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Design Decision Tool

This chapter contains the design decision tool which enables the user to make informed decisions about the most appropriate design options provided in chapter three. The process is intended to enhance the existing approach for shelter design decisions. Questions are presented in order to align user preferences with the evidence and analysis. The user is guided through the selection of wall, roof, and foundation typologies. This outline design is evaluated against the key performance criteria which are 'Safe and Resilient', 'Acceptable', and 'Sustainable'. Detailed design options are discussed in order to identify what options or additional design measures the user may want to include.

How to Use the Design Decision Tool

The design decision tool is organised in three stages: outline design, evaluation and detailed design. The notes sheet (see chapter four) can be used throughout to record answers and notes. This sheet functions as a record of these decisions and identifies what design information is required from chapter three.

There are 13 components to choose from (five wall types, three roof types and five foundation types). The compatibility of these components results in a total of 26 potential outline designs. Three pages guide the user through the selection of the wall, roof and foundation which constitutes their outline design. The questions align user preferences with the appropriate component. The questions were designed in consultation with end users and are based on actual questions used in the design of previous shelter programmes in Sindh.

The design decision tool begins with 'what wall should I use?'. However, it is possible to use the design decision tool in other ways and start with foundations or roofs as desired. Consultation with end users identified the wall type as the primary driver of component selection, i.e. people think about the wall first, then decide what roof and foundation to use.

Having selected the wall, roof and foundation types the user may have several potential outline designs. The guide recommends that a maximum of 2-3 outline designs be evaluated. The user can revisit their answers in order to refine or limit the number component types. We recommend that this should be based on user prioritisation of budget, material availability or user preferences.
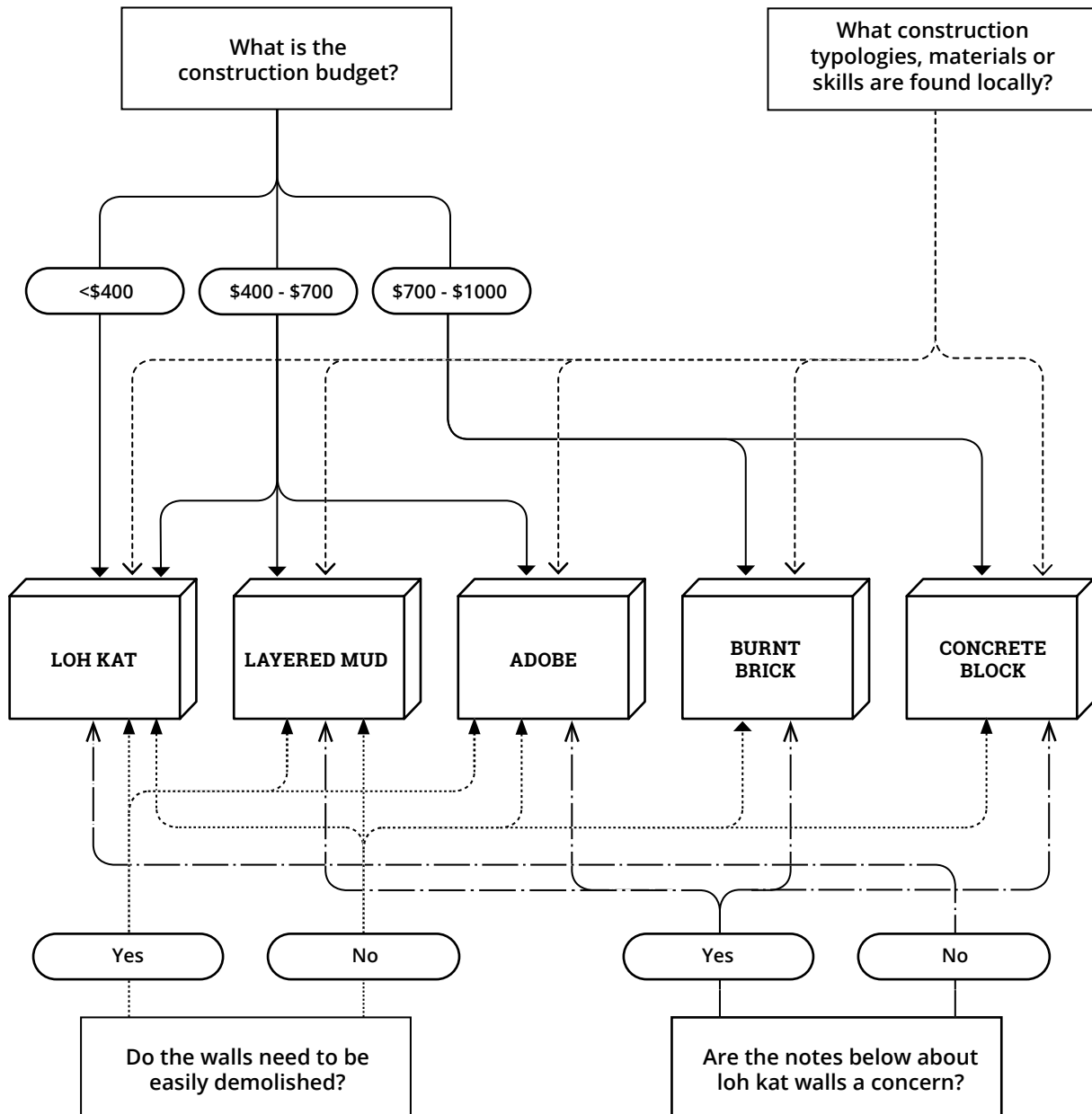
The evaluation graph on page 34 allows the user to identify which of their outline designs performs best. Ultimately, this evaluation is subjective as the relative importance of 'Safe and Resilient', 'Acceptable', and 'Sustainable' will vary according to the priorities of the user.

