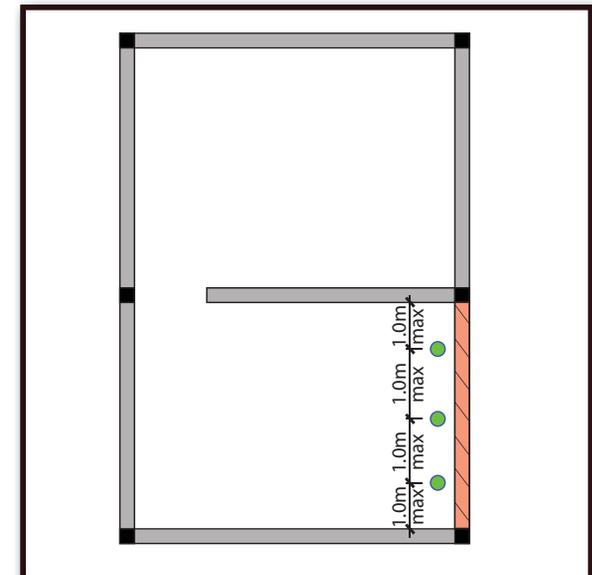
3. Ensure metal shoring is plumb by checking it with a level in two perpendicular directions.



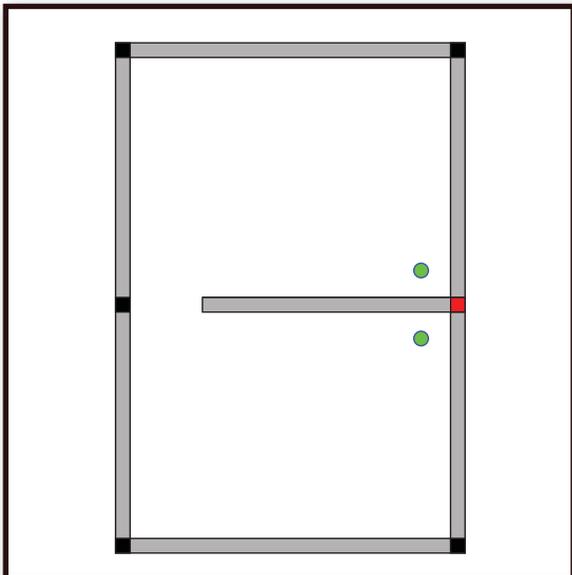
4. Space props at a maximum of 1 meter apart before doing any demolition work that involves breaking walls, columns, slabs or other elements that support the roof or floor above.



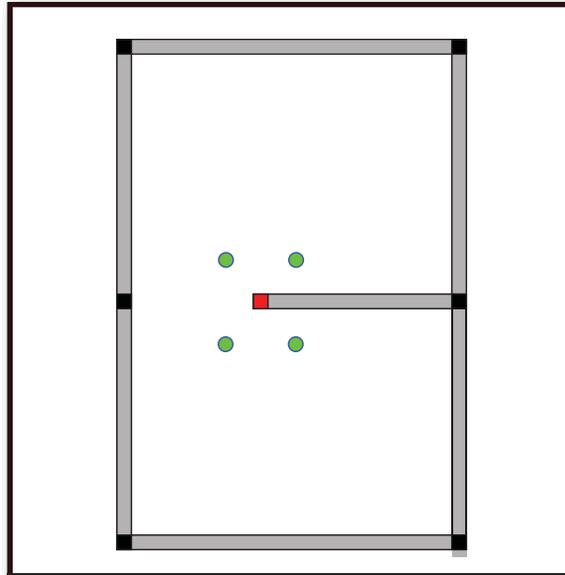
5. For an interior wall, or exterior wall with an overhang, place a line of shoring on each side of the wall.



6. For an exterior wall without an overhang, place one line of shoring on the interior side of the house.



7. For an exterior column without a slab overhang, place one shoring prop on either side of the column being supported.



8. For an interior column or exterior column with a slab overhang, use a minimum of 4 props equally spaced around the column.

Concrete and Mortar Mixing



1. Find a clean surface to mix on. Do not mix on dirt.



1.



2.



3.

2. Using buckets to control the proportions, batch out gravel first, then sand, then cement. In the case of mortar, empty sand then cement.



1



2



3

3. Shovel the mix from pile to pile three times, or until the mixture is the same color throughout.



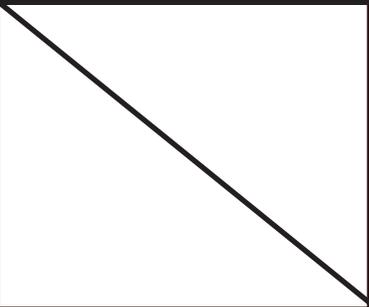
4. Open a depression in the middle of the pile and slowly add water. Take care when mixing not to let streams of water flow from the pool and away from the pile.



5. Continue to mix and add water, until the entire mix is uniform and of the desired consistency. Only mix as much as can be used within a half hour to avoid having to re-wet.



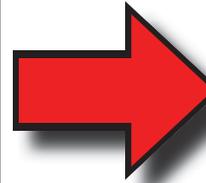
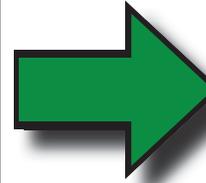
6. Add enough water for the concrete to flow and be workable when poured, but not so much that the concrete drips when picked up. Excess water decreases strength.

	Cement	Sand	Gravel
Structural Concrete	1 	2 	3 
Mortar and Plaster	1 	5 	

Making Concrete Spacers



Concrete spacers are essential to ensure that there is sufficient cover around all reinforcing bars and steel will not be exposed when the columns and beams are poured.



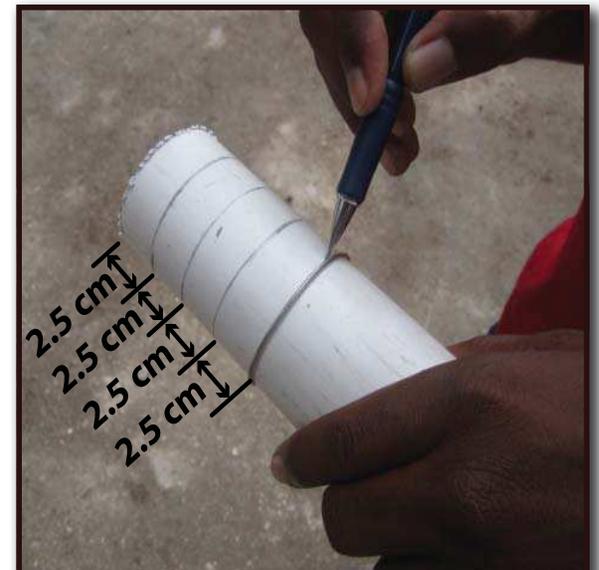
There are several methods to make concrete spacers, each using a different material to form the spacers. Choose the method that is most appropriate based on the materials available. On the following page, the use of PVC forms is shown.



1. Cut binding wire and bend as shown above. The loop should be about the size of pinkie finger or 2cm in diameter. Make one of these for each spacer you plan on making.



2. Tie a piece of binding wire around a PVC pipe. This will serve as a guide to mark a line around the outside of the PVC pipe.



3. Mark lines on the PVC pipe at 2.5cm intervals.



4. Cut the PVC as marked in the previous step.



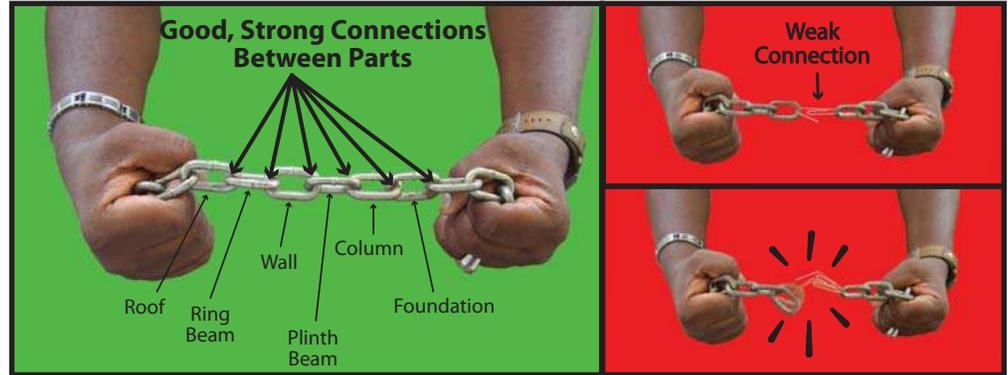
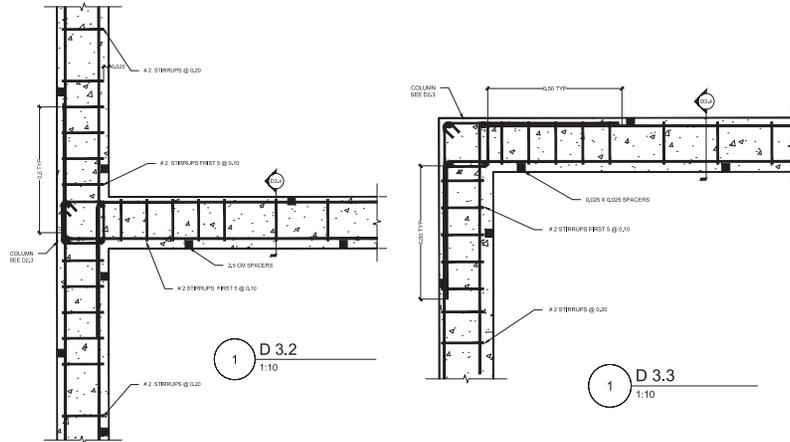
5. Cut each form as shown. This will make it easier to remove forms once spacers are made.



6. Fill the form with concrete and insert binding wire. Sprinkle the spacers with water regularly. After two days the spacers will be hard enough to use. The PVC forms can be removed and reused indefinitely.

Connections and Joint Detailing

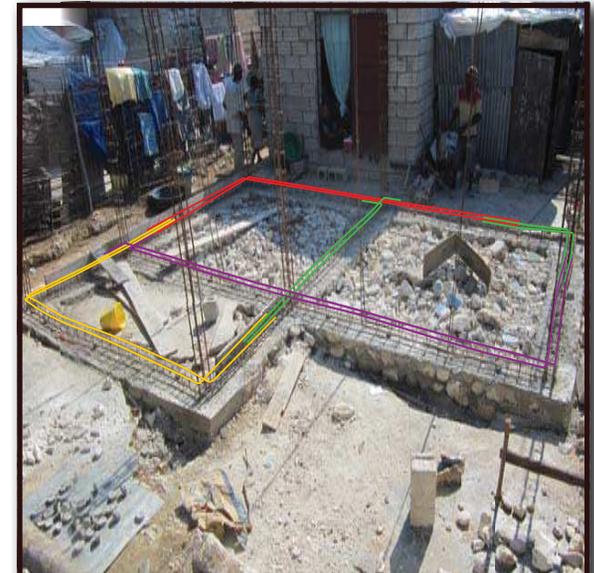
Connections are an extremely important part of seismic retrofit and earthquake resistant construction. A weak connection between elements can cause the entire system to fail. Therefore it is important to pay special attention to the connections.



1. Don't use short hooks to make connections.



2. The preferred methods for detailing T and L joints are shown above



3. Keep bars continuous through joints and uncut as long as practically possible. This will minimize steel wastage and reduce the number of splices.

4. Avoid bending steel at an inside corner. Instead the bar should pass through the corner and arrive on the other side.

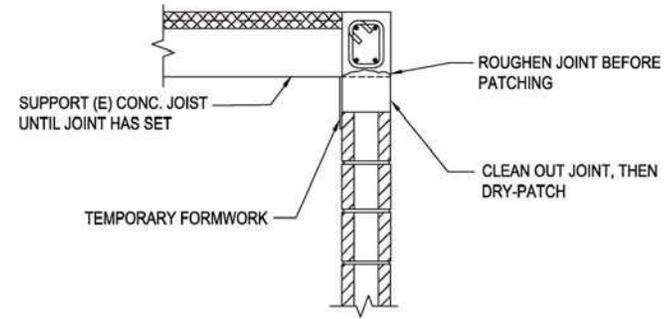
5. Splice lengths that are too short are NEVER to be accepted, and must be redone or corrected.

6. Wherever a bar ends, make sure there is an adequate splice with the next bar. Splices should be 40cm for 3/8" bars and 50cm for 1/2" bars.

7. Near beam-column joints, space the first 6 stirrups at 10cm. Space all other stirrups at 20cm.

8. In certain cases, such as in small, space confined areas, it may not be possible to continue the longitudinal bars through the joint as show in steps 2 and 3. In these cases it may be permitted to cut the longitudinal bars at the joint and use L or U shaped pieces to make the connection. However, this method is less economical and less strong, and should therefore only be used in cases when steps 2 and 3 are not possible.

Wall to Slab Connection Repair



1. Shore the underside of the slab. (See pgs. 1-2)



2. Roughen the underside of the slab along the length of the block wall.



3. Attach formwork to one side of the gap. One method is to use concrete nails and binding wire to secure a 2x4 as shown above.



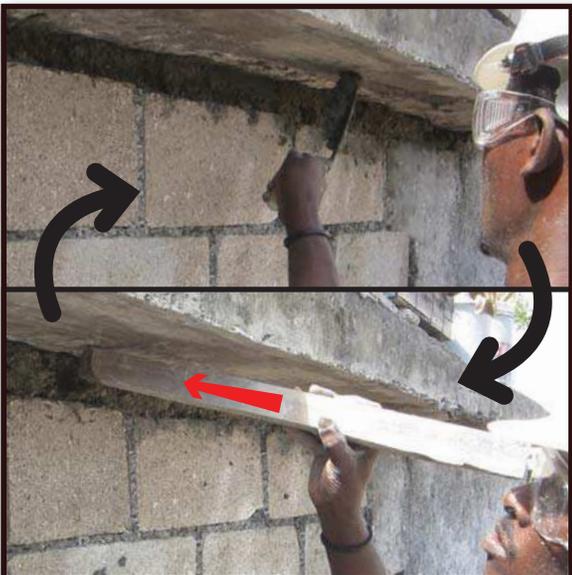
4. Prepare a non-shrink grout. This is a 1:3 mortar mix with very little water added. The mix must be very dry, which will help prevent slumping during placement and shrinkage in the future.



5. Add some of this grout to the top joint above the blocks. This should be done opposite the side that was blocked off in step 3.



6. Using a tool with a blunt end, such as a peice of lumber, pack the grout tightly into the joint.



7. Continue to add grout and pack, bit by bit, until the entire top joint has been completely filled with a dense and well compacted grout.



8. Finish the top joint smooth by applying pressure with a trowel.



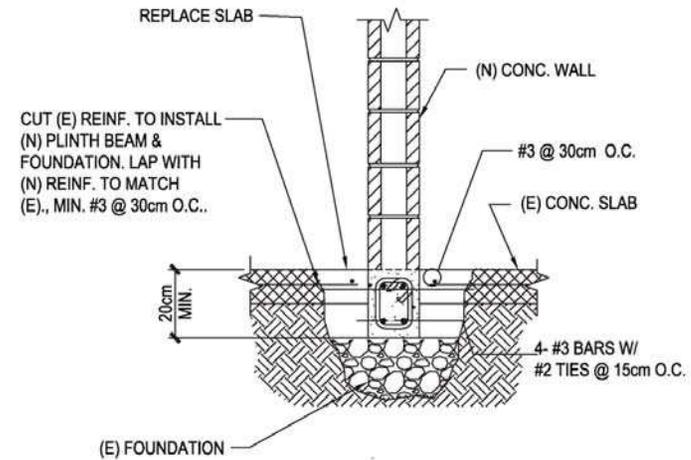
9. The top joint must be well compacted and completely filled. Cure the mortar for 3 days. Check the joint again after one week to ensure there are no gaps due to shrinkage.



Checklist

1	Surface Preparation	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	All loose and flakey material has been removed	Yes/No				Yes/No			
b	Roughen underside of slab using chisel	Yes/No				Yes/No			
2	Mortar Mixing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use mortar 1:2 mix	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			
d	Use Type 1 Cement	Yes / No				Yes / No			
e	Mix on a clean, concrete or asphalt surface, not on dirt	Yes / No				Yes / No			
f	Turn over 3 times or until color is uniform	Yes / No				Yes / No			
g	Add just enough water so that you can form a ball of mortar that sticks together.	Yes / No				Yes / No			
3	Implementation	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use hammer and wooden dowel to pack mortar into joint.	Yes / No				Yes / No			
b	Joint completely filled	Yes / No				Yes / No			

New Plinth Beam on Existing Foundation



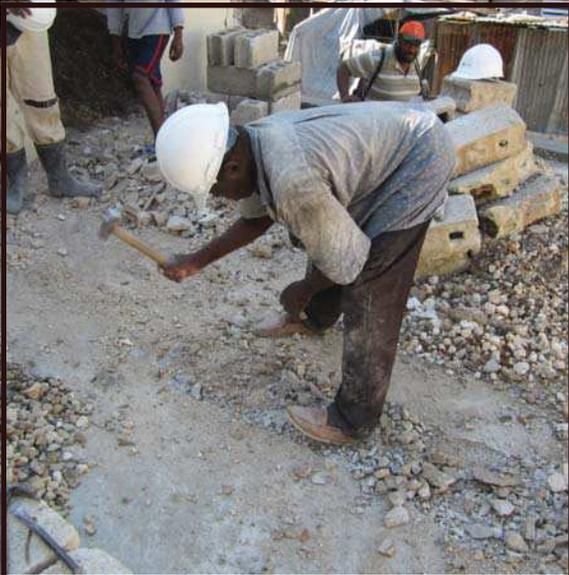
1. In a convenient place, such as the location of a new column, excavate to expose the existing foundation.



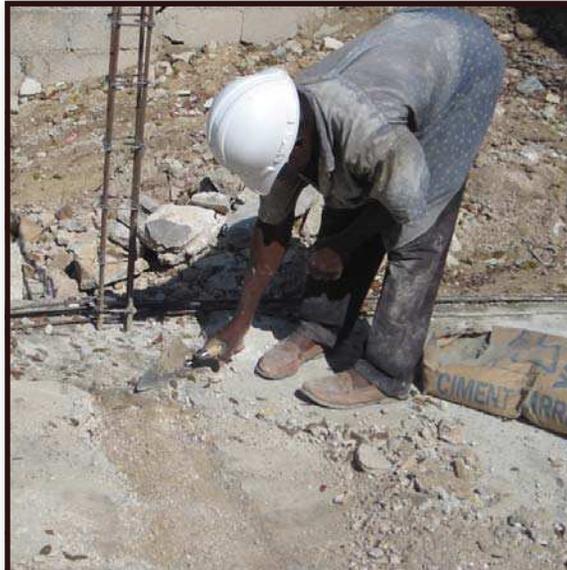
2. Measure the dimensions of the foundation and ensure that it meets minimum requirements. Widening or complete replacement of the foundation may be required.



3. Use a string to mark a straight line along the edges of where the plinth beam will go. Make sure that the plinth beam will be aligned with any columns, new and existing.



