

POPULAR OR TECHNICAL?

A review of Information, Communication and Education materials (IECs) on foundations.

Report by Melvin Tebbutt MCIQB

The collage consists of several key components:

- SAFE LOCATION:** A diagram showing a house on a slope with a retaining wall, illustrating safe placement relative to the water table and ground level.
- Content Table:**

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- Setting Out by 3-4-5 Method:** A diagram showing a right-angled triangle with sides of 3, 4, and 5 units to ensure square corners for a foundation.
- Proposed Type 1-4:** Four diagrams showing different foundation types: Type 1 (simple footing), Type 2 (stepped footing), Type 3 (pile foundation), and Type 4 (post-and-rail).
- 2. Build on strong foundations:** A section with text and diagrams explaining the importance of soil strength and how to assess it.
- What can I use as a foundation for my house?:** A diagram comparing different foundation options: 'too weak' (wooden posts), 'Strong & Stronger' (concrete footings), and 'Strongest' (pile foundations).
- MAKE YOUR HOUSE SAFER:** A section with diagrams and text providing safety tips for existing structures, such as checking for rot and ensuring proper drainage.
- Structural Specifications:** A table listing technical requirements for foundations, including materials, dimensions, and construction methods.
- CONCRETE FRAMES:** A diagram showing a cross-section of a concrete frame foundation with reinforcement details.
- CONCRETE MASONRY:** A diagram showing a cross-section of a concrete masonry foundation with reinforcement details.
- CONCRETE SETTING:** A diagram showing the process of setting a concrete foundation, including the use of formwork and reinforcement.
- CONCRETE LIFE:** A diagram showing the long-term performance of a concrete foundation, including the effects of weathering and maintenance.
- RECOMMENDATIONS:** A section with diagrams and text providing practical advice on foundation construction, such as using proper materials and techniques.
- WHY?:** A section with diagrams and text explaining the reasons for using certain foundation types, such as soil conditions and building requirements.

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INTRODUCTION SUMMARY

The Shelter Compendium

INFORMATION EDUCATION AND COMMUNICATION MATERIALS
FOR SHELTER AND SETTLEMENTS PROGRAMMING

iec.sheltercluster.org



This document is a report on rapid review of foundation details in over 300 IEC materials extracted from the database of the IEC Shelter Compendium (iec.sheltercluster.org). Over 70 IEC materials were selected by the consultant and reviewed to understand whether the provided advice and technical details are sufficient for the purpose. The document is intended to start a broader discussion on **how to develop, present and use building details in IEC materials**. In each section we highlight questions that arose and comments representing the opinions of the consultant.

There's a definite tension between providing simple practical and accessible information, which people can follow themselves, and providing technical construction drawings. Clearly IEC materials need to be part of a larger social engagement programme and be created in consultation with communities. Otherwise, depending on background and knowledge of the audience, the message can be interpreted differently.

Who is responsible for the decision over which foundation detail is to be used and on what grounds is the decision taken?

Who is employed to produce the posters and is there best practice for identifying both the designer (is it a cartoonist, graphic designer, or architectural draughtsman) and the production process to ensure both relevance, accuracy, and speed? (This could also tie into co-production/participatory techniques potentially).

While the IEC database enables quick access to existing IEC materials, is there a way to develop and more effectively catalogue editable formats so that existing relevant materials can be found and adapted more quickly and easily?

SEPTEMBER 2021



Disclaimer: The materials (mainly posters) were reviewed as seen, as most are only available as documents without any context. The comments reflect the opinions of the consultant and must be taken in the context of trying to improve the information provided to affected people rather than as being seen as a criticism of the work of others.

I.0 CONCEPT

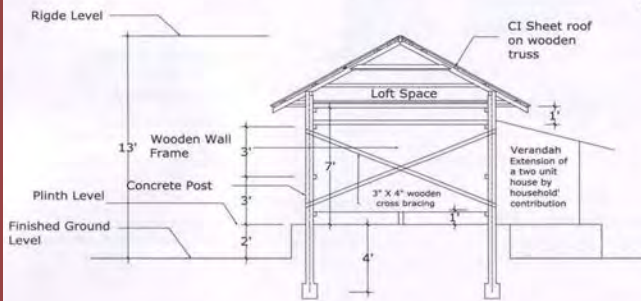
Who is the intended Audience of an IEC material?

What are their skills, and how do we ensure the relevance and usefulness of the message at professional, technical, and household levels without oversimplification?

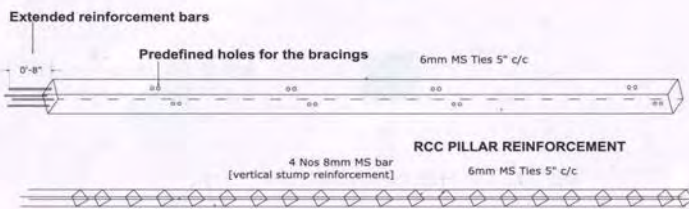
Where does individual shelter advice fit within the larger shelter strategy?

Proposed Type 1

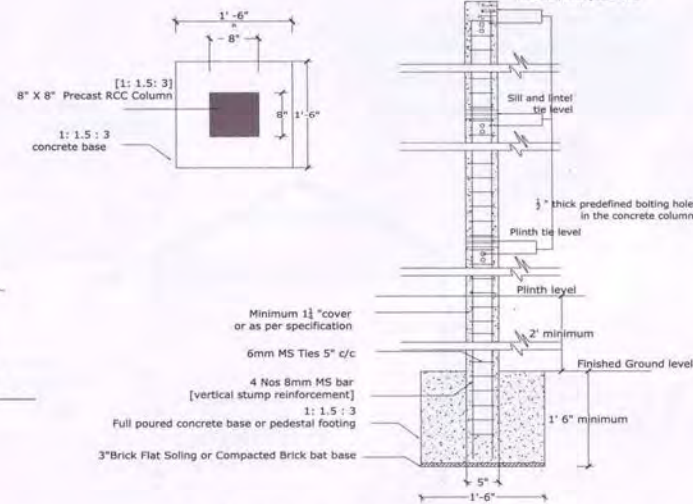
A Wooden Framed Structure with Full length RCC Main Post, CGI Sheet hip roof, alternatively the roof could be a gable roof with proper tied down with optional materials, the structure shall be anchored adequately underground as per the specification .