Finally, there are various detailed design variations which are required or optional and these are discussed on page 36.

The user can record their chosen outline design and detailed design variation on the notes sheet and extract the relevant pages form the design information in chapter three.

What wall should I use?

Answer the questions below and use the decision tree to identify the most appropriate wall type. If more than two wall types are selected, try to prioritise your answers based on what is most important to you: the overall construction budget, availability of materials, user preferences or permanence. Record your preferred wall type(s) on the notes sheet.
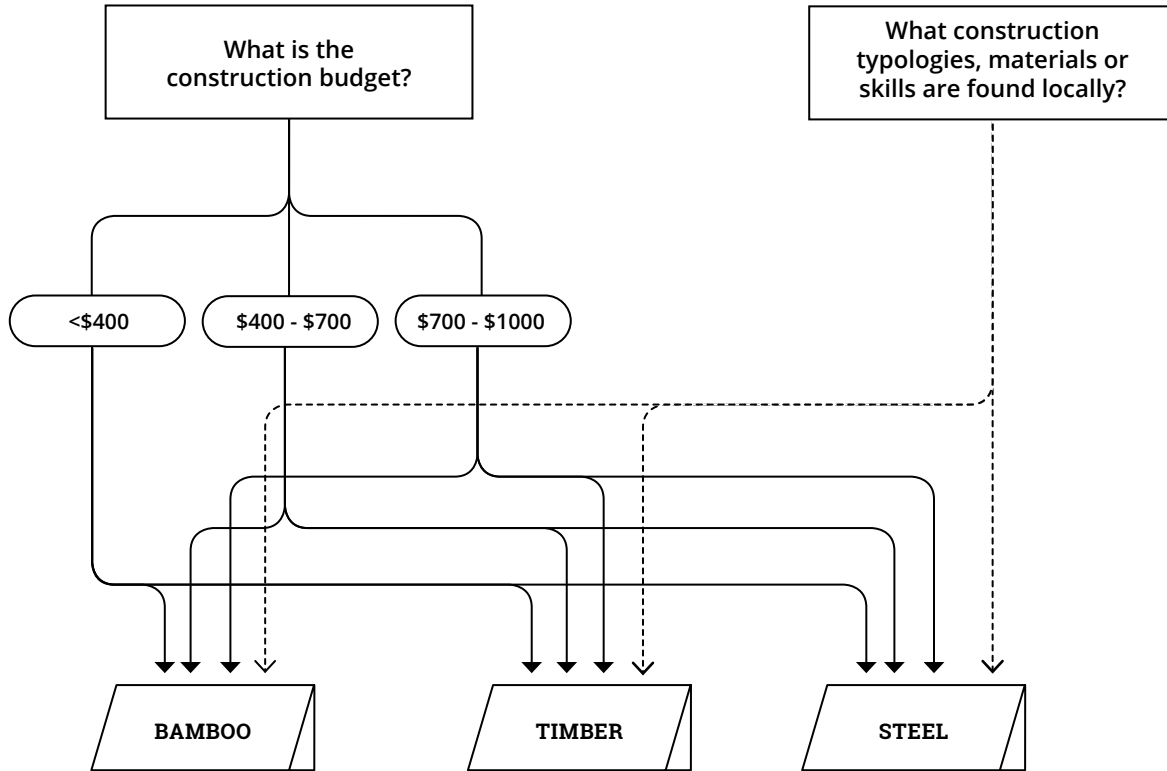
What is the
construction budget?