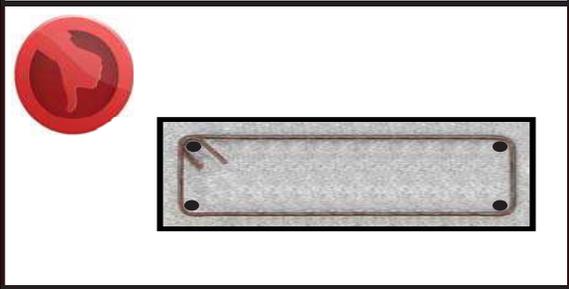
4. Break out the floor slab along the marked lines until you reach the top of the existing stone masonry foundation.



5. Clean debris from the surface where the plinth beam will be poured.



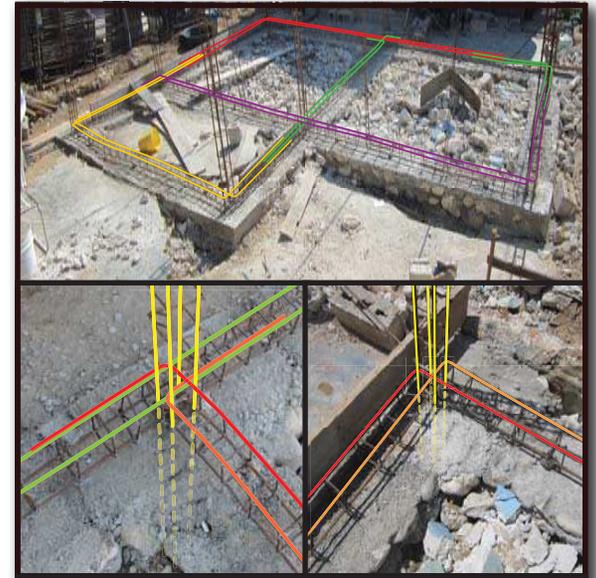
6. After supporting the structure, break out the base of existing columns and devise a good connection from the plinth beam to existing columns and additional reinforcement, (see pgs. 7-8).



7. Make stirrups 10cm x 10cm or 5 cm less than the width of a block. There is no need to make stirrups extra wide.



8. Tie plinth beam using four 1/2" Ø bars. Use 1/4" Ø stirrups at 10cm within 50cm of joints and 20cm elsewhere.



9. Keep longitudinal bars continuous as long as practically possible and follow all connection rules, (see pgs. 7-8).



10. Place formwork. Using a string, ensure that the edges of the plinth beam will be straight.



11. Use spacers and a string to ensure at least 2.5cm of cover around all reinforcing steel. Use a water level to set the height of the string. This will ensure that the surface on which blocks will be laid is level.



12. Set the width of the plinth beam using concrete blocks and/or wood formwork spacers. Make sure the plinth beam width is at least the width of the block in all places.



13. Moisten the formwork and the top of the existing foundation.



14. Place the concrete. Tap the formwork with a hammer to properly consolidate the concrete. Roughen the top surface of the plinth beam with a trowel to create a better bond between the beam and the block mortar.



15. Cure the concrete 3 times a day for a minimum of 3 days. After this, remove the formwork and begin building the wall.

Checklist

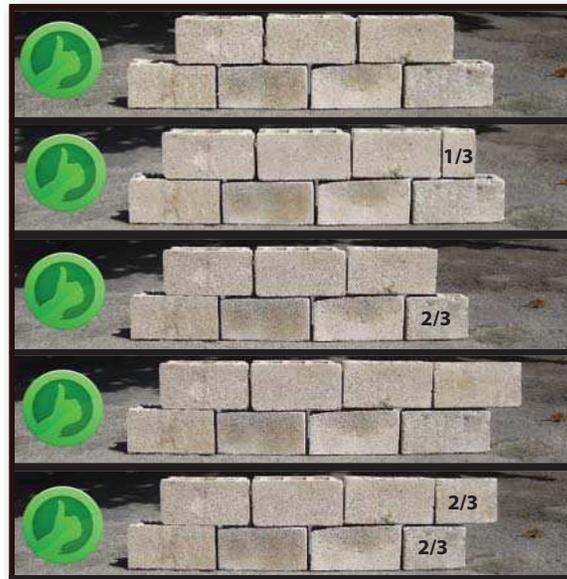
1	Setting-out	Implemented correctly ?
a	Wall axis marked out in accordance with the plan	Yes/No
b	Width of strip to be broken-out marked out correctly	
1	Slab unreinforced - 40cm to be broken out	Yes/No
2	Slab reinforced - 100 x diameter of slab reinforcement	Yes/No
2	Preparatory works	Implemented correctly ?
a	Slab broken out to correct width	Yes/No
b	If present, slab reinforcement cut centrally and bent back on both sides	Yes/No
c	Does the existing foundation meet the requirements of the MTPTC	Yes/No
5	Plinth Beam	Implemented correctly ?
a	20 cm wide, 15cm high	Yes/ No
b	Longitudinal Bars	
1	Four #3 (3/8") longitudinal bars	Yes/ No
2	Minimum Strength = Grade 60 or...	Yes/ No
3	Grade 40 for single story buildings with lightweight roofs	Yes/ No
5	Type of longitudinal bars RIBBED	Yes/ No
c	Stirrups	
1	#2 closed stirrups	Yes/ No
2	Stirrup hooks bent at 135 degrees	Yes/ No
3	Hook length for stirrup minimum 4 cm	Yes/ No
4	Cover over steel minimum 2.5 cm	Yes/ No
6	Bar Assembly	Implemented correctly ?
a	Beam Stirrups	
1	Stirrup spacing maximum 20cm	Yes/ No
2	Stirrups closely spaced (10cm) near all beam-column joints	Yes/ No
3	Stirrup hooks rotated	Yes/ No
4	Stirrups tied to longitudinal bars with binding wire	Yes/ No
b	Joint Detailing	
1	Minimum lap length = 50Ø (50cm for #3 bars, 60cm for #4 bars)	Yes/ No
2	Apply one of overlap detailing options	Yes/ No
3	Use extra L or T bars only if bars not cut properly	Yes/ No
4	All bent bars at corners and T-junctions bent at 90 degrees	Yes/ No
5	Laps tied with binding wire	Yes/ No
3	Reinstating cut reinforcement	Implemented correctly ?
a	If slab reinforcement present	
1	Slab reinforcement re-bent into horizontal position	Yes/ No
2	Cut reinforcement spliced using bar of same or larger diameter	Yes/ No
3	Minimum lap length = 50Ø (30cm for #2 bars, 50cm for #3 bars)	Yes/ No
b	Reinforcement parallel to wall	
1	Type of longitudinal bars RIBBED	Yes/ No
2	Reinforcement used - Two #3 bars @ 30cm spacing along the full length of wall	Yes/ No
3	Ensure minimum 2.5cm cover above and below all reinforcement	Yes/ No
4	FORMWORK and CONCRETE SPACER	Implemented correctly ?
a	Formwork is good quality (not warped)	Yes/ No
b	Use wood spacer to maintain distance between forms	Yes/ No
c	Space between steel and formwork minimum 3 cm	Yes/ No
d	Use concrete spacers every 3-4 stirrups or as req to maintain cover	Yes/ No
e	Maximum size for concrete spacer is 3 cm x 3 cm x 3 cm	Yes/ No
f	Use binding wire in concrete spacer	Yes/ No
g	Check formwork for beams is level	Yes/ No
h	Check formwork for columns is plumb	Yes/ No

6	CONCRETE MIXING	Implemented correctly ?
a	Use Mix 1:2:4	Yes/ No
b	Use crushed, angular gravel	Yes/ No
c	Use gravel with size less than 2 cm	Yes/ No
d	Use clean, washed river sand	Yes/ No
e	Use clean water (not salty or muddy)	Yes/ No
f	Use Type 1 Cement	Yes/ No
g	Mix a clean, concrete or asphalt surface, not on dirt	Yes/ No
h	Using a mechanical mixer is best	Yes/ No
i	Batch out gravel, then sand, then cement	Yes/ No
j	Turn over 3 times or until color is uniform	Yes/ No
k	Do not use too much water! Add water slowly	Yes/ No
l	Use slump test or hand test for water content	Yes/ No
7	CONCRETE POURING and CURING	Implemented correctly ?
a	Wet adjoining slab and steel before pouring concrete	Yes/ No
b	Use concrete within 90 minutes of mixing with water if from factory	Yes/ No
c	if manually use in less than 30 minutes	Yes/ No
d	Use rod to consolidate concrete around reinforcement	Yes/ No
e	Complete entire beam within one day	Yes/ No
f	If concrete pouring must stop, use a diagonal joint with stones	Yes/ No
g	Have plastic on standby, cover if it rains	Yes/ No
h	Cure for minimum 3 days by sprinkling clean water,	Yes/ No
i	Cure 5 times perday : MORNING, At 8 , 10	Yes/ No
j	AFTERNOON: 12, 14, 16, pour water slowly	Yes/ No
8	CONCRETE INSPECTION	Implemented correctly ?
a	If steel showing, demolish and rebuild	Yes/ No
b	Remove the border of slab and/or beams after 48 hours	Yes/ No
c	Any cracks larger than 3 mm	Yes/ No
d	Many cracks in one location	Yes/ No
e	If any of the above exist, demolish concrete and repour	Yes/ No

Masonry Wall Construction



1. Before laying any blocks with mortar, place the first two courses dry (without mortar) to determine the placement of the blocks and size of the vertical joints.



2. Above are five acceptable patterns for a block wall. Chose one that will best fit the length of wall in your particular case. Any 1/3 or 2/3 size blocks should be placed at the ends of the wall, not in the middle.

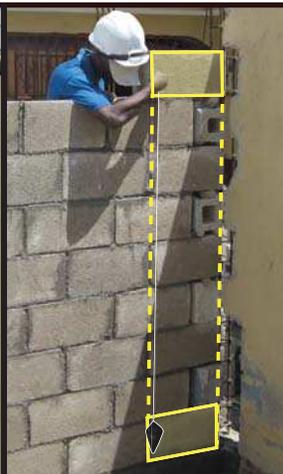


3. Ensure that the wall is in line with any columns and/or opening reinforcement. Then begin to lay the blocks.

METHOD 1: Using vertical profiles (storey poles) and a guide string is one way to achieve a good quality masonry wall.

				
<p>4a. Select wood that has at least one straight, unwarped edge. Use a planer to make the edge straight if needed.</p>	<p>Erect the profile with the straight edge plumb. Orient the profile so that the string will project from the straight, plumb edge.</p>	<p>Mark the levels of each course on the profile. Use a water level to make sure the wall will arrive to the same level on both ends.</p>	<p>Tie the guide string between profiles to the marked levels and lay block using the string as a guide.</p>	

METHOD 2: When vertical profiles are not available, the guide string can be tied between end blocks.

			
<p>4b. Start each row by placing the blocks at each end of the wall FIRST. These two blocks will serve as guides for the blocks in between, so make sure they are well laid. Use a plumb bob to set the end blocks to make sure that the wall is plumb and the vertical joint bonding (stagger) is correct.</p>		<p>Tie a guide string between the end blocks. Check to make sure the string is level.</p>	<p>Place blocks, using the string as a guide.</p>

5. Leave a small gap between the blocks and guide string to prevent displacement of the string. Don't place blocks without a guide string.

6. Blocks must have an overlap that is at least 1/3 of a full block length (13.5cm minimum).

7. Make sure all joints are well filled and of the correct size. All joints must be between 1cm and 2cm thick. Oversized joints are less strong and less economic than a correctly sized joint.

8. Never use peices of block any smaller than a 1/3 sized block. Partial blocks must have at least one cell intact.

9. Furrow bed joints so that mortar is concentrated under the face shells of blocks. This will eliminate waste and ensure that mortar is placed where it is really needed.

10. Lay each course of block following the pattern set by the first two courses. Continue to check that all basic rules are respected throughout the height of the wall.

1 MORTAR MIXING		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Use mortar 1:3 mix	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			
d	Use Type 1 Cement	Yes / No				Yes / No			
e	Mix a clean, concrete or asphalt surface, not on dirt	Yes / No				Yes / No			
f	Using a mechanical mixer is best	Yes / No				Yes / No			
g	Batch out gravel, then sand, then cement	Yes / No				Yes / No			
h	Turn over 3 times or until color is uniform	Yes / No				Yes / No			
i	Do not use too much water! Add water slowly	Yes / No				Yes / No			
2 WALL MASONRY		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Wet concrete blocks prior to use	Yes / No				Yes / No			
b	Use a line and deadman	Yes / No				Yes / No			
c	Prop up column steel so it remains plumb	Yes / No				Yes / No			
d	Use 1/3 bonding, chase the bond before starting	Yes / No				Yes / No			
e	Vibrate block	Yes / No				Yes / No			
f	Tooth wall at tie columns and openings by 1/3 block	Yes / No				Yes / No			
h	Maintain minimum 2.5 cm between block and column tie	Yes / No				Yes / No			
i	Maximum bed joint thickness 12.5mm	Yes / No				Yes / No			
k	Minimum head joint thickness 12.5mm	Yes / No				Yes / No			
j	Maximum variation in mortar joint size 4mm	Yes / No				Yes / No			
l	Prepare a reasonable amount of mortar to avoid wetting from time to time	Yes / No				Yes / No			
m	Pour the beam in one time	Yes / No				Yes / No			
n	Check the wall is plumb	Yes / No				Yes / No			
o	Maximum variation from plumb 2cm over 3m height	Yes / No				Yes / No			
p	Pour the column after completing min 1 m, max 1.2m height of wall	Yes / No				Yes / No			
q	Cure the wall 3 times per day for 3 days	Yes / No				Yes / No			
r	Check the top of the wall is level	Yes / No				Yes / No			
3 INTERMEDIATE RING BEAM		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Directly below window level, 8cm high, 15cm wide	Yes / No				Yes / No			
b	Use two #3 (3/8") bars	Yes / No				Yes / No			
c	Use #2 (1/4") stirrups spaced at 20 cm	Yes / No				Yes / No			
d	Apply one of overlap detailing options	Yes / No				Yes / No			
4 OPENING REINFORCEMENT		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Form 8x15cm column either side of openings	Yes / No				Yes / No			
b	Use 2 #4 (12mm) vertical bars	Yes / No				Yes / No			
c	Use #2 (1/4") stirrups at 15 cm spacing	Yes / No				Yes / No			
d	Tie reinforcement for doors into foundation beam	Yes / No				Yes / No			
e	Grout reinforcement for windows into blocks 50cm below sill beam	Yes / No				Yes / No			
f	Tie reinforcement into ring beam	Yes / No				Yes / No			
g	Use at least 40 cm overlap	Yes / No				Yes / No			
h	Fill space above door opening with lightweight material, or...	Yes / No				Yes / No			
i	Cast concrete lintel monolithic with ring beam	Yes / No				Yes / No			
j	Reinforce concrete lintel according to standard detail	Yes / No				Yes / No			
5 ELECTRICAL and PLUMBING		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Never break the wall to put electrical or plumbing	Yes / No				Yes / No			
b	Leave free space for utility piping	Yes / No				Yes / No			
6 POURING COLUMN CONCRETE		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Clean out the bottom before placing formwork	Yes / No				Yes / No			
b	Pour column in one day to the same height as wall	Yes / No				Yes / No			
c	Pour columns after minimum 1m wall built	Yes / No				Yes / No			
d	Distance between formwork and steel bars 25mm minimum	Yes / No				Yes / No			
e	Ensure toothed areas of columns completely filled with concrete	Yes / No				Yes / No			
7 FINISH THE WALL WITH PLASTER		Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	10mm plaster on both sides of walls	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			

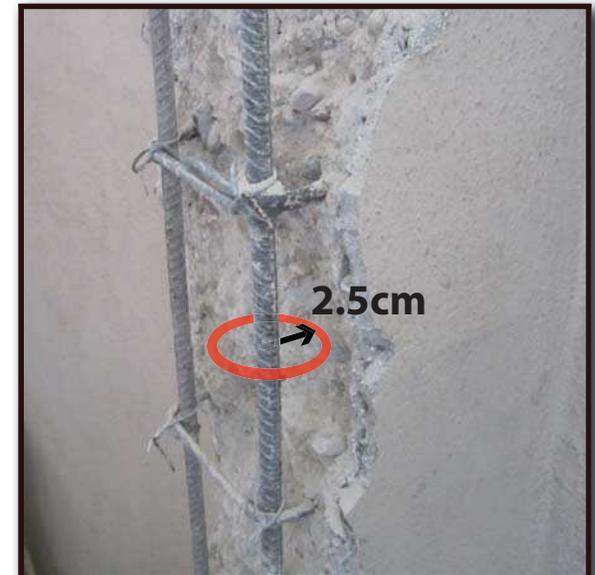
New Wall to Existing Column Connection



1. Before starting any demolition work, add shoring to support the slab, (see pgs. 1-2).



2. Break out the face of the existing column on the side that the new wall will attach to.



3. Break out enough concrete so that there is 2.5cm of space around each longitudinal bar along the length of the reinforcement. Brush the surface clean to remove bits of loose aggregate.



4. Break a hole in the slab at the top of the column through which the concrete can be poured.



5. Build the wall. Leave 5cm between the wall and reinforcing steel. Break a hole in the last cell to ensure good concrete quality along the toothed edge.



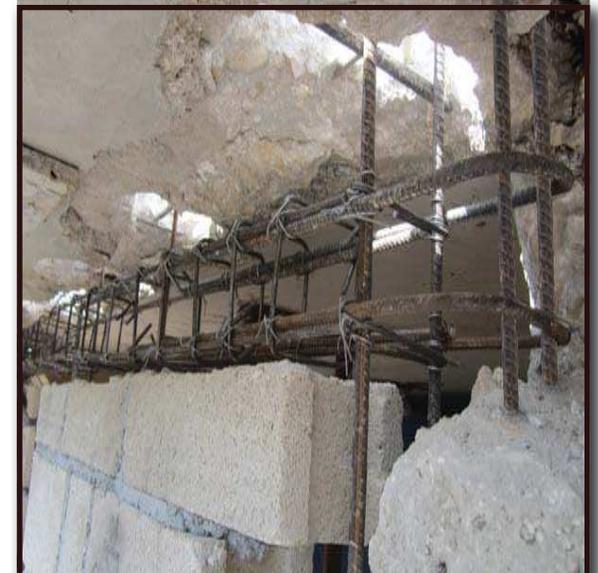
6. Every 2 courses of block, place a "C" tie to connect the wall and column. The tie should hook into a column stirrup on one end and enter into the cell of the block on the other end.



7. Form either side of the wall up to about half height and pour concrete. Hit the formwork with hammer to vibrate the concrete and use a rod to consolidate from above.



8. Pour the concrete in two lifts. This is necessary to ensure good quality concrete throughout the height of the narrow section. Using this method will also prevent the need to cut formwork to exactly the ceiling height.



9. Before pouring the second lift of concrete, refer to pages 26-29 to make the connection between the new wall and existing slab, and the connection between the ring beam and column.