Section YY'



Only for Engineers



DETAIL OF Precast concrete column and footing

How do we separate engineer only and owner builder use?

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

Guideline for use by engineers only, no liability accepted from use.

1.1 Audience

Who is the target audience for the 'popular sketch' details? Shelter practitioners, builders, or homeowners?

Are we expecting homeowners to build their shelters using the given advice or to hire a builder and monitor their work?

How do we provide drawings and details that builder can build from, and that agencies or families can also use to monitor construction against agreed standards?

IEC materials need a defined audience, for whom the messages are targeted, comprehensible, and useful.

In many IEC materials a relaxed 'popular sketch' format is preferred. These often miss out intricate but necessary construction details, fail to define quality requirements, do not include best construction practices, create space for builders to deliver lower quality products and lead to poor construction practices. Quality assurance and quality control depend upon setting standards that can be measured and controlled by the builder and monitored for compliance by the homeowner, architect, engineer and/or local authority.

Examples of this include foundation details showing sloping excavation, poor footing detailing, poor backfilling and compaction, poor specification and details, and inadequate finished ground level details.

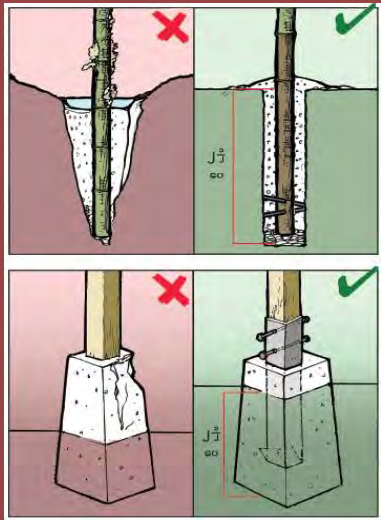
1.2 Skills levels

How do we classify skills levels?

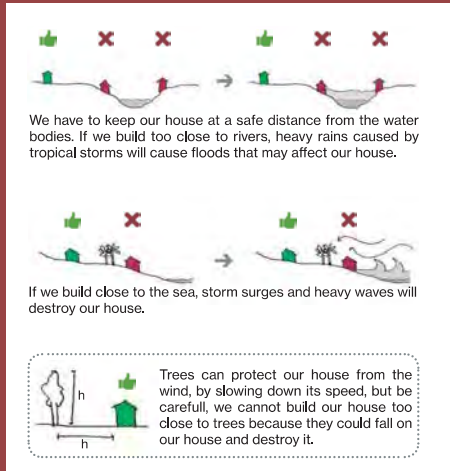
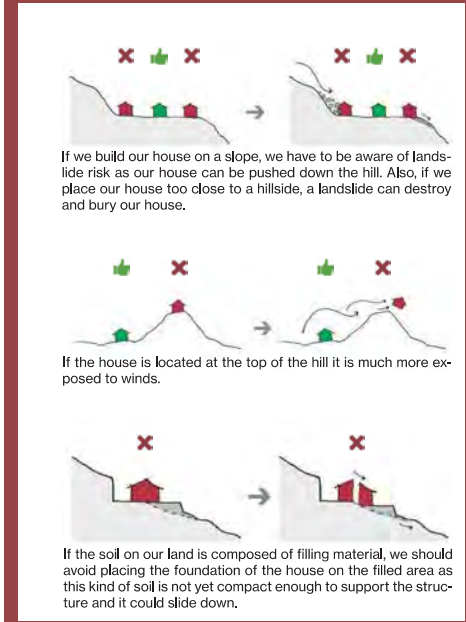
How do we ensure that IEC materials are fit for purpose at different levels of use?

What are the correct skills and language needs for each user level?

For professional and technical level, how do we identify the appropriate experienced skillset for a shelter specialist to design shelters that meet the conditions expected throughout the predicted life of the shelter, seismic, hurricane, flooding, shelter transition? How do we define this need in IEC materials?



How do these simple details stand up to risks?



How do we ensure that location details are relevant to the context we are in?
How do we locate this geographically for a community?

For owners and builders, how do we ensure that IEC design and build guidelines can be used by the people who actually do the building?

IEC materials do not quantify the skill level or effort necessary to achieve a specific design solution, which can lead to the assumption that anyone can do the job, rather than requiring specific artisans and skilled labour with recognised competencies. (See also section 4.0 how to)

IEC materials and guidelines sometimes clearly identify the architect or engineering role and qualify the material with text such as 'for engineers only' or 'these construction guidelines are intended for use by qualified engineers only, the organisation does not accept liability for damages or injuries resulting from the use of these guidelines.'

Whilst designing shelter to meet specific environmental conditions might need specialist engineering or architectural expertise to ensure that designs perform to agreed national and international standards, the working IEC material need to reflect the skill required to build the shelter. In general, most houses are designed and built by the householder and local builder alone without specialist support. IEC materials aimed at self-build should be in, sufficient, detail to support this process.

PROVIDE

- Slightly Slanting cut
- Sand Compaction thickness more than 150mm
- PCC thickness more than 75mm

AVOID

- Straight Cut
- Sand compaction less than 150mm
- PCC less than 75mm

PROVIDE

- Foundation width should be $2\frac{1}{2}$ times thickness of the wall or 0.8m, whichever is more
- Use baked bricks and stones

AVOID

- Foundation width should not be less than $2\frac{1}{2}$ times thickness of the wall
- Never make a wall without foundation
- Don't use unbaked bricks in the foundation

What is this foundation designed for, is there a simpler form?

House construction: Build a strong building that can withstand moving water and will not collapse when wet.		
House shape, foundations and drainage		
Key Messages	Reason	
Consider constructing a round building instead of a long rectangular building.	Round buildings are stronger against strong winds and flooding.	
Build the shelter on foundations or pilings that rest on stable ground.	Unstable ground can be washed away by flood waters, causing the house to collapse.	
Provide good drainage to the shelter and settlement.	Good drainage prevents erosion of foundations.	

Are standard IEC details fit for purpose, how do they link with build back better with site specific designs?