What construction
typologies, materials or
skills are found locally?

<$400 $400 - $700 $700 - $1000

LOH KAT   LAYERED MUD   ADOBE   BURNT BRICK   CONCRETE BLOCK

Yes   No   Yes   No

Do the walls need to be
easily demolished?

Are the notes below about
loh kat walls a concern?

Notes

Loh kat walls slightly under perform relative to other wall typologies in relation to thermal comfort. Their reduced thickness provides less thermal mass to absorb heat from the sun.

Loh kat walls are generally perceived as being less secure than there wall typologies as they are easier to break into. If built in accordance with the design information, loh kat walls can be physically secure but this may not change their perception of safety.
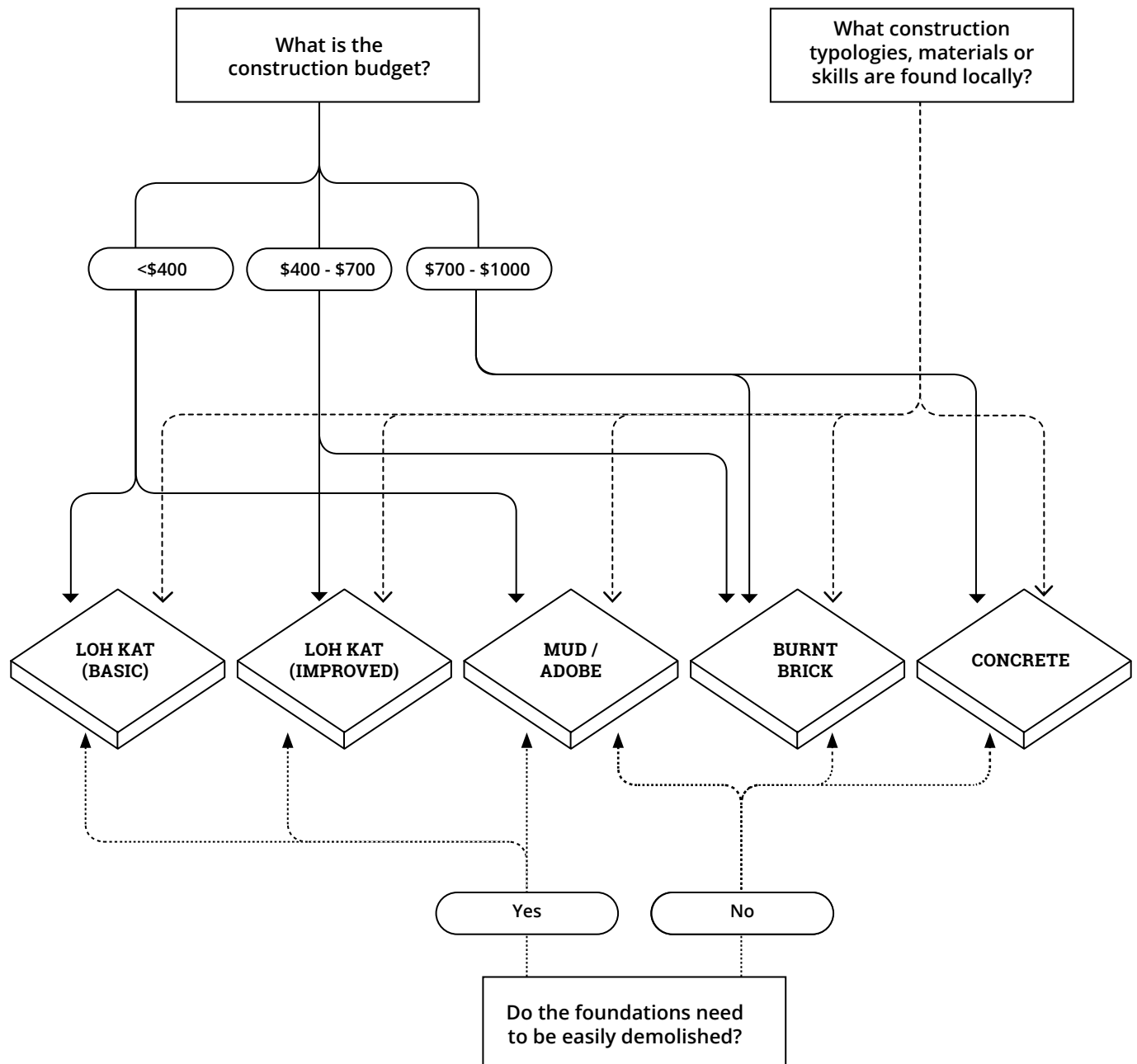
What roof should I use?