10. After 48 hours, remove the formwork from the first lift of concrete and continue curing.



11. Place formwork to pour the upper half of the wall to column connection. The ring beam connecting the new wall to the slab should be poured at the same time.

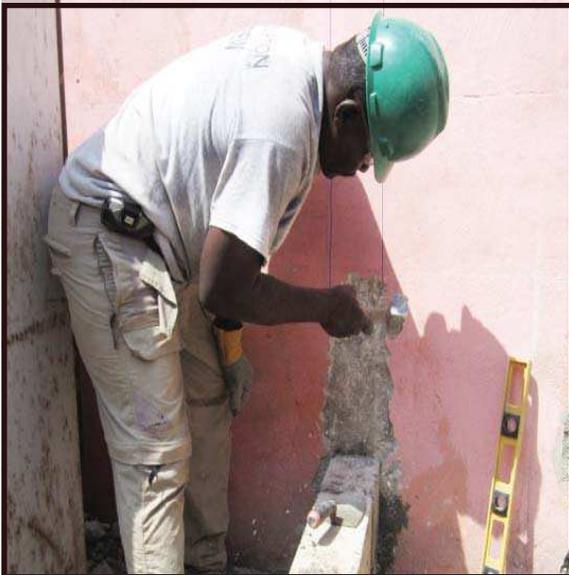
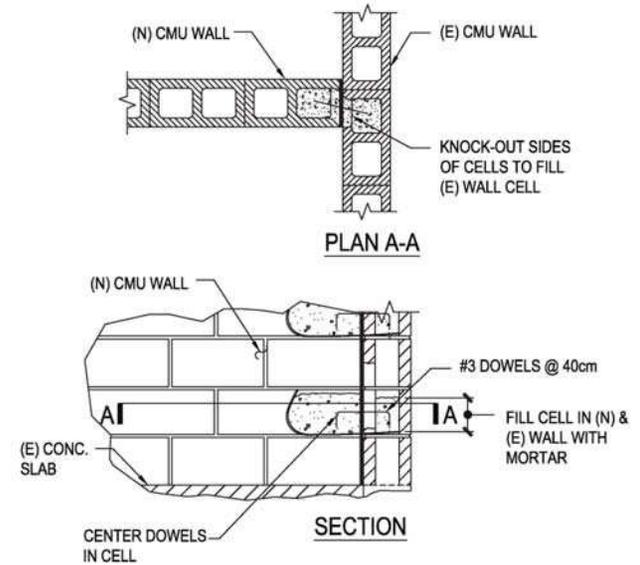


12. Pour concrete from above. Hit the formwork with hammer to vibrate the concrete and use a rod to consolidate from above.

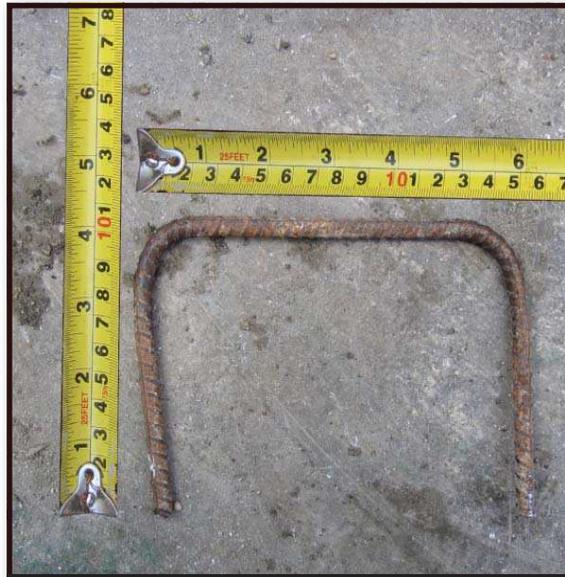


13. Remove the formwork after 48 hrs. Continue to cure the concrete as usual.

New Wall to Existing Wall Connection



1. Mark line of new wall on existing wall with the aid of a plumb bob. Roughen surface of existing wall to create a better bond between the new and old walls.



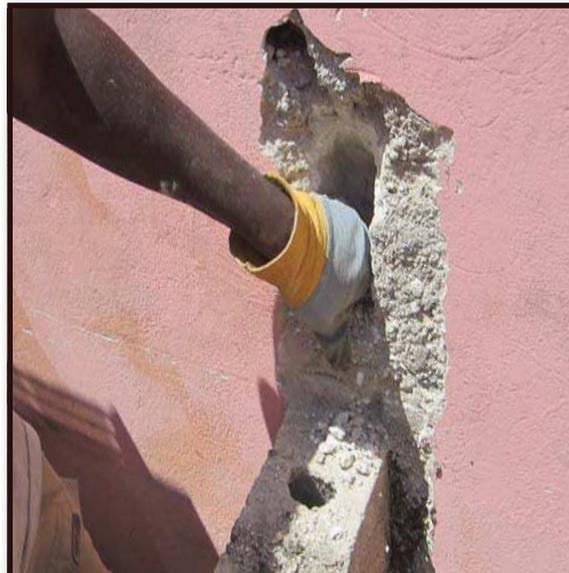
2. Create a "C" tie with a 3/8" Ø bar, 10cm x 15cm



3. In the place where you will put the "C" tie, knock out a hole in the existing wall.



4. Chip down into the hole to create space for the tie.



5. Clear debris from the hole



6. Water the roughened surface of the wall, the inside of the hole, and the block.



7. Using a full-sized block, knock open the cell from the top of the new block and cut a notch in the top rear edge of the block as shown.



8. Lay the new block next to the hole in the existing wall.



9. Fill the hole in the existing wall and the cell in the new block with mortar



10. Place the “C” tie into place to connect the old and new walls. Ensure the legs of the “C” tie are centered in the voids.



11. Cover the rest of the “C” tie with mortar. Make sure there is mortar surrounding all sides of the tie.

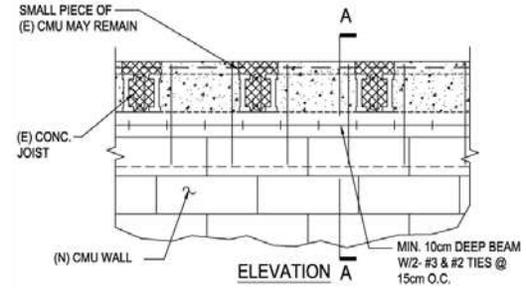
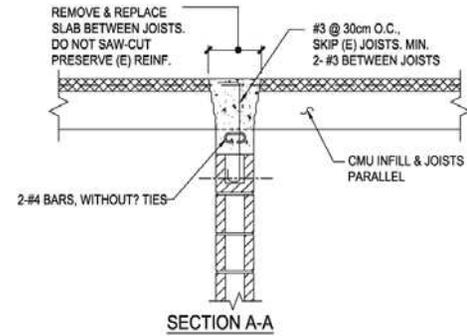


12. Repeat this step every two courses of block, using the tie on the full sized blocks and skipping the partial blocks.

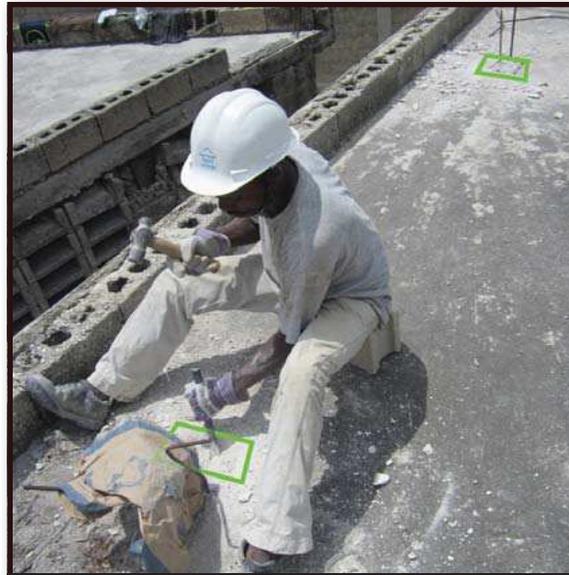
Checklist

1	Setting-out	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Wall axis marked out in accordance with the plan	Yes/No				Yes/No			
2	Preparatory works	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Existing wall propped prior to commencing breaking-out works	Yes/No				Yes/No			
b	Break out side wall of every second cell in line with the new wall	Yes/No				Yes/No			
5	Connection	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Reinforcement stiches								
1	#3 (3/8") stiches	Yes/ No				Yes/ No			
2	Minimum Strength = Grade 60	Yes/ No				Yes/ No			
3	Type of bar RIBBED	Yes/ No				Yes/ No			
4	Dimensions of stich = 10 x 15 x 10 cm	Yes/ No				Yes/ No			
5	Ensure stiches are placed centrally in cells	Yes/ No				Yes/ No			
b	Grouting of cells								
1	Ensure cells are completely filled with grout before laying next block course	Yes/ No				Yes/ No			
6	MORTAR MIXING	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use mortar 1:3 mix	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			
d	Use Type 1 Cement	Yes / No				Yes / No			
e	Mix a clean, concrete or asphalt surface, not on dirt	Yes / No				Yes / No			
f	Batch out gravel, then sand, then cement	Yes / No				Yes / No			
g	Turn over 3 times or until color is uniform	Yes / No				Yes / No			
h	Do not use too much water! Add water slowly	Yes / No				Yes / No			
i	Cure the wall 3 times per day for 3 days	Yes / No				Yes / No			

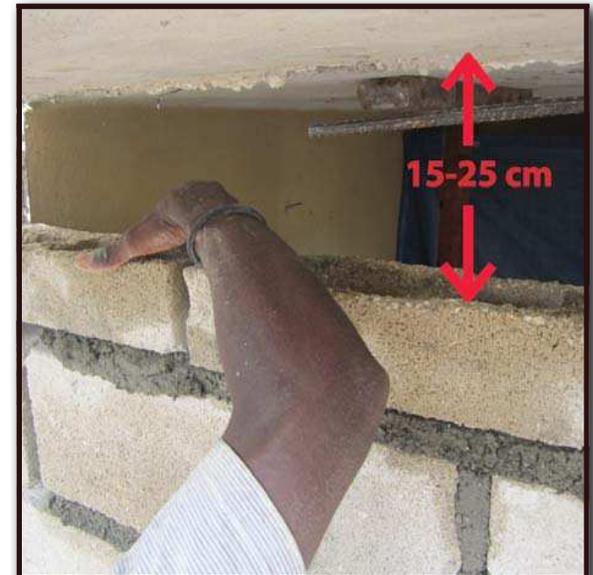
New Wall to Concrete Slab Connection



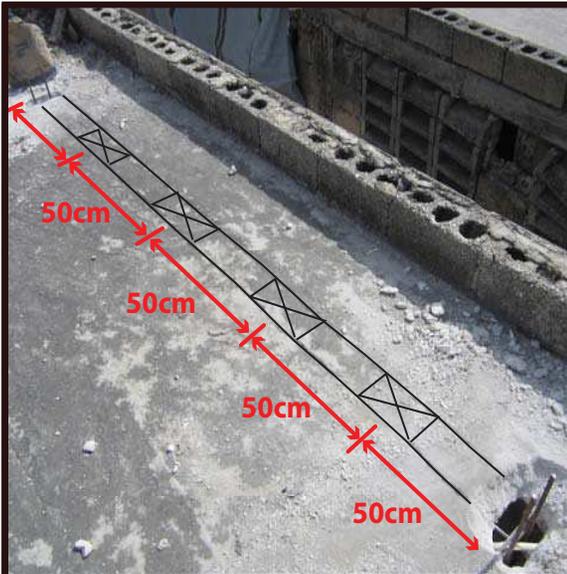
1. Before beginning any demolition work, shore the concrete slab.



2. Knock out two guide holes in the slab above at each end of the new wall.



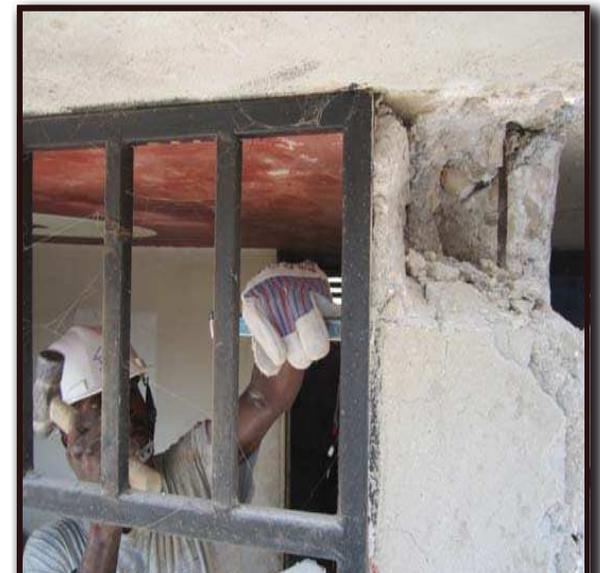
3. Build up the wall below to within 15-25 cm of the slab



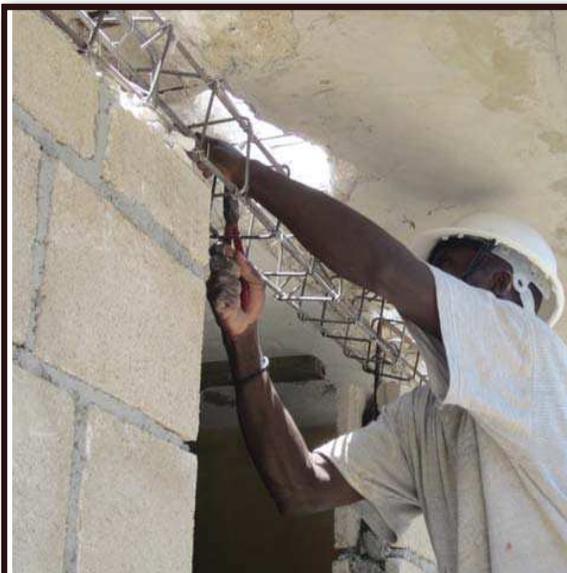
4. Tie a string between the two guide holes and mark the location of 10cm x 20cm holes at 50cm intervals along the length of the wall.



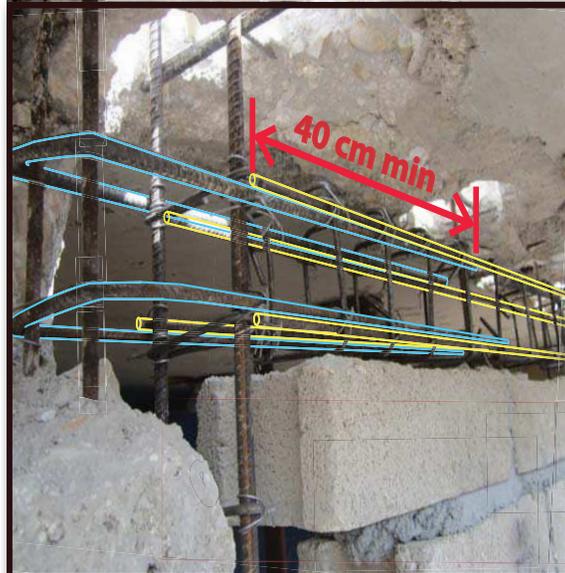
5. Break a series of holes in the slab where marked in step 4.



6. Break the concrete at the top 15cm to 25cm of the columns that are at either end of the wall. Ensure slab is adequately supported and take care not to damage the existing column reinforcement.



7. Create the ring beam cage in place. Use four $3/8"$ \varnothing bars and $1/4"$ \varnothing stirrups spaced at 20cm max.



8. Make sure that the connections at columns follow all joint detailing and connection rules (see pgs. 7-8).



9. At each hole in the slab, tie in $3/8"$ \varnothing dowels that extend from the cells of the top course of block up into the slab above.



10. Attach spacers to the ring beam cage before erecting formwork.



11. Wet all surfaces that the new concrete will touch, including the top of the block wall,



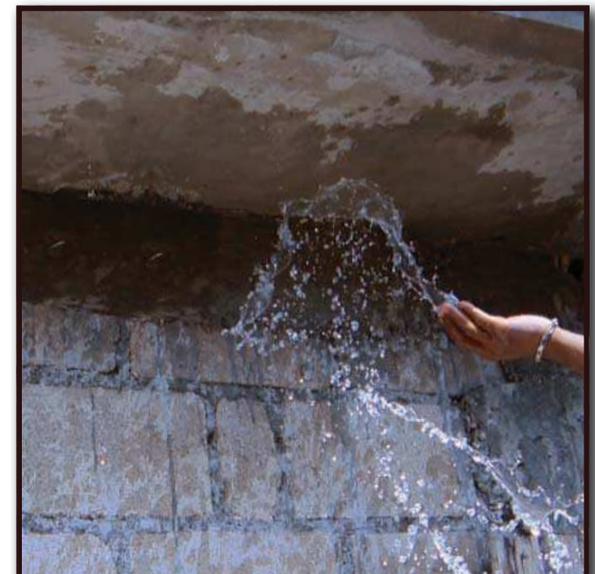
12. Pour concrete through the holes in the slab. Vibrate and compact thoroughly with a rod and hammer. Using a curved rod can help to consolidate hard to reach spaces.