Content

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Plinth Preparation	13
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How do owners finish the shelter if components are not elaborated?
Roof truss details are not included.

1.3 Oversimplification

Should IEC materials present a one size fits all solution or put forward options with information to support choice?

How do we ensure that the suggested advice is accurate, fits the context and represents the choices available for the people we are serving?

How can we assess or evaluate complicated construction details and make simple recommendations?

Many shelter IEC foundation materials are repeated in different contexts: timber and bamboo posts, concrete pad foundations etc. Many standard details have been used, amended, simplified, and presented in multiple languages.

IEC materials often detail timber posts or bamboo embedded in concrete or in direct underground positions with details showing the use of cross pieces or protruding nails to improve performance as an anchor. In general this is bad practice because of the impact of moisture and insects on the posts making them susceptible to rapid deterioration and early failure. Nails and wire similarly corrode rapidly in moist ground conditions. Where we suggest rapid solutions, we need to be specific in what the performance is likely to be in terms of longevity and structural capacity.

Similarly, IEC materials often show complex cement or brick based foundation solutions, where a simple form would be easier to construct and do the same job. Pyramid shaped pad foundations can be more easily made rectangular, reducing the time and skill required to fabricate the form and cast concrete, increasing the ability to mass produce and simplifies construction lining and levelling improving construction times. Corbelled brick work foundations or stone ground beams are far simpler to construct if they are kept rectangular, even with confined reinforced structures included in the design.

1.4 Shelter strategy

Where does individual shelter advice fit within a larger strategy?

Can IEC materials look at the single unit against the big picture?

Can IEC materials be devised for planning and implementation of large-scale shelter needs?

What are the impacts of scale on the chosen design, procurement and logistics supply chain, skilled and unskilled labour supply, training and capacity building, management, Quality Assurance and Quality Control needs, risk identification and management?

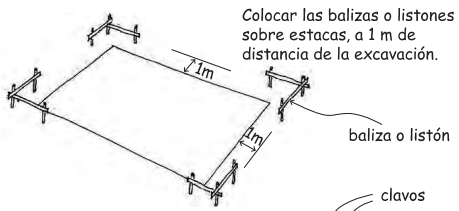
Most IEC materials include a section on site selection using the standard repetitive details available, many focus on the singular shelter. IEC materials do not deal with site or construction planning and management.

Shelter solutions and construction advice have to be tailored to the needs of a specific community, camp, rural and urban settings when each have their own unique challenges. Turning the singular shelter into a settlement requires a physical planning element and a construction management process. The shelter community planning exercise should be a community led multi-sector process and is continuous throughout the life of the settlement. Likewise moving from singular to hundreds or thousands of shelters also requires detailed planning to identify and quantify all resources required to deliver the project within a specified time frame and to an agreed cost. There is no magic % addition to define the cost and resources required to build a single shelter or a thousand shelters. Fail to plan, plan to fail.

2.0 CONTEXT

How do politics, natural variables, environmental impacts, and building back better influence design, cost, impact of, and responsibility for the chosen messages in IEC materials?

Replanteo de la obra

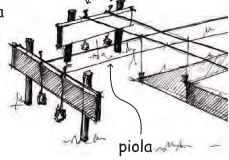


Colocar las balizas o listones sobre estacas, a 1 m de distancia de la excavación.

baliza o listón

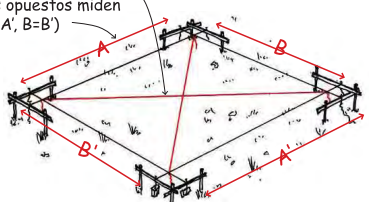
clavos

Colocar clavos para poner las piolas.



piola

Es un rectángulo :
- si las diagonales miden lo mismo, y
- si los lados opuestos miden lo mismo (A=A', B=B')



Trazando un ángulo recto (3:4:5)

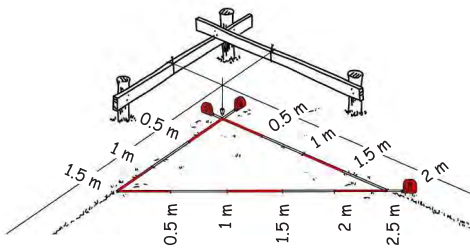
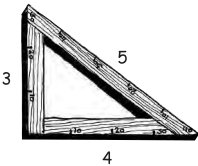


Tabla de proporciones :

3	4	5
30 cm	40 cm	50 cm
60 cm	80 cm	100 cm
90 cm	120 cm	150 cm
1,5 m	2 m	2,5 m
2,1 m	2,8 m	3,5 m
3 m	4 m	5 m
3 ft	4 ft	5 ft
6 ft	8 ft	10 ft



Setting out using a right angle with a 3-4-5 triangle. How do you set out on an irregular level site and what impact does it have on the foundation?

Num terreno inclinado deitamos o betão de limpeza assim como está, em forma de escada!



Se o projecto prevê a utilização de bloco de solo-cimento para as paredes das fundações, coloca-se um plástico em cima do betão de limpeza como aqui.



As fiadas são depois assentadas com argamassa de cimento e areia ao traço dado no projecto.



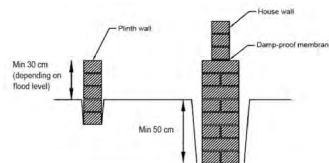
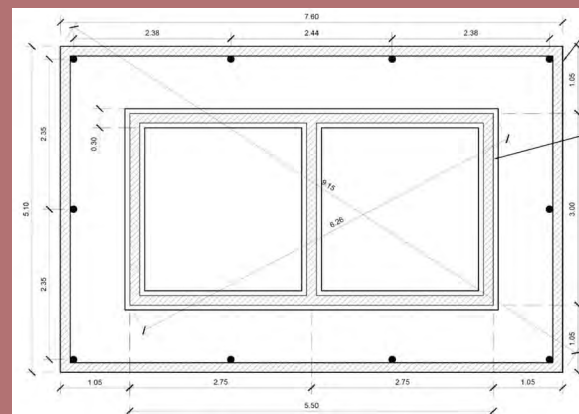
O plástico é um impermeabilizante e serve para proteger as paredes e o pavimento da humidade dos solos.