Answer the questions below and use the decision tree to identify the most appropriate foundation type. If more than two foundation types are selected, try to prioritise your answers based on what is most important to you: the overall construction budget, availability of materials, or ease of demolition. Record your preferred foundation type(s) on the notes sheet and quickly check if they are compatible with your preferred wall types.

What is the construction budget?

What construction typologies, materials or skills are found locally?

<$400 $400 - $700 $700 - $1000

BAMBOO   TIMBER   STEEL

What foundations should I use?

Answer the questions below and use the decision tree to identify the most appropriate foundation type. If more than two foundation types are selected, try to prioritise your answers based on what is most important to you: the overall construction budget, availability of materials, or ease of demolition. Record your preferred foundation type(s) on the notes sheet and quickly check if they are compatible with your preferred wall types.

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┌─────────────────────────┐                              ┌─────────────────────────┐
│     What is the         │                              │  What construction      │
│ construction budget?    │                              │ typologies, materials or│
└─────────────────────────┘                              │ skills are found locally?│
                                                          └─────────────────────────┘

  ( <$400 )   ( $400 - $700 )   ( $700 - $1000 )

  ◇ LOH KAT      ◇ LOH KAT        ◇ MUD /      ◇ BURNT       ◇ CONCRETE
    (BASIC)        (IMPROVED)       ADOBE         BRICK

                            ( Yes )      ( No )

                  ┌─────────────────────────┐
                  │ Do the foundations need │
                  │ to be easily demolished?│
                  └─────────────────────────┘
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Outline Design Evaluation

This graph presents the evaluation of all 26 outline designs against the key performance criteria which are 'Safe and Resilient', 'Acceptable', and 'Sustainable'. While all the recommended designs conform to improved resilient standards, there are differences in performance based on our analysis and testing. The primary differences are in 'Safe and Resilient' and 'Sustainable'. Most designs perform consistently well in 'Acceptable'. For example, burnt brick and concrete are very safe and resilient but relatively unsustainable due to their cost. In contrast, loh kat and layered mud are very sustainable but relatively less safe and resilient due to the fragility of their material characteristics.

The user can identify which of their outline designs performs best. Ultimately, this evaluation is subjective as the relative importance of 'Safe and Resilient', 'Acceptable', and 'Sustainable' will vary on a case by case basis.
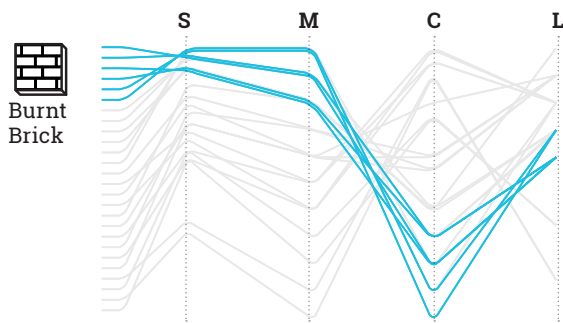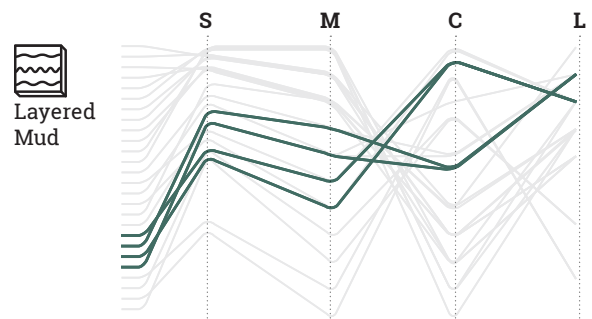