13. Cure the concrete from above 3 times a day for the first 2 days.



14. After 2 days, remove formwork.



15. Continue to cure for at least one more day (a minimum of 3 days total).

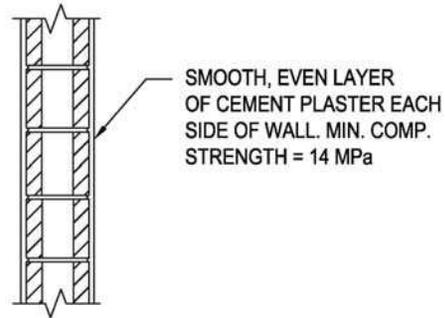
Checklist

1	Preparatory works	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Working area is clear and secured	Yes/No				Yes/No			
b	Plank to prevent falling debris is securely installed	Yes/No				Yes/No			
c	Ribs either side of wall are propped with metallic props @ ??cm centers	Yes/No				Yes/No			
2	Breaking-out of slab	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Line of wall correctly set-out using a stringline	Yes/No				Yes/No			
b	Width of slot is holes between 15 and 20cm	Yes/No				Yes/No			
c	All loose debris is removed from slot before plank is removed	Yes/No				Yes/No			
3	Reinforcement	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Longitudinal Bars								
1	For CM wall use four #3 (3/8") longitudinal bars	Yes/ No				Yes/ No			
2	For URM wall use two #4 (1/2") longitudinal bars	Yes/ No				Yes/ No			
3	Minimum Strength = Grade 60	Yes/ No				Yes/ No			
4	Type of longitudinal bars RIBBED	Yes/ No				Yes/ No			
b	Stirrups								
1	#2 closed stirrups	Yes/ No				Yes/ No			
2	Stirrup hooks bent at 135 degrees	Yes/ No				Yes/ No			
3	Hook length for stirrup minimum 4 cm	Yes/ No				Yes/ No			
4	BAR ASSEMBLY	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	BEAM STIRRUPS								
1	Stirrup spacing maximum 20cm	Yes/ No				Yes/ No			
2	Stirrups closely spaced (10cm) near all beam-column joints	Yes/ No				Yes/ No			
3	Stirrup hooks rotated	Yes/ No				Yes/ No			
4	Stirrups tied to longitudinal bars with binding wire	Yes/ No				Yes/ No			
b	JOINT DETAILING								
1	Minimum lap length = 50Ø (50cm for #3 bars, 60cm for #4 bars)	Yes/ No				Yes/ No			
2	Apply one of overlap detailing options	Yes/ No				Yes/ No			
3	Use extra L or T bars only if bars not cut properly	Yes/ No				Yes/ No			
4	All bent bars at corners and T-junctions bent at 90 degrees	Yes/ No				Yes/ No			
5	Laps tied with binding wire	Yes/ No				Yes/ No			
5	FORMWORK and CONCRETE SPACER	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Formwork is good quality (not warped)	Yes/ No				Yes/ No			
c	Space between steel and formwork minimum 2.5 cm	Yes/ No				Yes/ No			
d	Use concrete spacers every 3-4 stirrups or as req to maintain cover	Yes/ No				Yes/ No			
e	Maximum size for concrete spacer is 3 cm x 3 cm x 3 cm	Yes/ No				Yes/ No			
f	Use binding wire in concrete spacer	Yes/ No				Yes/ No			
6	CONCRETE MIXING	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use Mix 1:2:4	Yes/ No				Yes/ No			
b	Use crushed, angular gravel	Yes/ No				Yes/ No			
c	Use gravel with size less than 2 cm	Yes/ No				Yes/ No			
d	Use clean, washed river sand	Yes/ No				Yes/ No			
e	Use clean water (not salty or muddy)	Yes/ No				Yes/ No			
f	Use Type 1 Cement	Yes/ No				Yes/ No			
g	Mix a clean, concrete or asphalt surface, not on dirt	Yes/ No				Yes/ No			
h	Using a mechanical mixer is best	Yes/ No				Yes/ No			
i	Batch out gravel, then sand, then cement	Yes/ No				Yes/ No			
j	Turn over 3 times or until color is uniform	Yes/ No				Yes/ No			
k	Do not use too much water! Add water slowly	Yes/ No				Yes/ No			
l	Use slump test or hand test for water content	Yes/ No				Yes/ No			
7	CONCRETE POURING and CURING	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Wet formwork and steel before pouring concrete	Yes/ No				Yes/ No			
b	Use concrete within 90 minutes of mixing with water if from factory	Yes/ No				Yes/ No			
c	if manually use in less than 30 minutes	Yes/ No				Yes/ No			
e	Use rod to consolidate concrete around reinforcement	Yes/ No				Yes/ No			

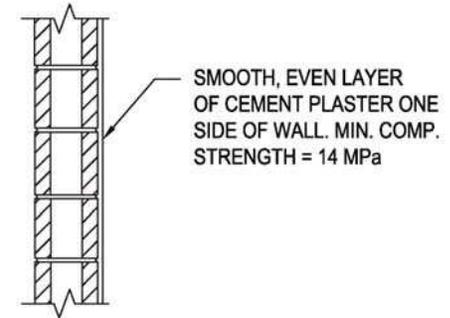
Structural Plastering



D3.1 - PLASTER ON EACH SIDE OF THE WALL



D3.2 - PLASTER ON ONE SIDE OF THE WALL



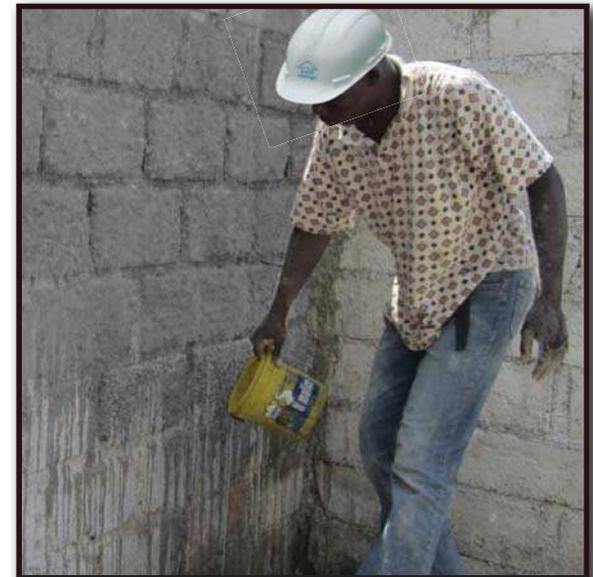
- NOTE: SEE MTPTC GUIDELINES FOR MIX PROPORTION AND APPLICATION OF CEMENT PLASTER



1. Set up string as shown on the wall to be plastered.



2. Ensure that there is at least 1.25cm between the string and the surface of the wall.



3. Moisten the surface to be plastered with water.



4. Using proper mixing practices, make a plaster and apply it to the wall.



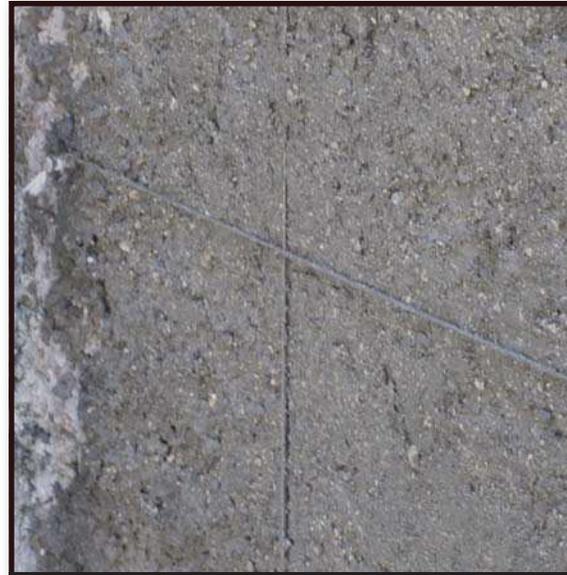
5. Using the strings as a guide, use a straight edge to ensure a smooth layer of plaster at the correct thickness.



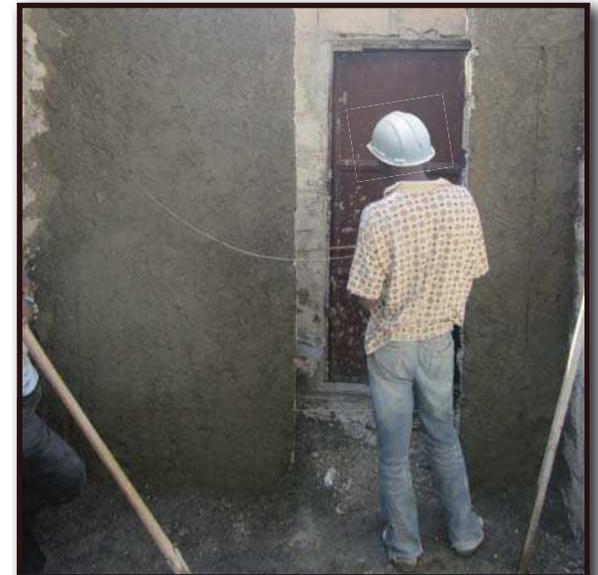
6. Add more plaster to any areas that have not reached the required thickness.



7. Smooth the surface once again.



8. Repeat steps 6 and 7 as many times as necessary until the level of the plaster reaches the strings.



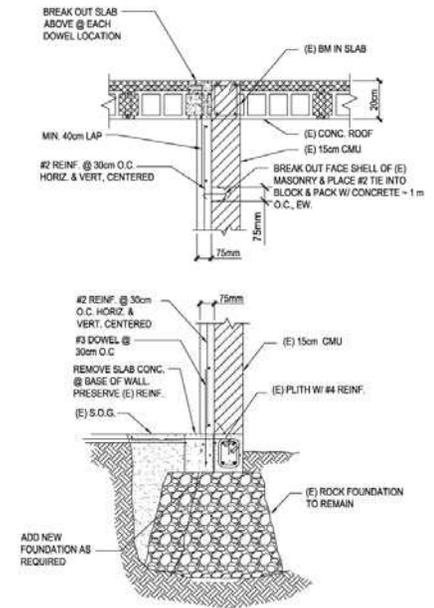
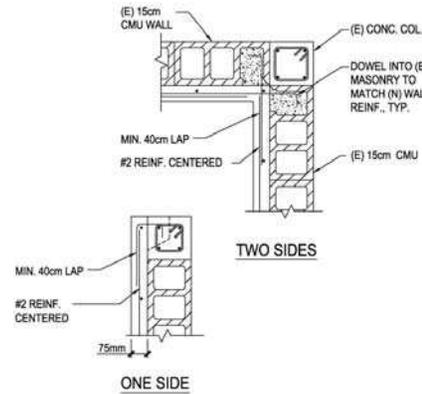
9. Remove the guide strings. If applicable, repeat the process on the other side of the wall. A smooth finishing coat may be applied afterwards but is not required.



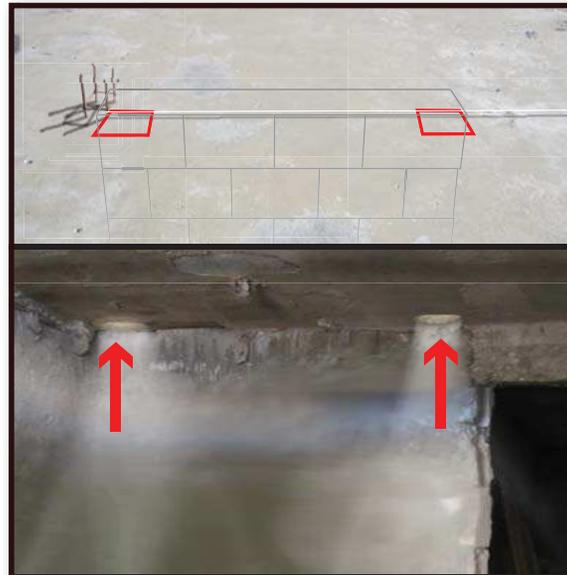
Checklist

1	Surface Preparation	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	All loose and flakey material has been removed	Yes/No				Yes/No			
b	Wall wetted prior to application of cement plaster	Yes/No				Yes/No			
2	Mortar Mixing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use mortar 1:3 mix	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			
d	Use Type 1 Cement	Yes / No				Yes / No			
e	Mix on a clean, concrete or asphalt surface, not on dirt	Yes / No				Yes / No			
f	Turn over 3 times or until color is uniform	Yes / No				Yes / No			
g	Do not use too much water! Add water slowly	Yes / No				Yes / No			
3	Implementation	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Wall coated with 1.25cm of plaster	Yes / No				Yes / No			

Reinforced Concrete Overlay



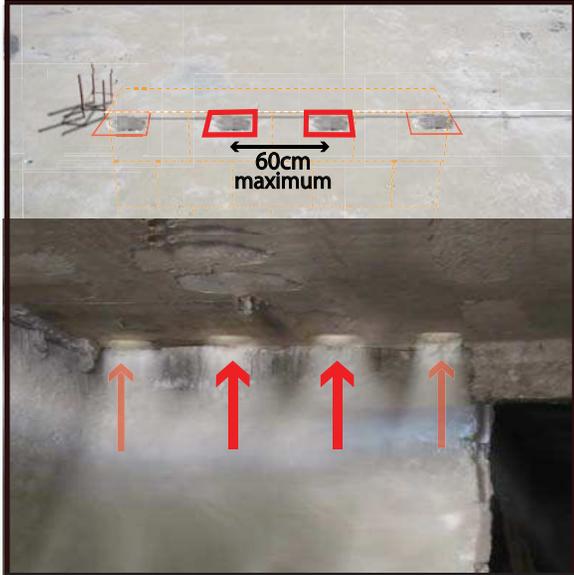
1. Above the wall that will receive the overlay, use a string tied between columns to mark the location of the wall on the slab.



2. Mark a 10cm x 10cm square above each end of the wall



3. Break out the holes in the slab above as marked in step 2. Use all proper site safety precautions, such as shoring and a crash deck.



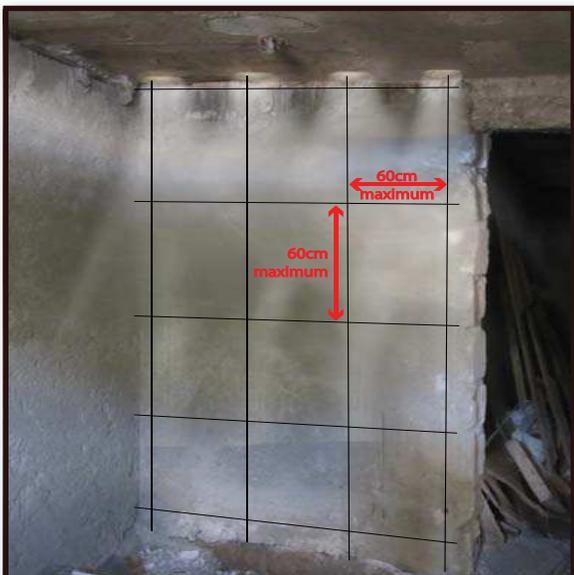
4. Break out holes in between the first two holes marked in step 2. The holes can be spaced at a maximum of 60cm on center, and may be closer if needed. Make as many holes as needed.



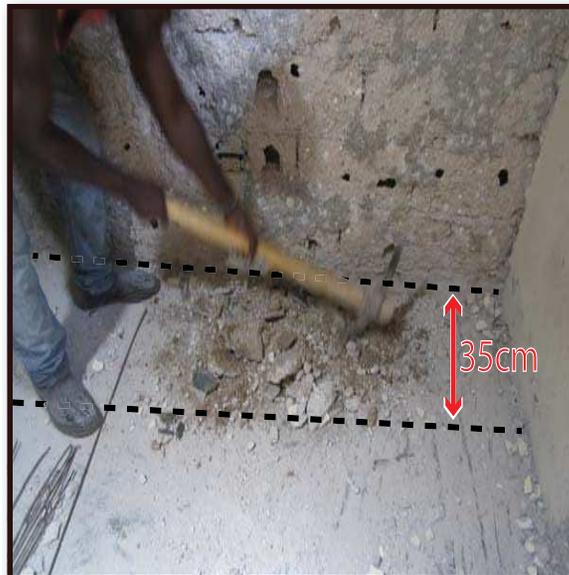
5. If the wall has been finished with a smooth layer of plaster, roughen the surface by chipping away peices of the smooth layer. This will make it easier to place the thrown concrete.



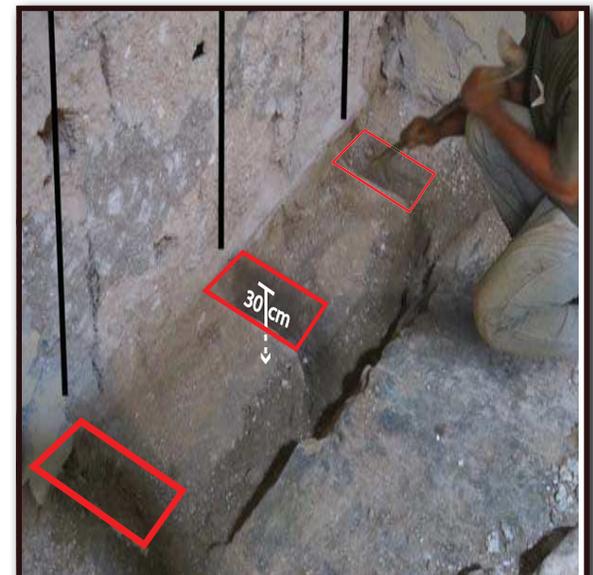
6. Using a plumb bob, mark a vertical line that extends from each hole in the slab down to the base of the wall.



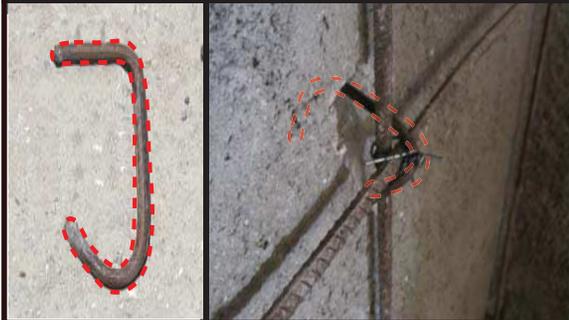
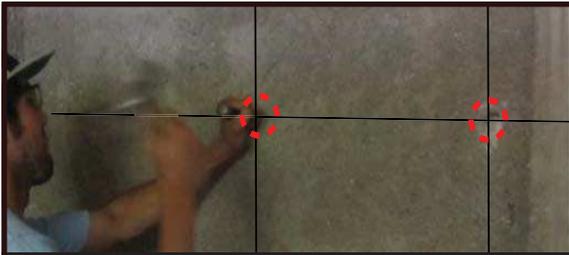
7. Complete the grid by marking horizontal lines on the wall as well. As with the vertical lines, the spacing can be a maximum of 60cm.



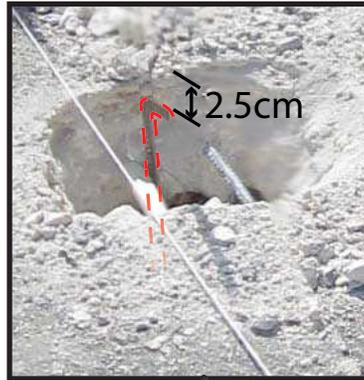
8. Excavate a 35cm wide strip along the base of the wall until the existing foundation is reached. If the existing foundation is in very poor condition or nonexistent, add foundation as needed.



9. After reaching the existing foundation, continue to excavate a trench at the base of each vertical line. The trench should extend 30cm below the level of the existing floor slab.



10. Everywhere that vertical and horizontal reinforcement crosses, break a hole into the wall. Place a 10cm long tie into this hole and tie it with binding wire to the 3/8" Ø bars.



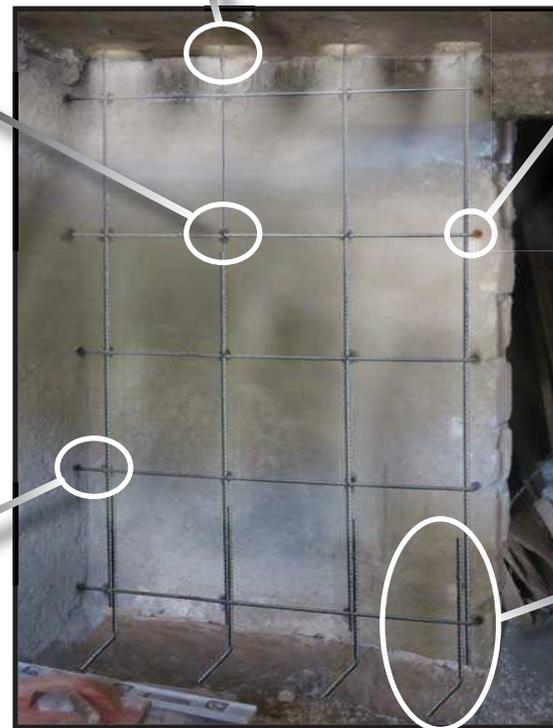
Vertical bars must continue up into the holes in the slab above. Leave at least 2.5 cm between the top of the slab and the top of the bars.