Na penúltima fiada das paredes de fundação, o plástico é dobrado para cobrir completamente os blocos de solo-cimento ...



... e continua-se o assentamento dos blocos em cima do plástico.

Under what conditions is it safe to build a step footing and how do you do it safely?



At what point do we define minimum and when do we include it in the design and budget?

2.1 Political environment

How does the political environment impact design solutions and risks and how do we communicate them?

How do we design, record, and communicate the imposed shelter solution and its risks on future living conditions, costs, maintenance, upgrading etc?

The choice of the shelter solution and its foundation needs may be dictated by the political environment prevailing in the location of the shelter need. When we agree to follow direct instructions on the quality and design of a specific shelter solution, the instruction must be recorded with potential risks and mitigation measures identified. The risk analysis informs on current and future risks, need for planned maintenance to keep the shelter habitable etc, it will also serve as a management tool to monitor the function of the shelter throughout its life.

2.2 Natural variables - Physical conditions

How do we identify and account for natural variables that affect the design and construction of foundations, for example ground conditions? How do we explain their impact on construction and construction costs?

The foundation design is normally presented as a level site with consistent ground conditions that provides for a standardised dimensioned foundation set against floor level and depth. There is no explanation of the impact of the site on the foundation height and its ultimate impact on materials, labour, and time.

The height of the floor is set against the high point of the ground, raising the height of the foundation above the remaining site. Poor ground conditions met at the minimum depth result in deeper excavation, increasing the depth of the foundation.

Some IEC materials show that you can overcome changes in level using steps without any adequate explanation on how this is done and the resulting impact on the functioning of the overall foundation.



Fig. 1: Every building element can be lime stabilised: foundations, plinths, walls, mortars, protective 'toes', renders, plasters, floor screeds and roof finishes.

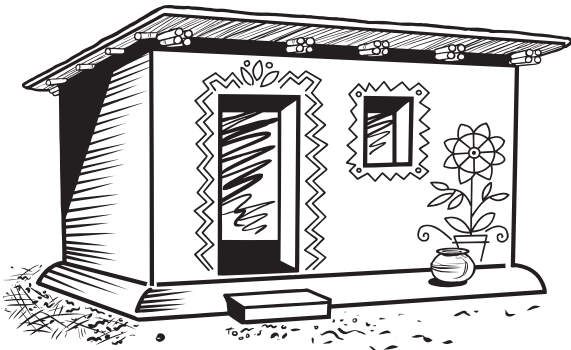


Fig. 114: Durability over Generations

Care and attention to testing local low cost materials and making, curing and testing trial mix samples with those tested materials: using the same materials and the same successful ratio of lime to soil (and pozzolan if necessary), should all result only after 28 days of curing in a durable building - a building that should stay stable in flood conditions for many generations ahead.

It is clear from many trials and from experience that the lime stabilization of soil can be successful with a wide range of mix proportions. Due to the variability of soils and clays however, it is essential to follow the test procedures in stage 1, 2, and 3, as recommended in this Manual for consistent and reliable results.

How do we assess the impact and benefits of lime and all other construction materials?

Building back better is not possible without quality materials and skills.

Lime has been used in construction for thousands of years. The longevity of lime based products are completely reliant on the quality of the materials and skilled workforce through materials selection, fabrication, design, construction and maintenance.

2.3 Environmental Impacts

What is the environmental impact of the shelter IEC messages? Are there alternatives? What is the lifespan and physical and economic cost of the alternative?

Should we do a full environmental assessment on specific advice identified in IEC materials?

Should IEC materials stop presenting the use of certain materials, e.g., locally fired clay bricks?

How does the natural environment and procurement cycle impact resource availability for solutions recommended in IEC materials?

Each element of a shelter has some impact on the environmental landscape. In response to a crisis, we need to be aware of the impact of each option available and to be able to advise on the choices available that can be delivered at the scale required. At present, IEC materials do not have clearly defined environmental impact information.

Similarly we need to evaluate how the natural environment and procurement cycle impact a solution proposed in the IEC material to inform the final decision making.

Natural cycles within the affected country affect the construction of foundations. Weather seasons, local festivals, building seasons, agricultural planting and harvesting cycles, cropping of natural building materials and availability of natural building materials. This aspects all impact shelter construction. The event that shelter is responding to may have impacted the current crop of building materials, or in wiping out assets or stores made resumption of farming or other livelihood activities a higher priority than shelter construction for affected people's time and resources.

We are ultimately responsible for the market assessment and supply chain management of shelter foundation solutions, including material supply, and skills available. The capacity of the local market to meet the demands of proposed projects may make some solutions impractical.

2.4 Build back better

What does build back better mean?

In general, good construction practice has been lost because skilled physical labour has not been valued.

Some build back better methods based solely on manufactured or imported materials and techniques can create the misunderstanding that local construction practices are wrong or temporary, rather than being a long-term solution.