Burnt brick performs well in structural and water resilience and maintenance but poorly in capital cost and carbon
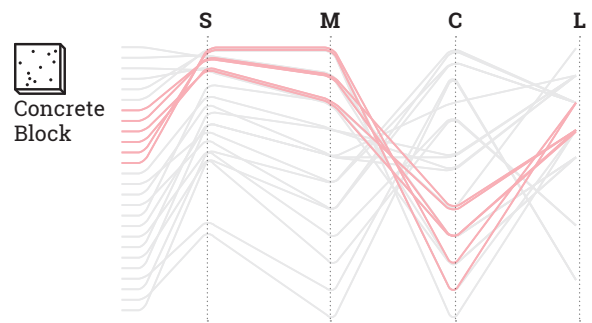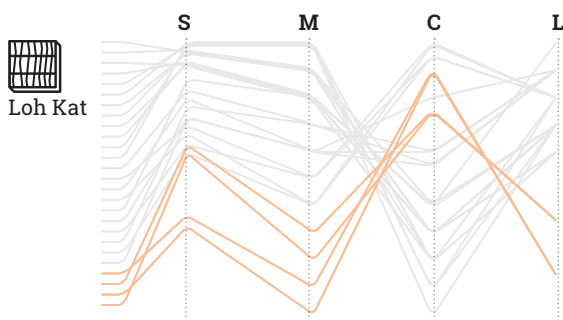

Concrete block performs similarly to burnt brick
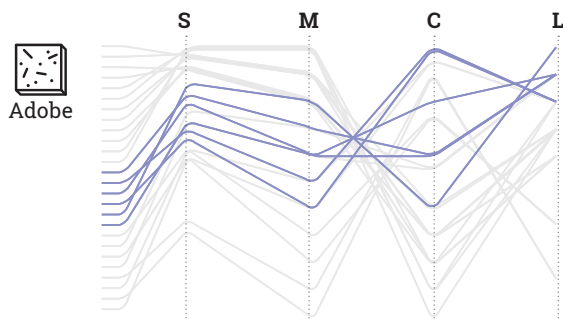
Stabilised adobe blocks perform relatively well across all categories, particularly in lift cycle cost
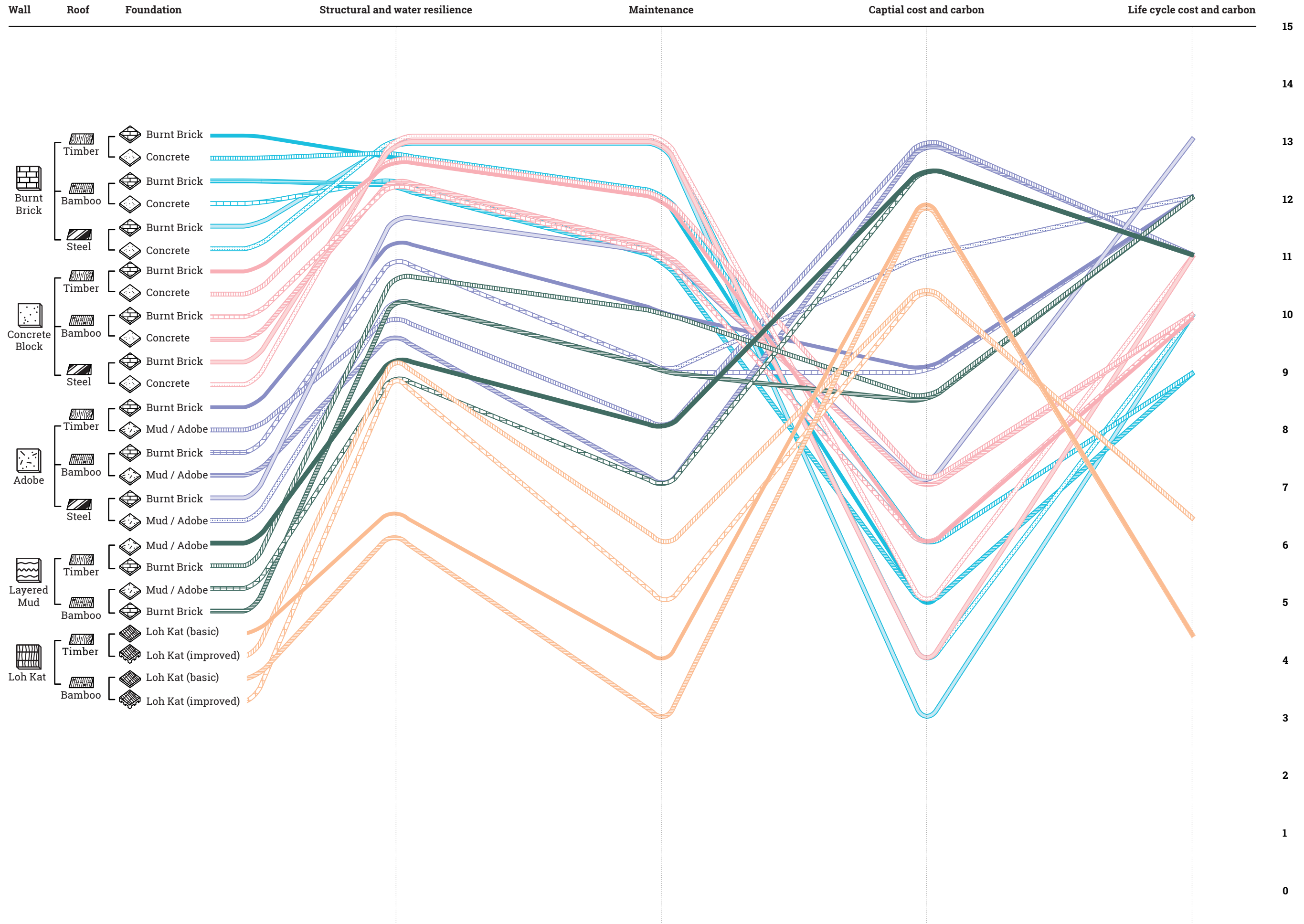