At ends of walls without a column, break a hole into the block wall and bend the end of the horizontal bar into the hole.



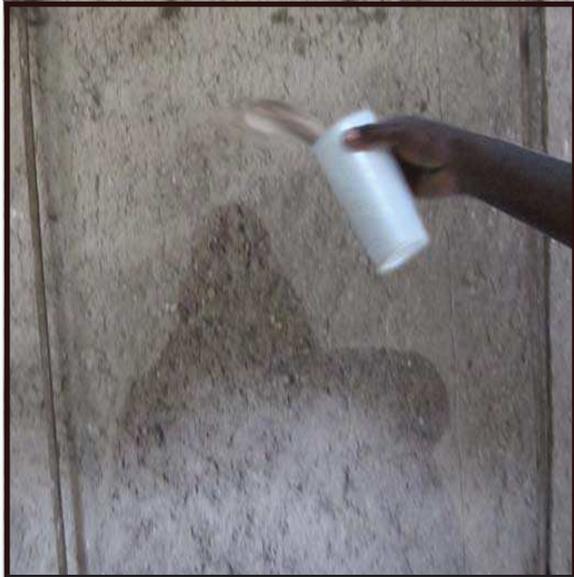
Where the overlay meets a perpendicular wall, break a hole into the perpendicular wall and continue the horizontal bar into the wall.



Use 3/8" Ø bars at a 60cm maximum spacing. Use nails and binding wire to keep the bars in place. Ensure 2.5cm cover.



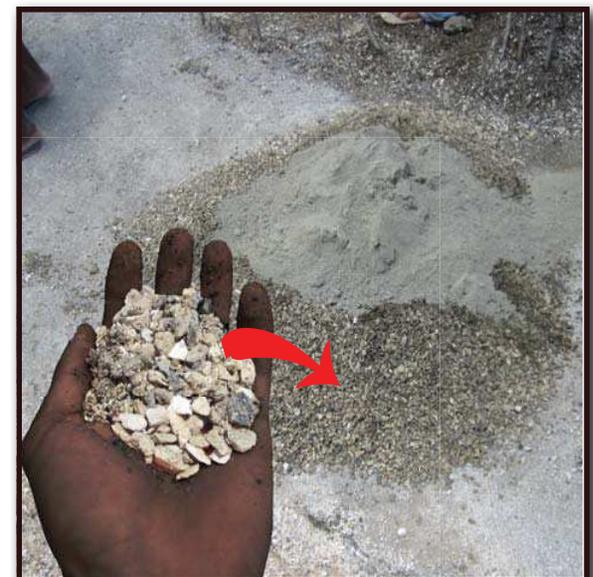
Place an L in the trench at the bottom of each vertical bar. Tie the L to the vertical bar using binding wire, and ensure that there is at least a 40cm splice. Use stacked spacers at the bottom of the L to ensure cover.



11. Dampen the surface of the wall with water. The best bond will occur when the surface has been just slightly moistened, but not completely wet.



12. Use a guide string to ensure the thickness of the overlay. Make sure that the overlay will be at least 7.5cm thick in all places and that cover over all steel will be at least 2.5cm.



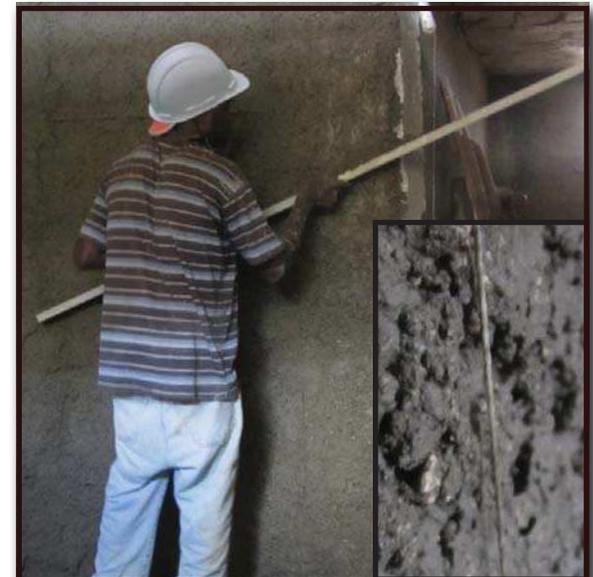
13. Prepare the thrown concrete mix. The mix must be 1 part cement, 2 parts sand, and 3 parts pea gravel (6cm-12cm). Gravel is necessary to provide adequate strength.



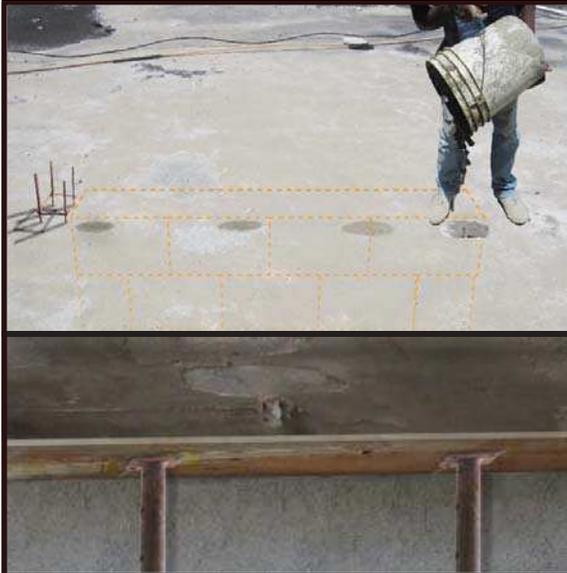
14. Start applying the overlay by filling up all holes broken out in the wall in step 10.



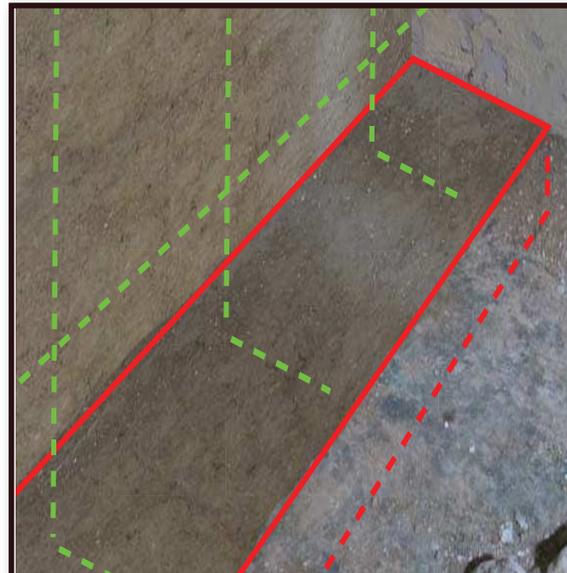
15. Continue to throw the concrete onto the surface of the wall.



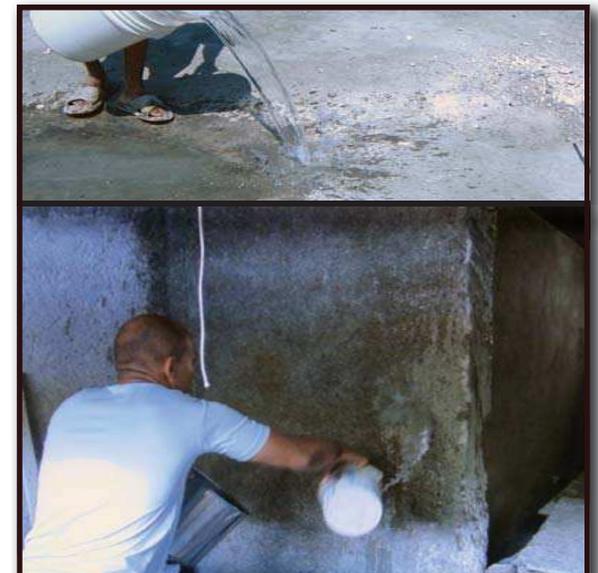
16. Layer by layer, build up the overlay until the concrete reaches the level of the strings.



17. From above, place concrete into the holes in the slab. This may require placing formwork along the top edge of the overlay.



18. Pour concrete at the base of the foundation, up to the level of the existing slab.

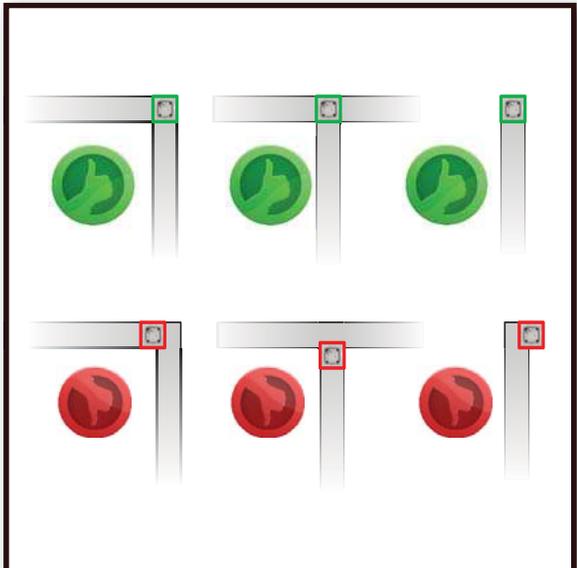
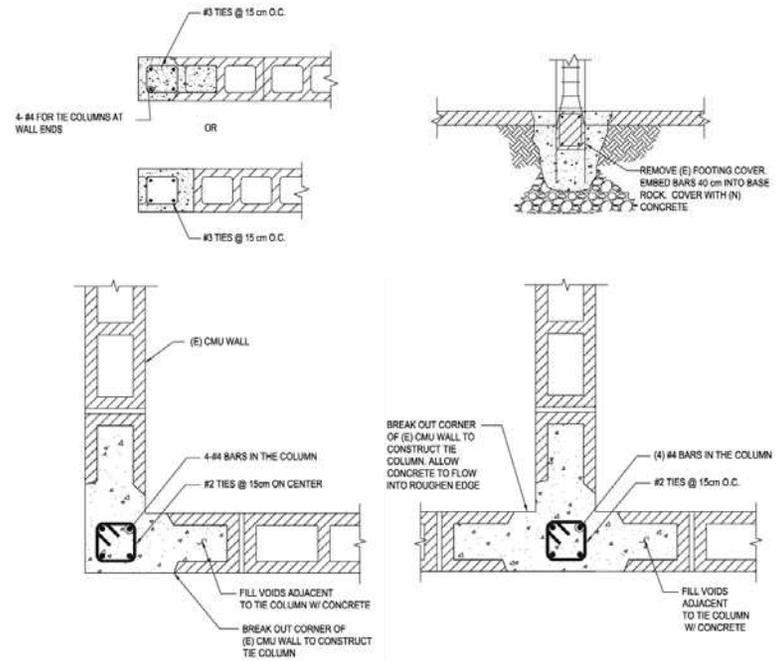


19. Cure the overlay 3 times a day for 3 days by pouring water from above and on the surface of the overlay.

1	Preparatory works	Implemented correctly ?
a	Working area is clear and secured	Yes/No
b	Plank to prevent falling debris is securely installed	Yes/No
c	Ribs either side of wall are propped with metallic props @ 75cm centers	Yes/No
2	Breaking-out of slab	Implemented correctly ?
a	Line of overlay correctly set-out using a stringline	Yes/No
b	10cm diameter holes @ 30cm centers formed in slab	Yes/No
c	All loose debris is removed from slot before plank is removed	Yes/No
3	Reinforcement	Implemented correctly ?
a	Type of dowel bars RIBBED	Yes/ No
b	Minimum Strength = Grade 60	Yes/ No
c	Use #3 dowel bars @ 30cm centers	Yes/ No
d	Minimum lap length with overlay steel = 40cm	
5	FORMWORK and CONCRETE SPACER	Implemented correctly ?
a	Formwork is good quality (not warped)	Yes/ No
b	Space between steel and formwork minimum 2.5 cm	Yes/ No
c	Use concrete spacers as req to maintain cover	Yes/ No
d	Maximum size for concrete spacer is 3 cm x 3 cm x 3 cm	Yes/ No
e	Use binding wire in concrete spacer	Yes/ No
6	CONCRETE MIXING	Implemented correctly ?
a	Use Mix 1:2:4	Yes/ No
b	Use crushed, angular gravel	Yes/ No
c	Use gravel with size less than 2 cm	Yes/ No
d	Use clean, washed river sand	Yes/ No
e	Use clean water (not salty or muddy)	Yes/ No
f	Use Type 1 Cement	Yes/ No
g	Mix a clean, concrete or asphalt surface, not on dirt	Yes/ No
h	Using a mechanical mixer is best	Yes/ No
i	Batch out gravel, then sand, then cement	Yes/ No
j	Turn over 3 times or until color is uniform	Yes/ No
k	Do not use too much water! Add water slowly	Yes/ No
l	Use slump test or hand test for water content	Yes/ No
7	CONCRETE POURING and CURING	Implemented correctly ?
a	Wet formwork and steel before pouring concrete	Yes/ No
b	Use concrete within 90 minutes of mixing with water if from factory	Yes/ No
c	if manually use in less than 30 minutes	Yes/ No
e	Use rod to consolidate concrete around reinforcement	Yes/ No
f	Complete entire beam within one day	Yes/ No
g	If concrete pouring must stop, use a diagonal joint with stones	Yes/ No
h	Have plastic on standby, cover if it rains	Yes/ No
i	Cure for minimum 3 days by sprinkling clean water,	Yes/ No
k	Cure 5 times per day : MORNING, At 8, 10	Yes/ No
l	AFTERNOON: 12, 14, 16, pour water slowly	Yes/ No
8	CONCRETE INSPECTION	Implemented correctly ?
a	For slabs, remove formwork after 14 full days	Yes/ No
b	If steel showing, demolish and rebuild	Yes/ No
c	Remove the border of slab and/or beams after 48 hours	Yes/ No
d	Any cracks larger than 3 mm	Yes/ No
e	Many cracks in one location	Yes/ No
f	Diagonal or vertical cracks anywhere in the beam	Yes/ No
g	If any of the above exist, demolish concrete and repour	Yes/ No

1	Preparatory works	Implemented correctly ?
a	If breaking-out of column concrete is required, the slab is adequately propped	Yes/No
2	Breaking-out of column/CMU wall	Implemented correctly ?
a	Column/CMU concrete broken out at 30 cm intervals	Yes/No
b	All loose debris removed	Yes/No
3	Reinforcement	Implemented correctly ?
a	Type of dowel bars RIBBED	Yes/ No
b	Minimum Strength = Grade 60	Yes/ No
c	Use #2 dowel bars @ 30cm centers	Yes/ No
d	Minimum lap length with overlay steel = 40 cm	Yes/ No
5	FORMWORK and CONCRETE SPACER	Implemented correctly ?
	See checklist for Detail 4.3	
6	CONCRETE MIXING	Implemented correctly ?
	See checklist for Detail 4.3	
7	CONCRETE POURING and CURING	Implemented correctly ?
	See checklist for Detail 4.3	
a	Are holes in column/cells in CMU fully filled with concrete	Yes/ No
8	CONCRETE INSPECTION	Implemented correctly ?
	See checklist for Detail 4.3	

New Tie Column in an Existing Wall



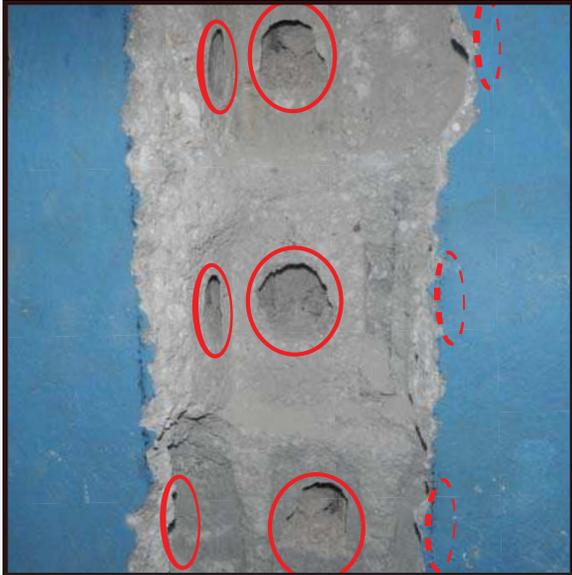
1. Determine the location of the new column. New columns should be on axis with any intersecting walls.



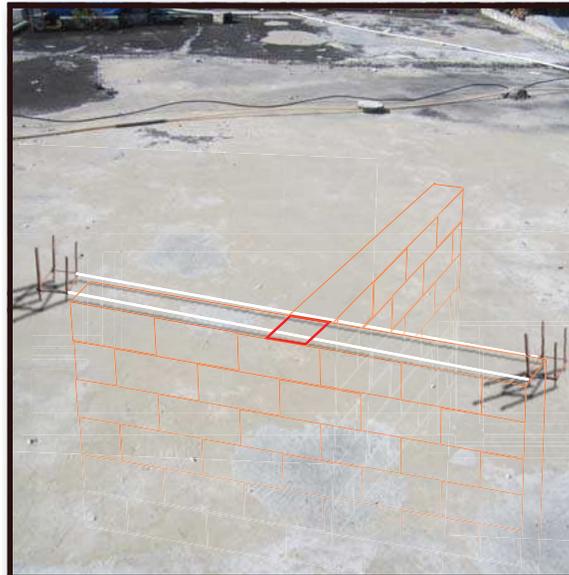
2. Use a plumb bob and mark the edge of the column that will be put in the wall.



3. After shoring the walls and the slab above, break out the wall inbetween the lines. Double check that the column will be on axis with perpendicular walls.



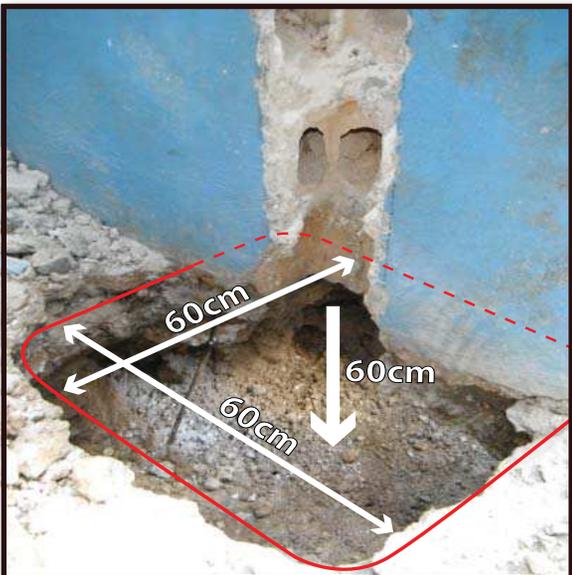
4. Break out holes in the ends of the walls. Similar to having toothing in a new wall, this will provide a good connection in between the column and walls once concrete is poured.