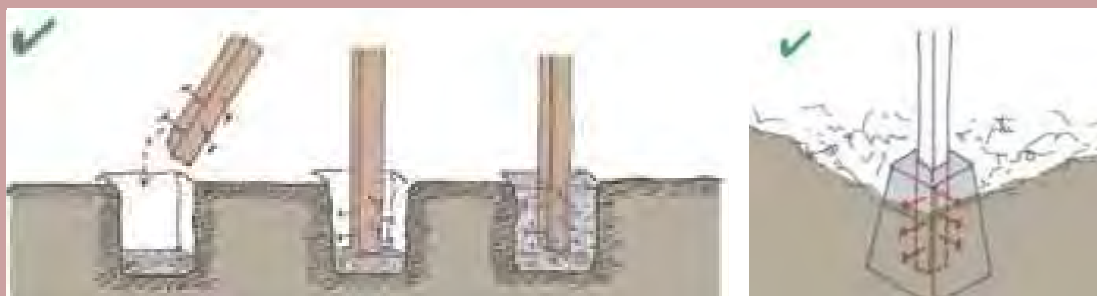
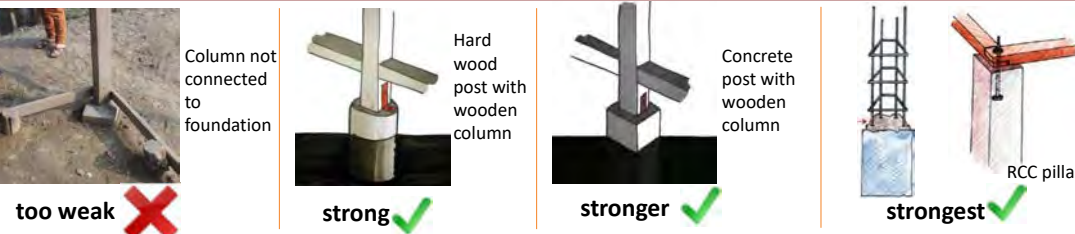
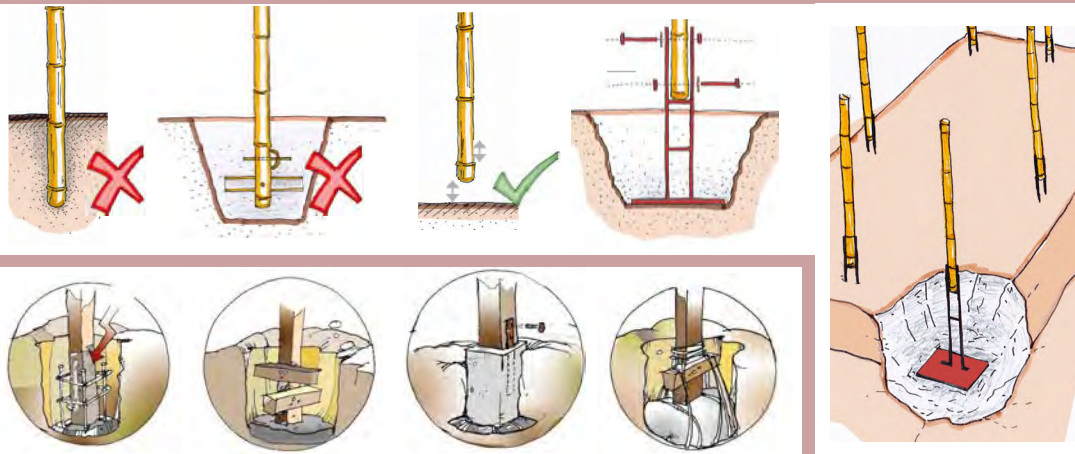
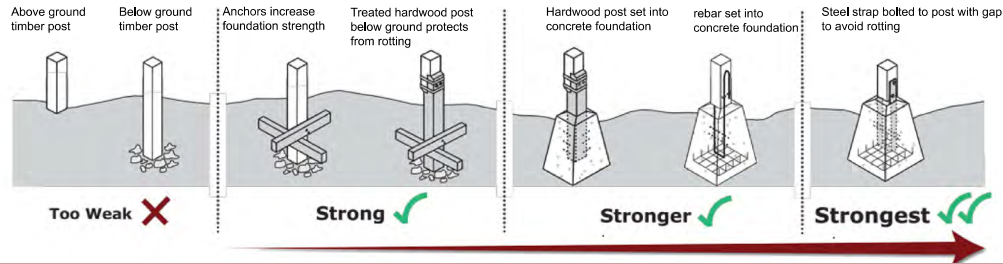
Training programmes can compensate for skills shortages by demonstrating that construction is a skill that requires a high level of competence to deliver quality work-competency in building techniques is not a short training course.

Building back better needs quality competent workers and to achieve this in both the near and longer term we need to show that improved building processes need to encourage people to come into the construction business, part of this process is ensuring the level of compensation is appropriate for the product provided, we have to elicit pride and respect in trade skills.

3.0 RISKS

Risk management is a critical component of developing an implementation plan. All risks can be identified and evaluated with an agreed response communicated to all participants of the project. There does not seem to be any IEC material for risk management.

WHAT CAN I USE AS A FOUNDATION FOR MY HOUSE?



What selection criteria has been used for the negative or positive marks?

Are we looking at lifespan, strength, ease of construction, material availability, cost or affordability?

Who decides what to use in what scenario?

Why do we show poor construction practice as a potential solution? For example timber inserted inside concrete will rot and fail, nails will corrode rapidly.

3.1 Limitations and risks

How do we define the limits and risks associated with a foundation design?

How and where do we qualify the limits of individual foundation designs on immediate and future shelter improvements?

Where and how do we clearly identify the risks associated with future constructions on an existing foundation?

The foundation design of any building is dependent on the superstructure design, imposed loads from the building use and loads imposed from the natural environment and how that impacts the ground conditions. Where a shelter is described as transitional, the foundation must be designed to be supportive of the final transitioned state envisioned and this state has to be defined and communicated to the shelter owner including its limits, for example this shelter cannot accept a second floor, or concrete block walls.

3.2 Life expectancy

How and when do we specify the life expectancy and risk assessment of the proposed shelter to ensure that the overall design is fit for purpose and risk mitigation needs are fully assessed?

The traditional design process for construction starts with the use of and life expectancy for the proposed building. The life expectancy is critical in defining the risks that a building could face during its expected life, and this defines the structural capacity, quality, and durability of materials to meet the design specification. Starting with the assumption that a temporary shelter has to withstand a cyclone of A and an earthquake of B you will automatically define a building that is not temporary.

IEC materials do not clearly define the life span of a proposed solution, nor indicate treatments and maintenance actions necessary to achieve the lifespan the design aims for.

DEPTH OF FOUNDATIONS

The function of foundations is to transfer the building loads to a stronger bearing strata.

Foundations need to be deep enough to protect them from erosion, surface water, and tree roots.

The depth of foundations will be dependent on site conditions.

FOUNDATIONS SHOULD NEVER BE CONSTRUCTED ON MADE UP GROUND.

FOUNDATIONS SHOULD BE CONSTRUCTED ON MADE UP GROUND.

If the ground is soft then foundations will have to be dug deeper.

FOUNDATION CONSTRUCTION

Anti termite insecticide

Where it is afforded, anti termite insecticide should be applied to the soil around the foundations. The effectiveness of the treatment will depend on the brand and applicator.