Stabilised layered mud has a similar performance to adobe in cost and carbon and life cycle. However layered mud performs less well for structure and maintenance.

Loh kat performs well for initial cost, but poorly for structure, maintenance and life cycle, due to the possibility of rot and insect attack of members. It should be noted that the structural score does not consider seismic performance.

Key

S	Structural and water resilience
M	Maintenance
C	Captial cost and carbon
L	Life cycle cost and carbon

Wall	Roof	Foundation	Structural and water resilience	Maintenance	Captial cost and carbon	Life cycle cost and carbon

Burnt Brick
Timber
Burnt Brick
Concrete
Bamboo
Burnt Brick
Concrete
Steel
Burnt Brick
Concrete

Concrete Block
Timber
Burnt Brick
Concrete
Bamboo
Burnt Brick
Concrete
Steel
Burnt Brick
Concrete

Adobe
Timber
Burnt Brick
Mud / Adobe
Bamboo
Burnt Brick
Mud / Adobe
Steel
Burnt Brick
Mud / Adobe

Layered Mud
Timber
Mud / Adobe
Burnt Brick
Bamboo
Mud / Adobe
Burnt Brick

Loh Kat
Timber
Loh Kat (basic)
Loh Kat (improved)
Bamboo
Loh Kat (basic)
Loh Kat (improved)

Detailed design variations

By this stage the user should have selected their preferred outline design and can now choose from a range of detailed design variations. Some elements are compulsory (e.g. ring beams, windows and doors) though there are variations which respond to cost and user preference. Other elements are optional (e.g. raised platforms) but recommended by this guide. Design information for all detailed design variations are included in chapter three. These variations and their characteristics are:

RING BEAM TYPE	COMPATIBLE WALL TYPE	COMPATIBLE ROOF TYPE
Reinforced Concrete	Burnt Brick, Concrete Block, Adobe	Bamboo, Timber, Steel
Timber	Burnt Brick, Concrete Block, Adobe, Layered Mud	Bamboo, Timber
Bamboo	Burnt Brick, Concrete Block, Adobe, Layered Mud	Bamboo

Figure 27. RIng beam compatibility

Ring beams

Ring beams are required for all designs except for loh kat which is a framed structure and doesn't require a separate ring beam. The ring beam options are reinforced concrete, timber or bamboo. Each one has slightly different characteristics which impact their cost, build ability and compatibility with different wall types. These parameters are described in figure 27 above. This guide makes specific recommendations which are explained in the design information.

Raised Platform and/or Plinth

Raised platforms and/or plinths are not required but are strongly recommended by this guide in order to maintain the functionality or use of the shelter during a flood. Platforms and plinths do not affect the structural performance of the shelter which requires water resistant treatment that is already included in the design information for walls and foundations. This guide makes specific recommendations which are included in the design information.

Windows and Doors

Windows and doors are required for all designs. This guide recommends two window variations which are 'hit and miss' or a shuttered version. Both perform adequately in terms of light, ventilation and security. Hit and miss is secure by design and comparatively cheaper. The screened version requires a locking mechanism and we anticipate could be considerably more expensive. This guide makes specific recommendations which are included in the design information.