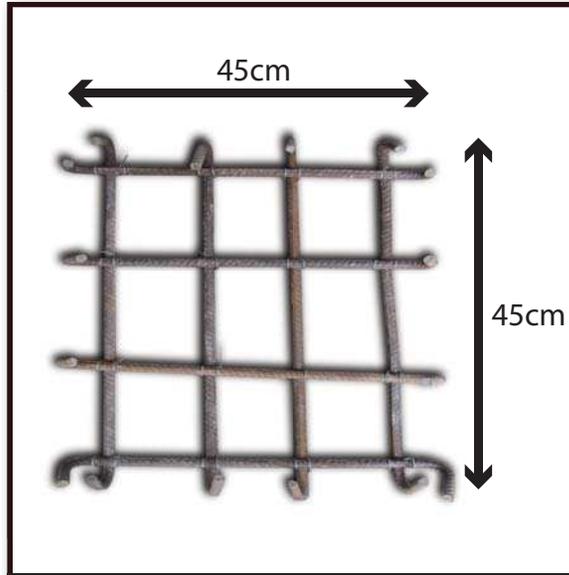
5. Using a string and a tape measure, locate and mark the location of the column on the slab above



6. Break out a hole in the slab as marked in the previous step. Make adjustments as necessary to ensure that the hole is in the right location.



7. At the base of the column, excavate 60cm wide and 60cm deep. The location of the column should land in the middle of the excavation. If there is an existing plinth beam, be careful not to damage any existing reinforcement.



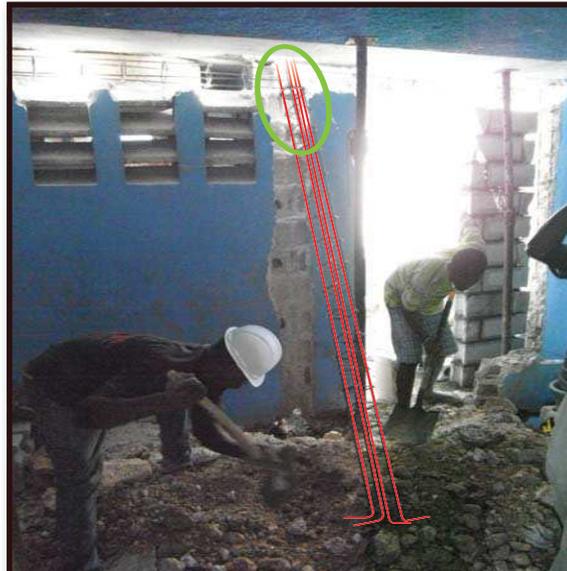
8. Make the footing steel as shown above, using 1/2" Ø bars.



9. Lay a 7.5 cm thick layer of lean concrete at the base of the footing.



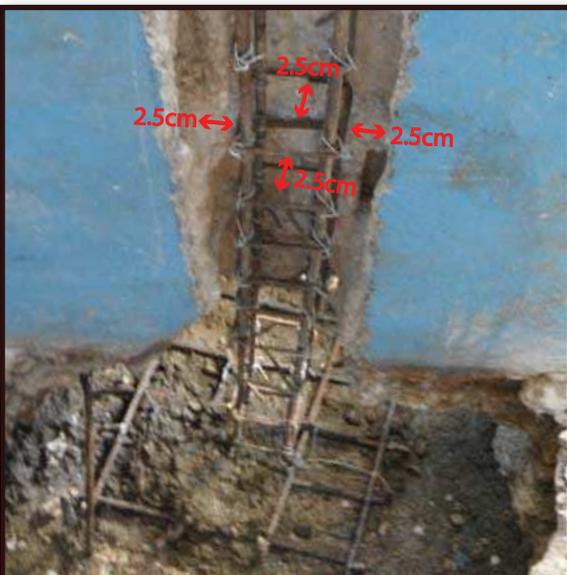
10. Place the footing steel on the concrete.



11. Put the column steel in place. This will likely require leaving several stirrups untied near the top of the column.



12. Tie the last stirrups in place, making sure the connection to the ring beam follows all connection rules. This includes having 4 L's that connect the ring beam to the column.



13. Before pouring concrete in the footing excavation, ensure there will be 2.5cm cover on all sides of the column steel.



14. Using cyclopean concrete (concrete and large stones), fill the footing excavation. Keep any stones at least 2.5 cm from any column steel.



15. Tie spacers to the column steel to ensure cover of 2.5cm around all column steel.



16. Moisten all surfaces that concrete will be poured against.



17. Place formwork. Make sure there is adequate support so that the formwork does not bulge when the concrete is poured.



18. Pour the concrete for the column through the hole in the slab.



19. After each bucket of concrete poured, use a long piece of steel to compact the concrete from the opening above and hit the formwork with a hammer as well. These methods will help to create well-compacted concrete.



20. After the concrete has set, cure the concrete from above three times a day.

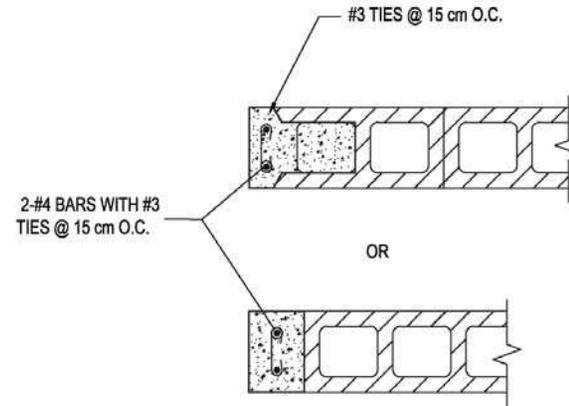


21. Remove the formwork after 2 days. Continue to cure for another day.

1	Preparatory works	Implemented correctly ?
a	Walls are adequately propped	Yes/No
2	Breaking-out of masonry	Implemented correctly ?
a	Size of slot created is 15x15cm	Yes/No
b	End cells of blocks are broken open	Yes/No
c	All loose debris is removed from slot	Yes/No
3	Footing	Implemented correctly ?
	See Detail D5.5	
4	Reinforcement	Implemented correctly ?
a	Longitudinal Bars	
2	Use four #4 (1/2") longitudinal bars	Yes/ No
3	Minimum Strength = Grade 60	Yes/ No
4	Type of longitudinal bars RIBBED	Yes/ No
b	Stirrups	
1	#2 closed stirrups	Yes/ No
2	Stirrup hooks bent at 135 degrees	Yes/ No
3	Hook length for stirrup minimum 4 cm	Yes/ No
5	Bar Assembly	Implemented correctly ?
a	COLUMN TIES	
1	Stirrup spacing maximum 20cm	Yes/ No
2	Stirrups closely spaced (10cm) near all beam-column joints	Yes/ No
3	Stirrup hooks rotated	Yes/ No
4	Stirrups tied to longitudinal bars with binding wire	Yes/ No
b	JOINT DETAILING	
1	Minimum lap length = 50Ø (60cm for #4 bars)	Yes/ No
2	In case of concrete roof, 60cm lap length above roof level	Yes/ No
3	In case of lightweight roof, column steel bent into ring beam with 60cm lap length	Yes/ No
4	All bent bars at comers and T-junctions bent at 90 degrees	Yes/ No
5	Laps tied with binding wire	Yes/ No
6	FORMWORK and CONCRETE SPACER	Implemented correctly ?
a	Formwork is good quality (not warped)	Yes/ No
c	Space between steel and formwork minimum 2.5 cm	Yes/ No
d	Use concrete spacers every 3-4 stirrups or as req to maintain cover	Yes/ No
e	Maximum size for concrete spacer is 3 cm x 3 cm x 3 cm	Yes/ No
f	Use binding wire in concrete spacer	Yes/ No
7	CONCRETE MIXING	Implemented correctly ?
a	Use Mix 1:2:4	Yes/ No
b	Use crushed, angular gravel	Yes/ No
c	Use gravel with size less than 2 cm	Yes/ No
d	Use clean, washed river sand	Yes/ No
e	Use clean water (not salty or muddy)	Yes/ No
f	Use Type 1 Cement	Yes/ No
g	Mix a clean, concrete or asphalt surface, not on dirt	Yes/ No
h	Using a mechanical mixer is best	Yes/ No
i	Batch out gravel, then sand, then cement	Yes/ No
j	Turn over 3 times or until color is uniform	Yes/ No
k	Do not use too much water! Add water slowly	Yes/ No
l	Use slump test or hand test for water content	Yes/ No
8	CONCRETE POURING and CURING	Implemented correctly ?

8	CONCRETE POURING and CURING	Implemented correctly ?
a	Wet formwork and steel before pouring concrete	Yes/ No
b	Use concrete within 90 minutes of mixing with water if from factory	Yes/ No
c	if manually use in less than 30 minutes	Yes/ No
e	Use rod to consolidate concrete around reinforcement	Yes/ No
f	Complete entire beam within one day	Yes/ No
g	If concrete pouring must stop, use a diagonal joint with stones	Yes/ No
h	Have plastic on standby, cover if it rains	Yes/ No
j	Cure for minimum 3 days by sprinkling clean water,	Yes/ No
k	Cure 5 times perday : MORNING, At 8 , 10	Yes/ No
l	AFTERNOON: 12, 14, 16, pour water slowly	Yes/ No
9	CONCRETE INSPECTION	Implemented correctly ?
a	For columns, remove formwork after 48 hours	Yes/ No
b	If steel showing, demolish and rebuild	Yes/ No
c	Any cracks larger than 3 mm	Yes/ No
d	Many cracks in one location	Yes/ No
e	Diagonal or vertical cracks anywhere in the beam	Yes/ No
f	If any of the above exist, demolish concrete and repour	Yes/ No

Door and Window Reinforcement



1. Mark on the wall the location of the opening reinforcement. For a window, the reinforcement must descend at least 40cm below the window sill, and arrive up to the ring beam.



2. For a door, the reinforcement will extend from the plinth beam to the ring beam.



3. Provide support to the slab, lintel, and walls as needed. Then break out the masonry wall as marked.



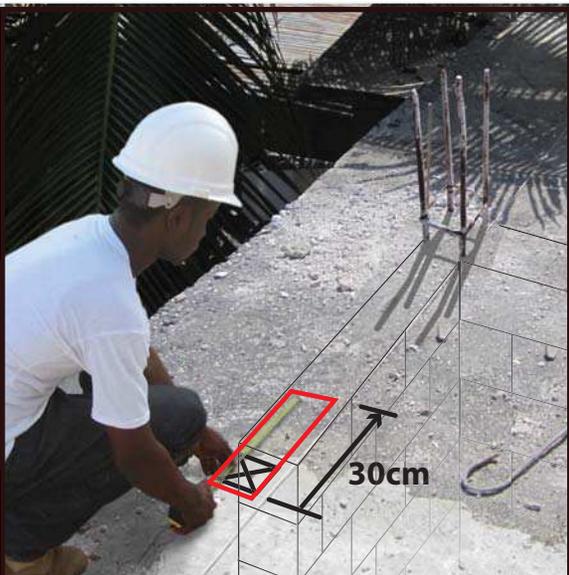
4. Break out holes in the end of the wall. This will help to tie the existing wall to the opening reinforcement once the concrete is poured



5. Measure the distance from a nearby column to the location of the opening reinforcement



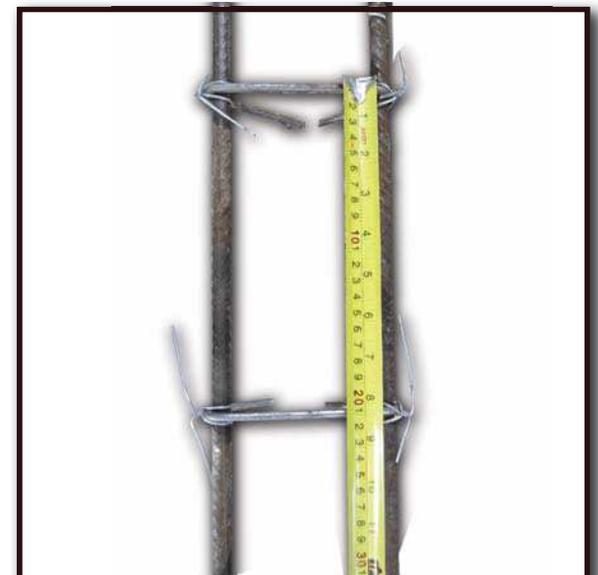
6. Using a string tied between columns and the measurement taken from the previous step, mark the location of the hole that will be broken in the slab.



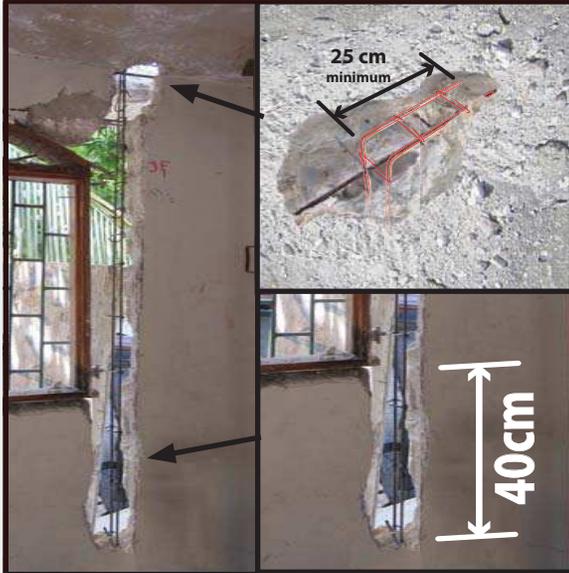
7. Also mark a 15cm x 30cm trough that will be broken out for the reinforcement to hook into.



8. Break out a hole and trough in the slab as marked in the previous steps.



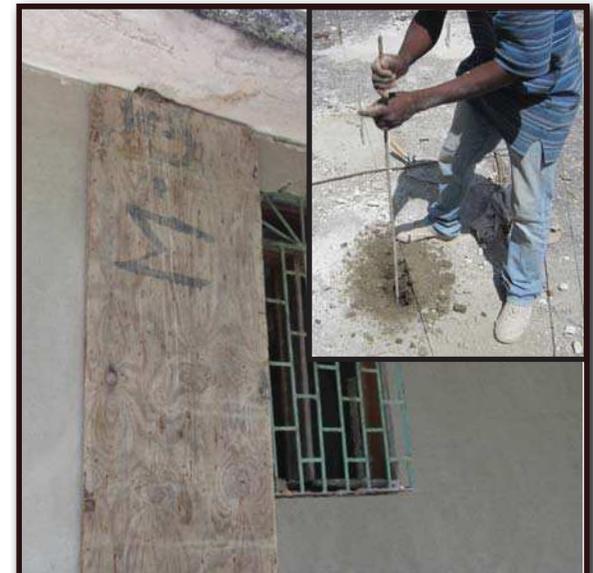
9. For opening reinforcement, use two 3/8" \varnothing bars with 1/4" \varnothing ties at 20cm.



10. Window reinforcement should be hooked into the slab or ring beam at the top. At the base, reinforcement should extend 40cm into the existing wall.



11. Door reinforcement should be hooked into the ring beam at the top. At the base, excavate and embed reinforcement into the plinth beam or foundation at least 20cm deep with a 25cm hook.

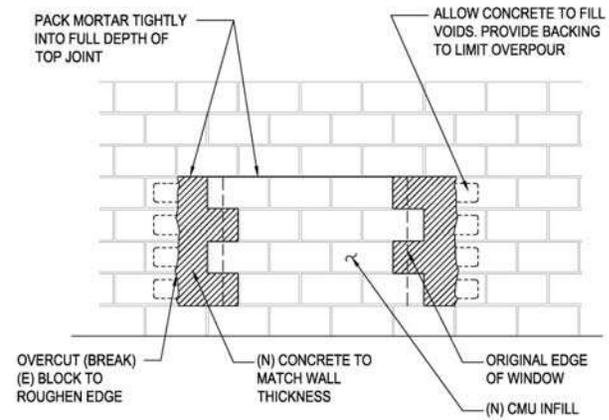


12. Add formwork and pour concrete from above. Use a rod to consolidate the concrete from the top and tap the formwork from the sides with a hammer.

Checklist

		Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
1	Preparatory works								
a	Walls is adequately propped	Yes/No				Yes/No			
2	Breaking-out of masonry								
a	End cells of blocks are broken open	Yes/No				Yes/No			
b	All loose debns is removed from slot	Yes/No				Yes/No			
3	Footing								
	See Detail D5.5								
4	Reinforcement								
a	Longitudinal Bars								
2	Use two #4 (1/2") longitudinal bars	Yes/ No				Yes/ No			
3	Minimum Strength = Grade 60	Yes/ No				Yes/ No			
4	Type of longitudinal bars RIBBED	Yes/ No				Yes/ No			
b	Stirrups								
1	#2 open stirrups	Yes/ No				Yes/ No			
2	Stirrup hooks bent at 135 degrees	Yes/ No				Yes/ No			
3	Hook length for stirrup minimum 4 cm	Yes/ No				Yes/ No			
5	Bar Assembly								
a	COLUMN TIES								
1	Stirrup spacing maximum 20cm	Yes/ No				Yes/ No			
2	Stirrups closely spaced (10cm) near all beam-column joints	Yes/ No				Yes/ No			
3	Stirrup hooks rotated	Yes/ No				Yes/ No			
4	Stirrups tied to longitudinal bars with binding wire	Yes/ No				Yes/ No			
b	JOINT DETAILING								
1	Minimum lap length = 50Ø (60cm for #4 bars)	Yes/ No				Yes/ No			
2	In case of concrete roof, 60cm lap length above roof level	Yes/ No				Yes/ No			
3	In case of lightweight roof, column steel bent into ring beam with 60cm lap length	Yes/ No				Yes/ No			
4	All bent bars at comers and T-junctions bent at 90 degrees	Yes/ No				Yes/ No			
5	Laps tied with binding wire	Yes/ No				Yes/ No			
6	Formwork and concrete spacer								
a	Formwork is good quality (not warped)	Yes/ No				Yes/ No			
c	Space between steel and formwork minimum 2.5 cm	Yes/ No				Yes/ No			
d	Use concrete spacers every 3-4 stirrups or as req to maintain cover	Yes/ No				Yes/ No			
e	Maximum size for concrete spacer is 3 cm x 3 cm x 3 cm	Yes/ No				Yes/ No			
f	Use binding wire in concrete spacer	Yes/ No				Yes/ No			
7	Concrete mixing								
a	Use Mix 1:2:4	Yes/ No				Yes/ No			
b	Use crushed, angular gravel	Yes/ No				Yes/ No			
c	Use gravel with size less than 2 cm	Yes/ No				Yes/ No			
d	Use clean, washed river sand	Yes/ No				Yes/ No			
e	Use clean water (not salty or muddy)	Yes/ No				Yes/ No			
f	Use Type 1 Cement	Yes/ No				Yes/ No			
g	Mix a clean, concrete or asphalt surface, not on dirt	Yes/ No				Yes/ No			
h	Using a mechanical mixer is best	Yes/ No				Yes/ No			
i	Batch out gravel, then sand, then cement	Yes/ No				Yes/ No			
j	Turn over 3 times or until color is uniform	Yes/ No				Yes/ No			
k	Do not use too much water! Add water slowly	Yes/ No				Yes/ No			
l	Use slump test or hand test for water content	Yes/ No				Yes/ No			
8	Concrete pouring and curing								
a	Wet formwork and steel before pouring concrete	Yes/ No				Yes/ No			
b	Use concrete within 90 minutes of mixing with water if from factory	Yes/ No				Yes/ No			
c	If manually use in less than 30 minutes	Yes/ No				Yes/ No			
e	Use rod to consolidate concrete around reinforcement	Yes/ No				Yes/ No			
f	Complete entire beam within one day	Yes/ No				Yes/ No			
g	If concrete pouring must stop, use a diagonal joint with stones	Yes/ No				Yes/ No			
h	Have plastic on standbv, cover if it rains	Yes/ No				Oui / No			
j	Cure for minimum 3 days by sprinkling clean water,	Yes/ No				Oui / No			
k	Cure 5 times perday : MORNING, At 8 , 10	Yes/ No				Oui / No			
l	AFTERNOON: 12, 14, 16, pour water slowly	Yes/ No				Oui / No			
9	Concrete inspection								
a	For columns, remove formwork after 48 hours	Yes/ No				Oui / No			
b	If steel showing, demolish and rebuild	Yes/ No				Oui / No			
c	Any cracks larger than 3 mm	Yes/ No				Oui / No			
d	Many cracks in one location	Yes/ No				Oui / No			
e	Diagonal or vertical cracks anywhere in the beam	Yes/ No				Oui / No			
f	If any of the above exist, demolish concrete and repour	Yes/ No				Oui / No			

Window Infill



1. Add shoring to support the slab from below before starting any demolition work.



2. Remove the window grill and roughen the vertical edges of the wall on either side of the opening.



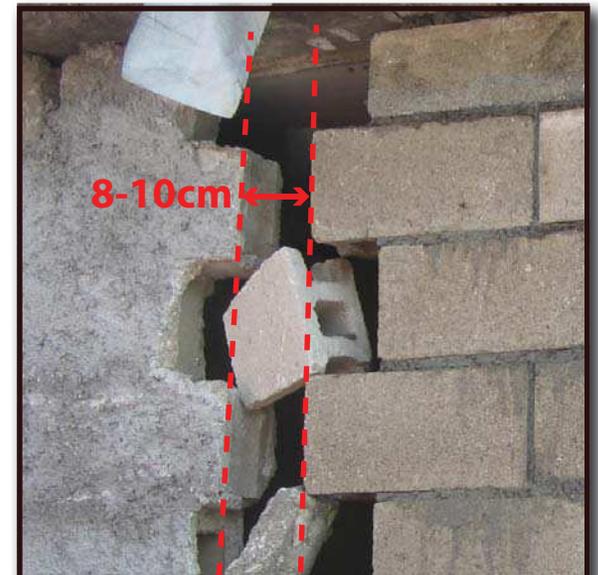
3. A good connection between the wall and the concrete can either be achieved by breaking out tothing on the wall edge or breaking holes into the ends of the block.