Foundation Construction

Foundations should be constructed on a 40mm compacted layer of sand. Burnt brick or lamp stone should be used for foundations.

Where the wall is 230mm wide and there are two courses of brick, then the footing will be a least 230mm wide.

FOUNDATION CONSTRUCTION

Damp Proof Course. Preferably using bitumen or steel sheet formed to ground termite protection. 500 gauge polythene is a real effective DPC but can be used where cost is an issue.

Foundation walls to be constructed using Sand / Cement Mortar at a ratio no less than 1:6

2 courses of controlled brick to form wall foundations 230mm wide 40 mm layer of sand compacted and watered

INFILL & DAMP PROOF MEMBRANE

The ground floor can be constructed in a number of different ways. A Damp Proof Membrane (DPM) using 500 gauge polythene (plastic paper) should be installed to prevent damp rising through the floor.

EXEMPLE 1	EXEMPLE 2	EXEMPLE 3
1. 20mm Sand / cement screed	1. 20mm float concrete	1. Brick paving
2. 75mm concrete	2. Crushed brick / stone	2. Sand bedding
3. DPM	3. Sand bedding	3. DPM
4. Sand bedding	4. DPM	4. Sand bedding
5. Crushed brick/stone	5. Compacted subsoil	5. Crushed brick / stone
6. Compacted subsoil		6. Compacted subsoil

Where and how do we reflect this in terms of health and safety and resource needs?

MAKE YOUR HOUSE SAFER

Step 7: fix the wooden pillar (4" x 4") in the beam with the 4" nails and nail the extended piece of the flat metal strap (6") onto the beam to reinforce the connection, as in the drawing.

TO AVOID!

For one pillar (3 ft above ground), you need:

- cement -- 0,5 bag
- sand -- 8 buckets
- gravel -- 16 buckets
- water
- 4" x 4" x 4ft -- 1 piece
- 2" x 4" x 3ft -- 2 pieces
- 4" nails -- 10 units
- 1 1/2" nails -- 1/4 lb

Note: shape the concrete with a 45° slope, the slope will allow the water to run off the pillar and will avoid the pillar rotting.

Step 8: prepare the concrete (ratio 1:3:6). Cast the footing as in the drawing and **vibrate well** the concrete. Insure that the wooden pillar is well anchored in the concrete (16 inches at a minimum).

Note: the more you vibrate the concrete, the more it will be compact and resistant.

Step 9: level the pillar, to make sure that it is vertical in both directions.

Note: you can add some cement on top of the concrete to smooth the surface and allow a better water-resistance to the concrete.

Step 10: brace the pillar in both directions using 2 pieces of 2" x 4", as in the drawings.

**Poteau d'angle: 4 straps
Montant: 2 straps**

30 cm
60 cm

EXTERIEUR INTERIEUR

Le bois est en appui sur le soubassement mais ne doit pas rentrer dedans

Biseauter le soubassement pour l'évacuation de l'eau

Macadam au même niveau du soubassement

Above are examples of messages on maintaining and upgrading foundations. How safe and easy is it to underpin a simple building? These details do not show the overall complexity of identification, design and replacement of foundations or health and safety needs to protect both the shelter and the workers upgrading the foundation.

3.3 Preservation

How do we define the need for preservative treatment whilst respecting the need to protect the workers and householders from any risks associated with particular methods?

Preserving and improving the performance of natural materials through chemical or surface treatments using locally developed or imported methods using readily available materials makes sense and should be incorporated into project planning at the outset.

3.4 Maintenance

How do we address and define planned maintenance needs in temporary and transitional solutions?

How do we monitor the process to ensure that the task is performed?

This may be more important in temporary and transitional environments because we are using lower quality materials and skills. IEC materials need to clearly define the maintenance needs and resources required to keep shelters operational.

Building maintenance is an essential activity to ensure that the building continues to perform as designed throughout its intended life span. Regular maintenance can extend the life of building components when planned and performed correctly.

All maintenance activities consume materials, tools, and time and hence a cost that can be measured.

4.0 SHOWING HOW TO

Showing how to build efficiently and safely and what resources are required including management, technical, skilled, and unskilled labour, materials, and equipment. How to identify and ensure all resources are accounted for, including health and safety measures, quality assurance and quality control for each stage of construction.



El metraje dependerá del diseño de patín que nos presente el técnico calculista. Haremos siempre el cálculo de 1 metro.

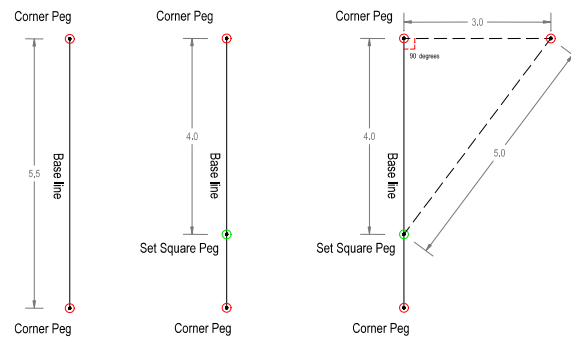
<p>Patín con una carrera sobre él, donde apoyará el muro. Calcularemos las áreas de:</p> <p>CARRERA PATÍN</p>	<p>Patín con una carrera sin pendientes laterales. Calcularemos las áreas de:</p> <p>CARRERA PATÍN</p>	<p>Patín sin carrera superior. Calcularemos las áreas de:</p> <p>PATÍN</p>
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Las áreas sumadas y multiplicadas por 1 m nos dará el volumen en metros cúbicos que deberemos multiplicar por la totalidad de metros lineales de muros que tengamos que cimentar. Ese valor total lo multiplicaremos por las cifras de abajo para obtener la cantidad de material necesario (aproximado), para su construcción.