4. Thoroughly roughen the underside of the slab. This will improve the connection between the wall and slab.



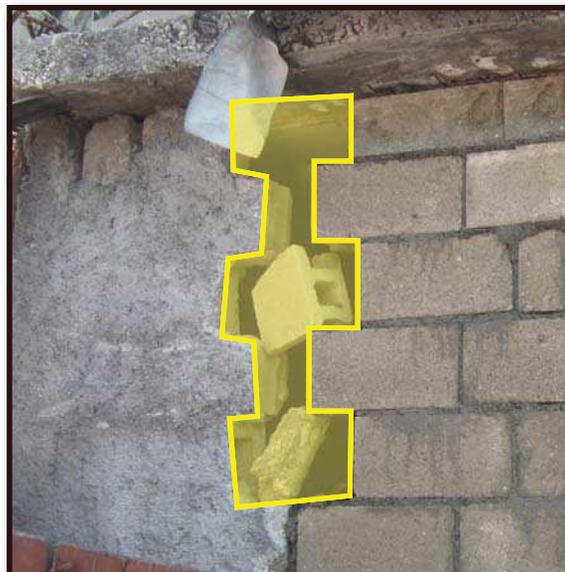
5. Place blocks to fill the space in the opening of the window. Use all of the normal rules of blocklaying (see pgs. 16-19).



6. When building the wall, make sure to leave a space between edge of the infill and the existing wall. Concrete must be able to flow through this space.



7. When laying the last course of block, make sure to leave a gap of 4cm to 10cm between the top of the block and the underside of the slab. If needed, partial height blocks can be used to achieve this.



8. Fill the space between the infill and existing wall with concrete. As shown on the next page, there are multiple ways to do this. Choose the appropriate method to execute this step.

CASE 1: When the window opening is directly below the slab or ring beam, concrete can be poured from above as shown:



9a. Break holes in the slab at each end of the infill, above where concrete will be poured to fill the space between the masonry infill and the existing wall.



10a. Place formwork at each window edge



11a. Pour concrete through the holes in the slab to make a connection between the infill and existing wall. Use a rod and hammer to ensure well consolidated concrete.

CASE 2: When a lintel or wall above prevents the pouring of concrete from above (as shown in Case 1), concrete can be placed from the side:



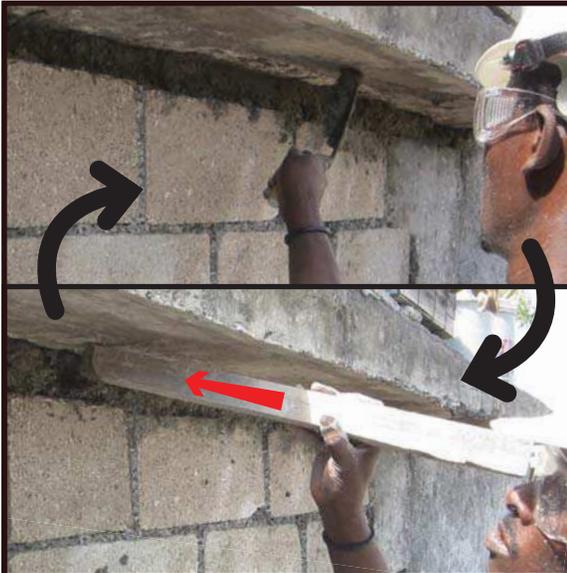
9b. Sometimes, an aligned second story wall or a lintel will make it difficult to pour concrete from above as shown in Case 1.



10b. In these cases, place formwork on one side of the infill while leaving the other side open.



11b. Using a stiff concrete mix, place concrete from the side. As usual, ensure that the concrete is well consolidated and all voids are filled.



12. Use the same process shown on pages 9-11 to fill the space between the blocks and the slab with non-shrink grout.



13. By the end, the infill should be well-connected on all four sides, with a well-filled top joint.

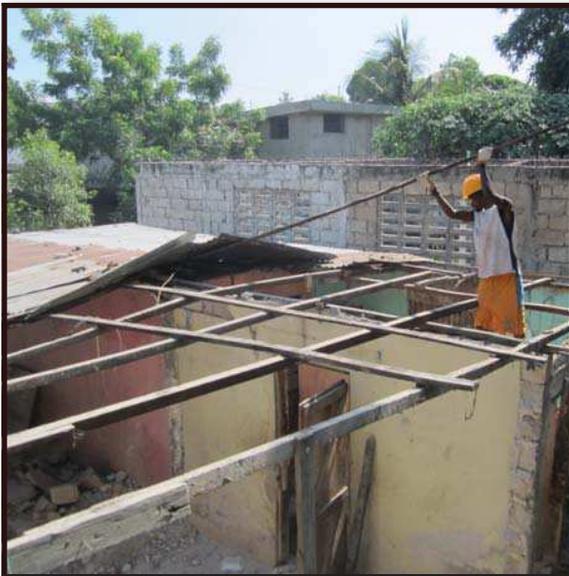
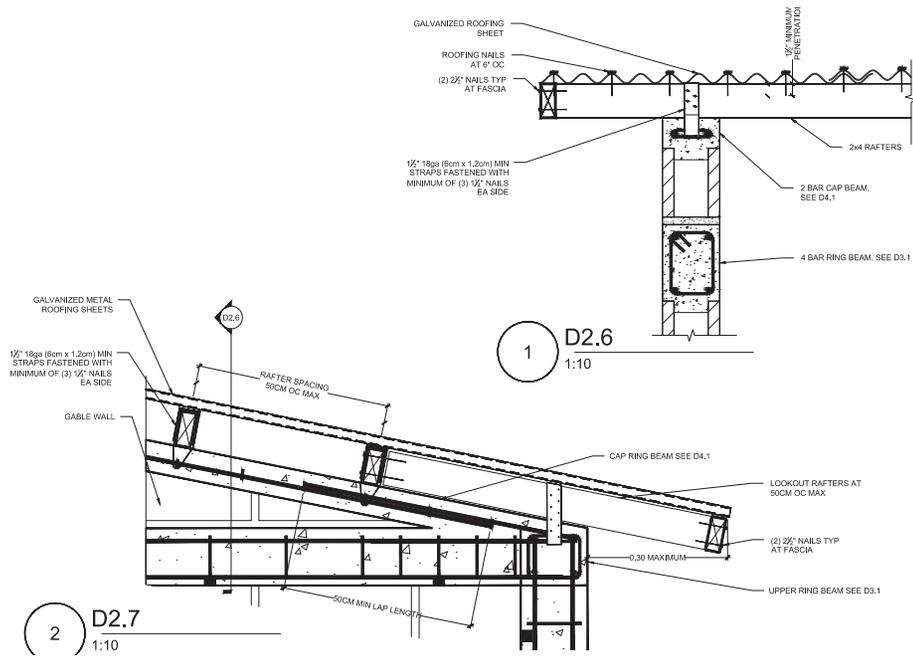


14. Cure the concrete, grout and mortar 3 times a day for 3 days.

Checklist

1	Preparatory Works	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	When there is no lintel, provide temporary support to masonry above window	Yes/No				Yes/No			
2	Demolition	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	All existing plaster and mortar is removed from around window frame.	Yes/No				Yes/No			
b	End cells of blocks adjacent to window opened up	Yes/No				Yes/No			
c	All loose material removed	Yes/No				Yes/No			
3	Mortar Mixing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use mortar 1:3 mix	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			
d	Use Type 1 Cement	Yes / No				Yes / No			
e	Mix a clean, concrete or asphalt surface, not on dirt	Yes / No				Yes / No			
f	Using a mechanical mixer is best	Yes / No				Yes / No			
g	Batch out gravel, then sand, then cement	Yes / No				Yes / No			
h	Turn over 3 times or until color is uniform	Yes / No				Yes / No			
i	Do not use too much water! Add water slowly	Yes / No				Yes / No			
4	Infill Masonry	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Wet concrete blocks prior to use	Yes / No				Yes / No			
b	Use 1/3 bonding, chase the bond before starting	Yes / No				Yes / No			
c	Tooth infill at extremities by 1/3 block	Yes / No				Yes / No			
d	Maximum bed joint thickness 12.5mm	Yes / No				Yes / No			
e	Minimum head joint thickness 12.5mm	Yes / No				Yes / No			
f	Maximum variation in mortar joint size 4mm	Yes / No				Yes / No			
g	Prepare a reasonable amount of mortar to avoid wetting from time to time	Yes / No				Yes / No			
h	Check the top of the wall is level	Yes / No				Yes / No			
i	Use slump test or hand test for water content	Yes / No				Yes / No			
5	Concrete Pouring and Curing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Clean out the bottom before placing formwork	Yes / No				Yes / No			
b	Pour infill concrete in one day to the same height as masonry infill	Yes / No				Yes / No			
c	Compact concrete with a reinforcing bar & by hammers blows to formwork	Yes / No				Yes / No			
d	Ensure toothed areas of columns completely filled with concrete	Yes / No				Yes / No			
e	Cure the wall 3 times per day for 3 days	Yes / No				Yes / No			
6	Concrete Inspection	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Remove formwork after 48 hours	Yes / No				Yes / No			
b	Any cracks larger than 3 mm	Yes / No				Yes / No			
c	Many cracks in one location	Yes / No				Yes / No			
d	Diagonal or vertical cracks anywhere in the beam	Yes / No				Yes / No			
e	If any of the above exist, demolish concrete and repour	Yes / No				Yes / No			
7	Dry-pack Mortar Mixing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use mortar 1:2 mix	Yes / No				Yes / No			
b	Use clean, fine river sand	Yes / No				Yes / No			
c	Use clean water (not salty or muddy)	Yes / No				Yes / No			
d	Use Type 1 Cement	Yes / No				Yes / No			
e	Mix on a clean, concrete or asphalt surface, not on dirt	Yes / No				Yes / No			
f	Turn over 3 times or until color is uniform	Yes / No				Yes / No			
g	Add just enough water so that you can form a ball of mortar that sticks together.	Yes / No				Yes / No			
8	Dry-pack Implementation	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use hammer and wooden dowel to pack mortar into joint	Yes / No				Yes / No			
b	Joint completely filled	Yes / No				Yes / No			

Ring Beam Addition to a House with a Light-weight Roof



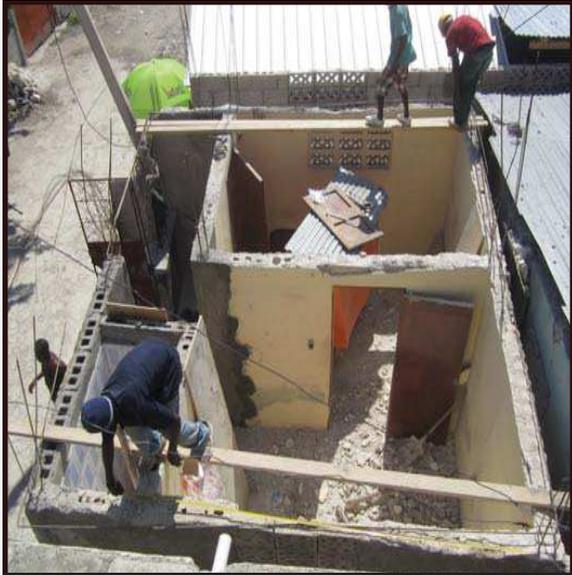
1. Carefully remove the existing LW roof. Sort through the roofing materials and keep any roofing sheets/lumber that is in good enough condition to be reused.



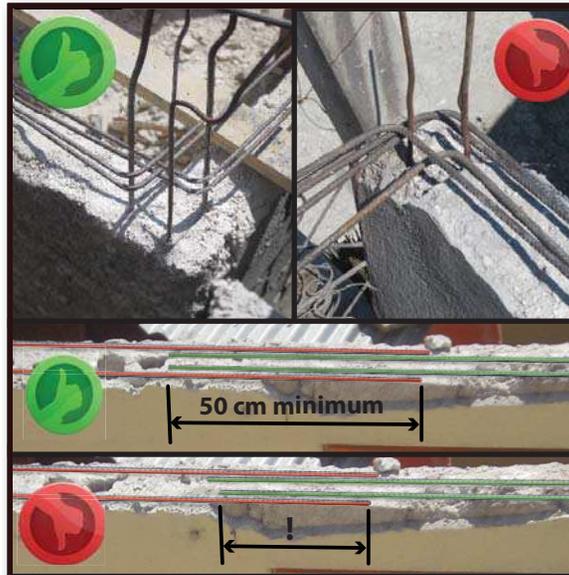
2. Remove the top parts of the walls so that the top surfaces are flat and level. A horizontal 4 bar ring beam will be constructed directly on these walls.



3. Use a water level to ensure that all walls arrive to a consistent level.



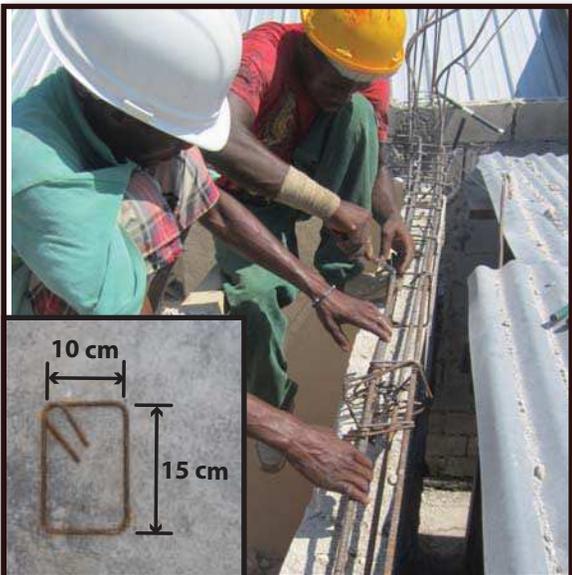
4. Cut, bend, and place the longitudinal bars for the 4 bar ring beam. Use four 1/2" Ø bars for the ring beam.



5. Respect all connection rules (see pgs. 7-8) when cutting and bending the longitudinal bars. Before bending/cutting, make sure all measurements are correct.



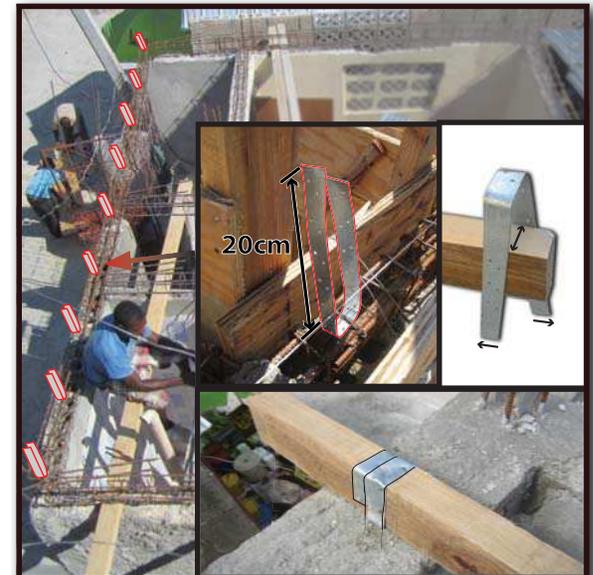
6. In some cases, it may be better to bend bars in place. This will make it easier to ensure correct joint detailing and splice lengths with fewer mistakes and minimum steel wastage.



7. Tie 10cm x 15cm stirrups in place, respecting a 10cm stirrup spacing within 50cm of joints. Space stirrups at 20cm elsewhere.



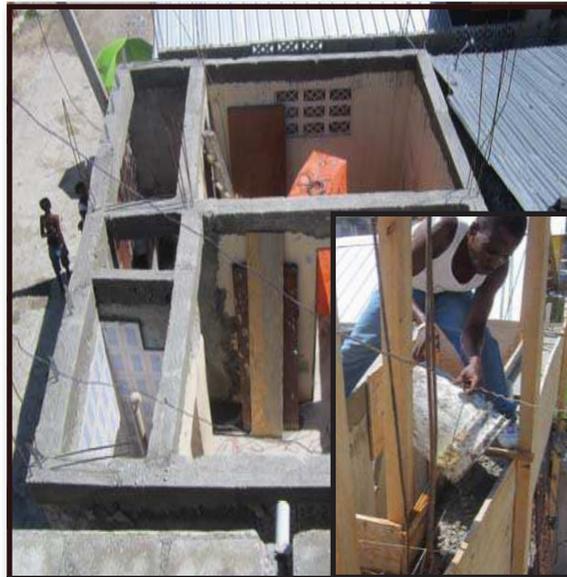
8. Using a guide string, bend two of the existing column bars to the angle of the roof slope. This will provide a connection at the lower end of the two bar sloped ring beam.



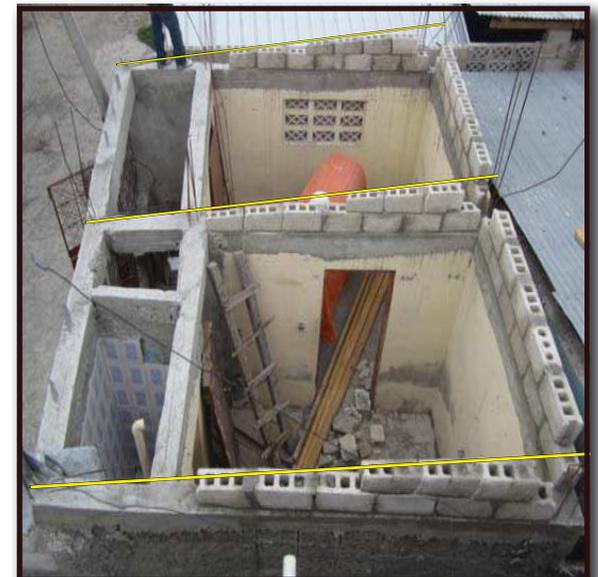
9. Place straps on the 4-bar ring beam at the base of the slope according to the roof plan. Cut each strap to the right length and bend appropriately to achieve the rafter connection as shown above.



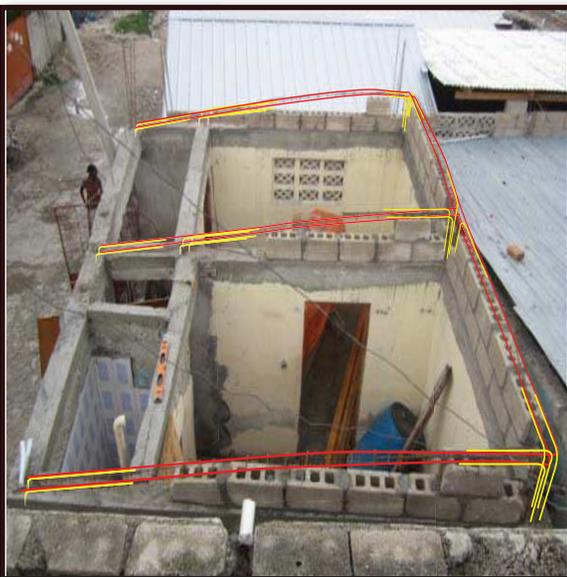
10. Place formwork and tie a string to set the top height of the beam. Use a water level to ensure the string is completely level. Use spacers to ensure that there is at least 2.5cm cover over all steel.



11. Pour the 4 bar ring beam to the height of the string, making sure concrete is well vibrated to prevent honeycombing, voids, and other defects.



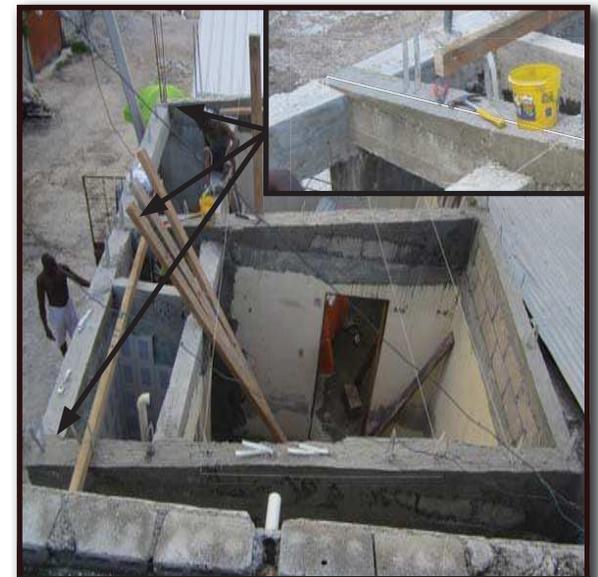
12. Using a guide string, place blocks to give the slope of the roof. Use a maximum of two courses of block. Partial blocks can be used to reduce the amount of concrete required.



13. Cut and bend the steel for a second ring beam with two 3/8" Ø longitudinal bars. Splice the ends of each bar with the exposed column bars that were bent in step 8.



14. Place straps and tie stirrups, ensuring each strap is wrapped around a stirrup. Strap placement is determined by the layout of the rafters (see the following page).



15. Tie the guide strings such that the lower end of the 2-bar beam arrives flush with the top outside edge of the 4-bar ring beam. Then pour the 2-bar sloped ring beam.

Reconstruction of the LW Roof

Each roofing sheet must be nailed to a rafter at its lower and upper ends. Therefore, the placement the rafters shown in red will be determined by the length of the roofing sheets.

Example: for a 6 foot (183 cm) roofing sheet:

$$183 \text{ cm (sheet length)} - 20 \text{ cm (sheet overlap)} = 163 \text{ cm}$$

Rafters shown in red are spaced at **163 cm** when 6 foot roofing sheets are used.

All other rafters, shown in blue, must be placed so that rafters are never spaced at more than 60cm. Note that this is a maximum spacing. In most cases, the spacing can and will be less than 60cm. When 6 foot roofing sheets are used, the rafter spacing will be roughly 54 cm.

Many existing houses are non-rectangular, with corner angles something other than the desired 90 degrees. This can cause difficulty when planning and rebuilding the roof. Do NOT vary the main rafter spacing to resolve this problem. Instead, vary the length of the lookout rafters (short rafters shown in yellow, maximum lookout length: 1.0m). In extreme cases it may be necessary to add another rafter on the longer side, as shown in this case.

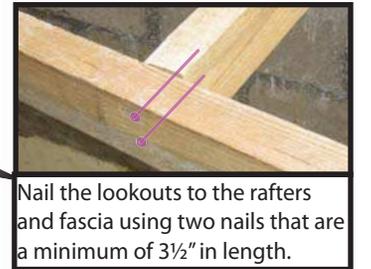
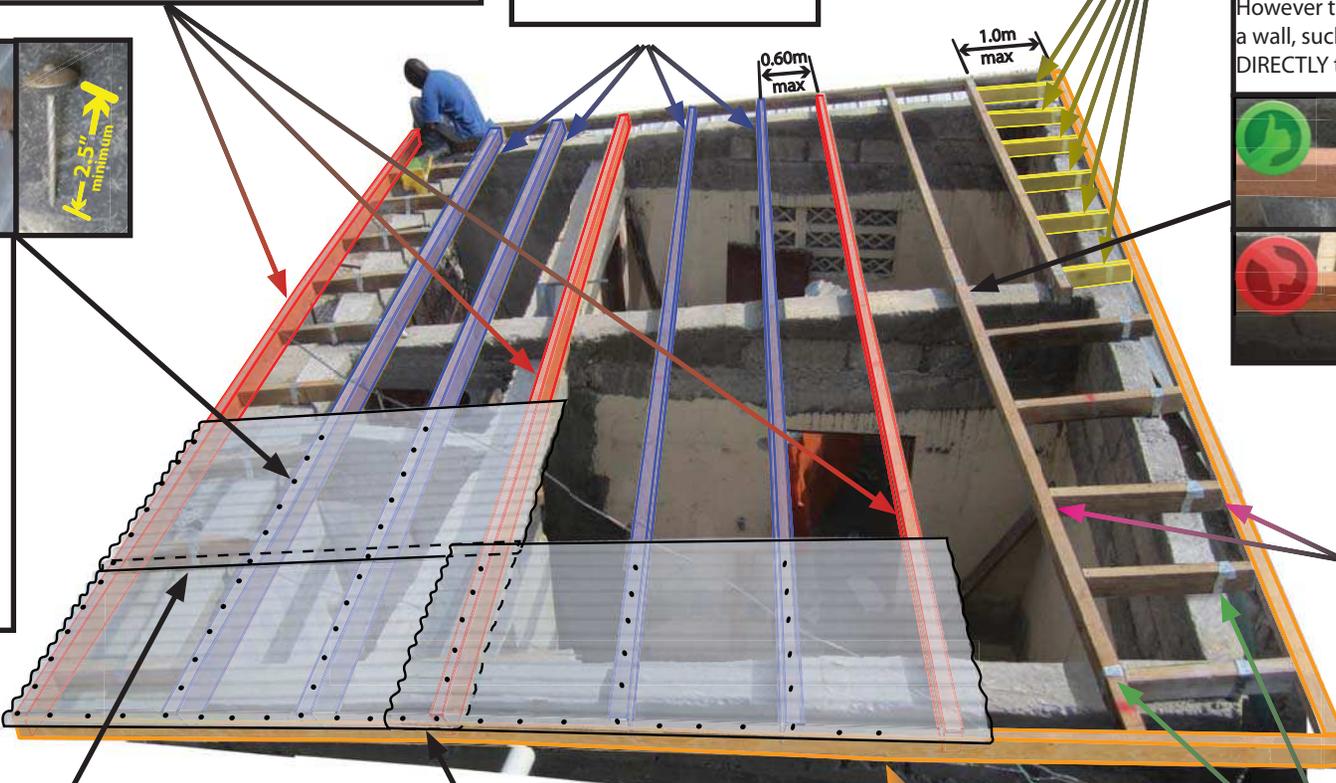
When needed, wood members can be spliced. However the splice must occur directly above a wall, such that the strap attaches each rafter DIRECTLY to the ring beam.



Using roofing nails or screws, secure the roofing sheets to the rafters/fascia board below. Space the nails at 15cm (nail every other ridge of the roofing sheet). Do NOT nail in the groove of the sheet as this will provide an opportunity for water to penetrate the roof.

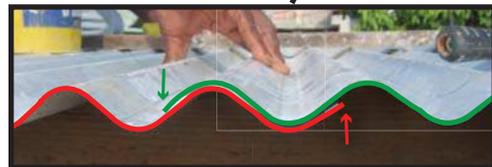
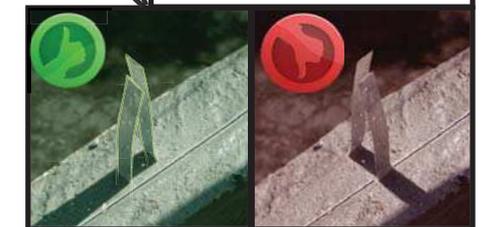


2.5" minimum

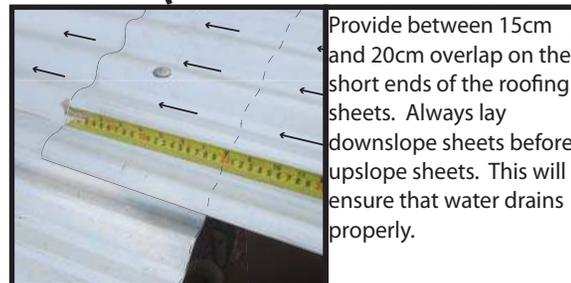


Nail the lookouts to the rafters and fascia using two nails that are a minimum of 3½" in length.

Use lookouts at the upper and lower roof edges. This means that the wood members will ALWAYS be strapped perpendicular to the wall on which they rest.



Overlap sheets by one ridge and one canal. The edge of the bottom sheet should end sloping upwards, while the top sheet's edge should point down. The overlapped ridge must be nailed to the rafters.



Provide between 15cm and 20cm overlap on the short ends of the roofing sheets. Always lay downslope sheets before upslope sheets. This will ensure that water drains properly.

Provide for a 2x4 fascia around the entire perimeter of the roof. Nail the roofing sheets to this perimeter board every 15 cm to prevent uplift in high winds.

Checklist

1	Preparatory works	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Ensure stability of existing walls – if necessary add props	Yes/No				Yes/No			
b	Retain reusable material (timber and metal sheets) on site	Yes/No				Yes/No			
c	Create shear key by breaking open tops of cells in existing wall	Yes/No				Yes/No			
d	Clean top of existing wall removing all loose debris	Yes/No				Yes/No			
2	Ring beam	Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	15 cm wide, 8 or 15cm high	Yes/ No				Yes/ No			
b	Longitudinal Bars								
1	Two or four #4 (1/2") longitudinal bars	Yes/ No				Yes/ No			
2	Minimum Strength = Grade 60	Yes/ No							
5	Type of longitudinal bars RIBBED	Yes/ No				Yes/ No			
c	Stirrups								
1	#2 stirrups	Yes/ No				Yes/ No			
2	Stirrup hooks bent at 135 degrees	Yes/ No				Yes/ No			
3	Hook length for stirrup minimum 4 cm	Yes/ No				Yes/ No			
4	Cover over steel minimum 2.5 cm	Yes/ No				Yes/ No			
4	Bar Assembly	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Ring beam								
1	Stirrup spacing maximum 20cm	Yes/ No				Yes/ No			
2	Stirrups closely spaced (10cm) near all beam-column joints	Yes/ No				Yes/ No			
3	Stirrup hooks rotated	Yes/ No				Yes/ No			
4	Stirrups tied to longitudinal bars with binding wire	Yes/ No				Yes/ No			
b	Joint detailing								
1	Minimum lap length = 50Ø (50cm for #3 bars, 60cm for #4 bars)	Yes/ No				Yes/ No			
2	Apply one of overlap detailing options (see D9.5)	Yes/ No				Yes/ No			
3	Use extra L or T bars only if bars not cut properly	Yes/ No				Yes/ No			
4	All bent bars at corners and T-junctions bent at 90 degrees	Yes/ No				Yes/ No			
5	Laps tied with binding wire	Yes/ No				Yes/ No			
5	Formwork and concrete spacer	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Formwork is good quality (not warped)	Yes/ No				Yes/ No			
c	Space between steel and formwork minimum 2.5 cm	Yes/ No				Yes/ No			
d	Use concrete spacers every 3-4 stirrups or as req to maintain cover	Yes/ No				Yes/ No			
e	Maximum size for concrete spacer is 3 cm x 3 cm x 3 cm	Yes/ No				Yes/ No			
f	Use binding wire in concrete spacer	Yes/ No				Yes/ No			
6	Concrete mixing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Use Mix 1:2:4	Yes/ No				Yes/ No			
b	Use crushed, angular gravel	Yes/ No				Yes/ No			
c	Use gravel with size less than 2 cm	Yes/ No				Yes/ No			
d	Use clean, washed river sand	Yes/ No				Yes/ No			
e	Use clean water (not salty or muddy)	Yes/ No				Yes/ No			
f	Use Type 1 Cement	Yes/ No				Yes/ No			
g	Mix a clean, concrete or asphalt surface, not on dirt	Yes/ No				Yes/ No			
h	Using a mechanical mixer is best	Yes/ No				Yes/ No			
i	Batch out gravel, then sand, then cement	Yes/ No				Yes/ No			
j	Turn over 3 times or until color is uniform	Yes/ No				Yes/ No			
k	Do not use too much water! Add water slowly	Yes/ No				Yes/ No			
l	Use slump test or hand test for water content	Yes/ No				Yes/ No			
7	Concrete pouring and curing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Wet formwork and steel before pouring concrete	Yes/ No				Yes/ No			
b	Use concrete within 90 minutes of mixing with water if from factory	Yes/ No				Yes/ No			
c	If manually use in less than 30 minutes	Yes/ No				Yes/ No			
e	Use rod to consolidate concrete around reinforcement	Yes/ No				Yes/ No			
f	Complete entire beam everywhere indicated within one day	Yes/ No				Yes/ No			
g	If concrete pouring must stop, use a diagonal joint with stones	Yes/ No				Yes/ No			
h	Have plastic on standby, cover if it rains	Yes/ No				Oui/ No			
j	Cure for minimum 3 days by sprinkling clean water.	Yes/ No				Oui/ No			
k	Cure 5 times perday : MORNING, At 8 , 10	Yes/ No				Oui/ No			
l	AFTERNOON: 12, 14, 16, pour water slowly	Yes/ No				Oui/ No			



8	Concrete inspection	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	For beams, remove formwork after 48 hours	Yes/ No				Oui / No			
b	If steel showing, demolish and rebuild	Yes/ No				Oui / No			
c	Any cracks larger than 3 mm	Yes/ No				Oui / No			
d	Many cracks in one location	Yes/ No				Oui / No			
e	Diagonal or vertical cracks anywhere in the beam	Yes/ No				Oui / No			
f	If any of the above exist, demolish concrete and repour	Yes/ No				Oui / No			

Checklist

1	Hurricane Staps	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Length of straps is 75cm (for four bar ring beam) or 65cm for two bar ring beam	Yes/No				Yes/No			
b	Straps placed at 50cm centers along the top of all walls	Yes/No				Yes/No			
c	Straps pass under the stirrups	Yes/No				Yes/No			

Checklist

1	Setting-out	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Mark rafter spacing on ring beam.	Yes / No				Yes / No			
b	All wood S-Y-P #2 (min) or equivalent	Yes / No				Yes / No			
2	Rafter / Wall Plate Attachment to Ring Beam	Planned?	Date	Photo #	Recommendation Made	Done?	Date	Photo #	Recommendation Implemented
a	Wood preservative recommended where necessary.	Yes / No				Yes / No			
b	2x4 (min) framing set out correctly (max rafter spacing 0.5m oc)	Yes / No				Yes / No			
c	Straps wrapped around framing member and secured with (3) 8d each side (min) in shear.	Yes / No				Yes / No			
3	Rafter / Slat Attachment to Wood Framing	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	1x4 (min) framing set out correctly								
1	Max rafter spacing 0.7m oc.	Yes / No				Yes / No			
2	Max slat spacing 1.2m oc.	Yes / No / NA				Yes / No / NA			
b	At each wall line, coiled strap over member and fastened to wood framing below w/ (3) 8d each side (min) in shear.	Yes / No				Yes / No			
4	Structural Fascia	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	1x4 (min) fascia nailed to rafters/slats w/ (3) 12d @ each connection (min).	Yes / No / NA				Yes / No / NA			
b	Fascia boards nailed together at corners w/ (3) 8d (min).	Yes / No / NA				Yes / No / NA			
5	Attachment of Roof Metal	Implemented correctly ?	Date	Photo #	If step not correctly implemented, following advice given:	Advice followed?	Date	Photo #	Action taken if advice not followed:
a	Roof metal is of good quality (not rusted, excessively bent, or damaged)	Yes / No				Yes / No			
b	Apply CGI roofing from bottom to top with 15cm (min) overlap	Yes / No				Yes / No			
c	Spiral or ring shank 8d (min) used to secure roofing.	Yes / No				Yes / No			
1	Field nail spacing: 8d @ 0.5m oc (min).	Yes / No				Yes / No			
2	Edge (perimeter of building) nail spacing: 8d @ 0.25m oc (min).	Yes / No				Yes / No			
3	Nails applied through CGI ribs, not between ribs	Yes / No				Yes / No			





Build Earthquake Resistant Houses,
Change Construction Practices Permanently