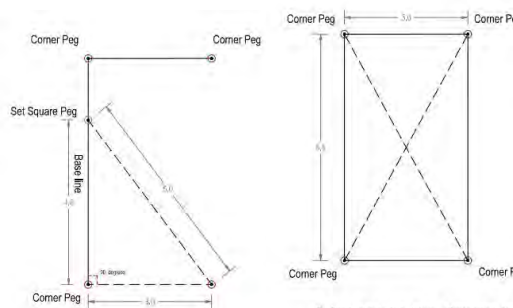
<p>Volúmen total de patín X</p>	<p>0,9 = m³ de pedregullo 0,6 = m³ de arena gruesa 7 = bolsas de cemento portland 1 = kilos de clavos de 2 pulgadas 1 = kilos de alambre para atar hierro</p>
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El hierro dependerá del técnico calculista. Para una aproximación de lo que necesitamos podría multiplicarse el volumen total de patín por 25 kilos.

Concrete mix materials shown per foundation, without any indication of how much material you might waste in mixing and placement.



1. Put in two pegs on the line of the longest measure 4m and fit in a wall to mark the corners of the house
2. From the first corner peg the 2 temporary Set Square Peg with a nail in the top to mark the exact position
3. Using 2 x tapes or measured lengths of string, find the point where the 3m and 5m length join. Fit a corner peg in this position and mark with a nail the exact position. This is the third corner of the house



4. Again use two tapes or measured string to find the position of the last corner peg.
5. Final check the house dimensions to make sure the setting out is accurate. Check the diagonal measures, if the corners are at right angle the measures will be the same.

On site accurate setting out is the first step. Using the 3-4-5 method of establishing right angles is a much repeated formula.

4.1 How do we show people how to build?

Do we show people how to build or monitor the quality?

How do we demonstrate temporary work needs for construction? How do we account for these costs?

IEC materials can show tools required for the works, but seldom show temporary material and equipment needs to perform construction tasks safely.

Many temporary shelter solutions show stub columns or full height foundation columns but do not show how to position, prop, or support them in their final location during construction.

IEC materials rarely show formwork for concrete nor explain how to prepare and reuse it or how many reuses you should expect from different quality of materials.

4.2 Resource needs, materials, tools, and labour

Where do we identify and define resource needs, in local terms, management, technical, labour (skilled and semi-skilled), equipment, materials, compare foundation and superstructure costs, value engineering, etc?

How do we ensure that all the resources are costed to reflect the total cost of building a foundation including temporary works, waste, and supervision?

Building up a fully resourced construction plan is a specialist skill, which is always left to the contractor to evaluate and include all that is required to complete the building to an agreed price, timeframe and to the quality defined in drawings and specifications within a competitive bidding process. The bill of quantities, specifications and drawings define the finished building but not how to do it or what resources you need to build.

Similarly there is a difference between a bill of quantities and the quantity of materials required to build a building. For example, for construction in timber or bamboo the procured length is not the same as the finished building element, there are offcuts and a limit to how many of these it is possible to use elsewhere. With bricks, blocks, mortar, and concrete there

Key Messages and recommendations for self-construction: DETAILS

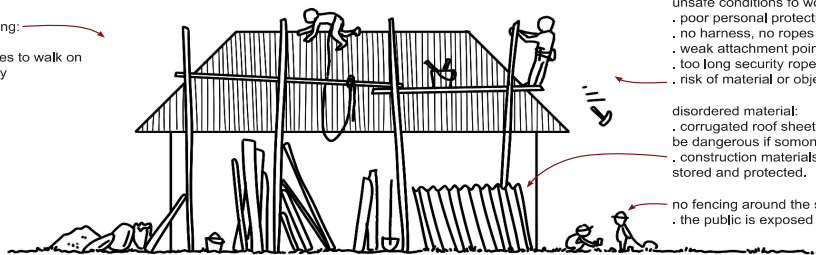
1 SECURITY RULES ON THE CONSTRUCTION SITE



1A : DANGEROUS SITE

✗ NO

improvised scaffolding:
· no barriers
· no boards or bridges to walk on
· apparent instability



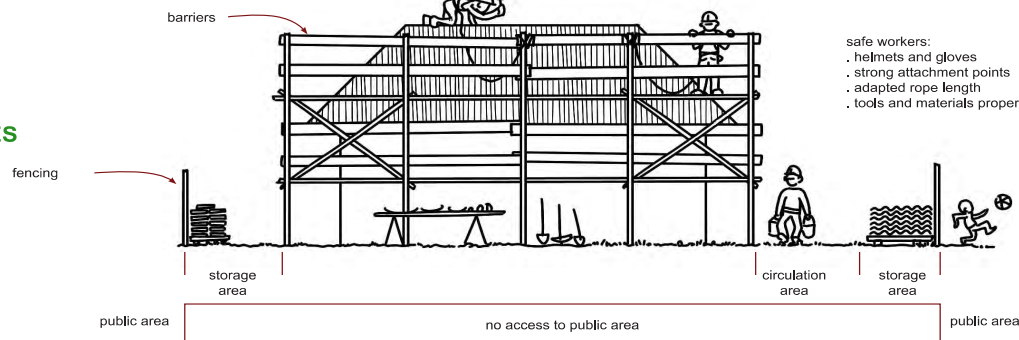
unsafe conditions for workers:
· poor personal protection equipment
· no harness, no ropes
· weak attachment points
· too long security rope
· risk of material or objects falling

disordered material:
· corrugated roof sheetings, boards and other materials can be dangerous if someone falls down on them
· construction materials can be damaged if not properly stored and protected.

no fencing around the site:
· the public is exposed to accidents

1B : SAFE SITE

✓ YES



safe workers:
· helmets and gloves
· strong attachment points
· adapted rope length
· tools and materials properly stored and secured

are cuts, breakages, unloading, storage, site transport and construction which results in losses.

This in general is termed “waste” and has to be measured and included in cost estimates and managed to minimise loss. Shelter IEC materials do not explain or demonstrate how to estimate the cost of building construction including waste, scaling up of multiple units and management needs.

4.3 Health and safety

*Who is responsible for the health and safety in a shelter project?
How do we manage health and safety on site?*

How do IEC materials define safe, practical, affordable, and responsible health-and-safety while working on shelter activities?

Some IEC materials show safe and dangerous site conditions, usually focussing on superstructure construction. There is a need to look at the wider health and safety practices of the construction process, including substructure works, propping and temporary works, safe use of tools and equipment. There is a need for identifying and establishing safe working practices using local and improved techniques that are affordable and replicable.

4.4 Quality Assurance (QA) and Quality Control (QC)

How do we ensure that IEC materials identify the procedures for QA/QC, and that professionals, builders and householders understand and manage the process to ensure buildings and their components are to standard?

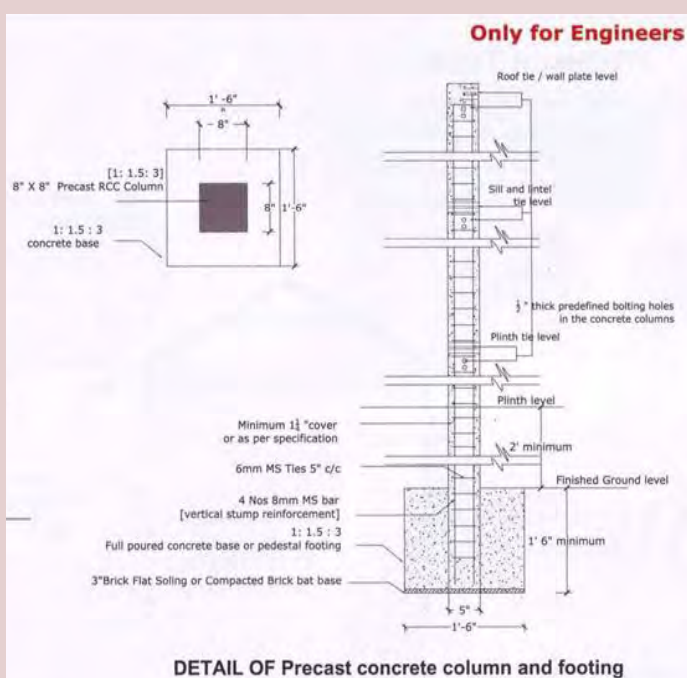
Ensuring quality of construction is about process, which requires having clear material and design details and defined quality work standards, that can be measured, monitored, and controlled. The process of quality control requires competent supervision as well as competent builders. QA/QC is the established procedure of checking compliance throughout the construction process and checking detail against design at the last point of being able to correct an element before it is covered up.

Is health and safety only at high level? Where do we identify the resources required, labour materials and equipment?
How much of this material is reusable?

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 MPTPC	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 rocks	Yes/No
4	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
5	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

What does "yes" or a "no" response mean? What action is taken if the answer is no?



This is a detailed construction drawing of a full height concrete column. It is used to fabricate the precast column, and to position the column in the building.

Structural Specifications

All wooden post shall be mounted on 1:1.5:3 RCC Stump with minimum 10" long standards Kaatla/ metal strap, or predefined bolting holes which ever is feasible best in the local context.

The Minimum cover around the wooden post and the edge of the concrete stump shall be 1"

All Kaatla/Embedded metal straps or the predefined bolting joints shall have minimum two bolting holes, size as per the specification of the column

A wooden post shall be minimum 5"X 5" and shall be bolted to the Kaatla using ½ inch MS bolt

All wood used in the construction shall be of treated and seasoned quality

All wood used for the structural framework shall be of hard and matured quality.

All clear cover of RCC work shall follow the minimum standards specification:

Minimum clear cover of reinforced concrete work above finished ground level

For precast column: 1 ¼"

For cast in situ column: 1 ½"

Minimum clear cover of reinforced concrete work below finished ground level

For precast column: 1 ¼"

For cast in situ column: 2"

These statements do not refer to any identified standards.

4.5 Skills

How do we identify professional and trade skills at each stage of the construction cycle?

How can IEC materials be developed to set out the skills and time necessary to build a foundation?

Designs included in IEC materials do not generally identify the competency and skill sets, necessary for building shelters e.g, mason, carpenter, steel fixer, joiner, roofer etc.

There is also no estimation of specific outputs that can be expected in any given instance. For example, how long does it take to excavate a pad foundation, form a concrete column, build a brick foundation. Standard construction outputs do exist and are well documented and can be adapted to meet specific environments to determine cost and time.

4.6 Supervision

How do we identify skills and recognition of supervisory and trade competencies?

How do we engender respect for the construction workers and their skills and knowledge? Could having working drawings rather than popular sketches help in this, encouraging people to recognise, value, and pay for the skills required?

Construction relies on progressive development of skill sets, eg. unskilled, apprentice mason, qualified mason, boss mason managing a group of masons, construction supervisor, manager. Not everyone goes the whole way. This progressive development can be accompanied by classroom training to achieve a recognised academic and trade skill qualification. Understanding the local skills level can be difficult to identify the actual ability of your trade skills, e.g. boss mason and also your local contractor. Having reached recognised skills level does not always guarantee that the quality of work is guaranteed, this is where we need to identify someone who can monitor and manage quality against the design and specification.

Simplifying foundation designs and short training workshops can help improve construction quality and knowledge but they do not guarantee that people with limited technical skills and education can become builders, there is still a need for competent supervision .

5.0 LEARNING FROM IEC MATERIALS

How do we record lessons from users of IEC materials?

There's a definite tension here between providing simple practical information which people can follow themselves and, in a format, everyone can access/understand Vs providing technical construction drawings. Indeed, poor details can lead to confusion and can even be dangerous. This balance needs to be considered on a case-by-case basis but also can only be achieved if in the context of communication programming on safer building. A poster on its own will not cause the level of transformation in local building cultures that is often required.

IEC materials clearly need to reflect lessons learnt and good practice for future response. Work is clearly required on how to maintain this memory, provide more context on materials that have been produced and find a way to effectively inform people when IEC materials have been updated to reflect lessons learnt.

Very few of the materials reviewed explicitly referenced local construction regulations, guidelines and national vocational qualifications. In responses, there is a constant challenge of how to cross reference standard IEC materials against local construction regulations and guidelines and vocational skills. Whilst in theory the development of IEC materials should ensure that messaging is not contrary to government policy, at the same time there needs to be a way to link materials to relevant building codes, and to ensure that homeowners know how to monitor works of craftsmen, or even build safe structures themselves, and for craftsmen to understand what legal requirements there may be on them. Improving and targeting IEC materials at specific skills levels with appropriate details and consistent messages can contribute to an overall improvement in the culture of safer construction.