

Bamboo transitional shelter in response to the Nepal Earthquake 2015

Nepal Earthquake 2015 (BBC, 2015)

- Nepal experienced two earthquakes of magnitude 7.8 (April) and 7.3 (May) on the Richter scale.
- 8 Million Lives were affected with 22,200 people injured, 8850 deaths and 712,000 homes destroyed.
- Historical Monuments, such as the Dharahara Tower were damaged (Figure 1).



Figure 1 – Dharahara tower post-quake (BBC, 2015)

One Year After (The Telegraph, 2016)

- Since the Earthquake Nepal has been recovering very slowly because of the inefficiency of the Nepalese government and the border closure incident with India (2015-16).
- Majority of 600,000 families who initially needed shelters are still living in temporary shelters.
- The Nepali Government admitted that most affected families were living under a tin roof or even tarpaulin.
- Temporary shelters that were provided by charities are not sufficient or appropriate to combat against the Climate of Nepal.



Figure 2 - Transitional Shelter (The Straits Times, 2015)

Local Solutions (Shelter Centre, 2012)

- Transitional Shelters can be used to address this major challenge and provide durable and adaptable shelters during the post disaster crisis.
- Humanitarian groups and disaster relief agencies have already started to design and implement transitional shelters in Nepal with great success (Figure 2).
- A transitional shelter is a semi-permanent post disaster shelter that provides durable, adaptable emergency shelters. They are regarded as a process and can be incrementally upgraded to improve and suit new or current climate conditions

Transitional Shelter Design Considerations

Within the Transitional Shelter Design guide, seven Design Considerations are found (Shelter Centre, 2015)



Site Selection

- Families within affected communities prefer to rebuild on their own lands for rapid recovery.
- Detailed surveys should be undertaken to assess suitability of the land.



Site Planning

- Can determine the overall protection of a community.
- Considers the present hazard vulnerabilities to determine site layout.



Designing with Community

- Community participation can reinforce a sense of responsibility
- Allows considerations for daily activities to create culturally appropriate shelter solutions.



Designing to Minimize Risk

- Risk reduction techniques are discussed with the community and implemented.
- Local builders and construction techniques provide information for designing shelters to minimize risk.



Climatic Design

- Taking the climate into consideration minimises long term environmental impacts.
- Four factors to consider are temperature, humidity, ventilation and thermal comfort.



Building Materials

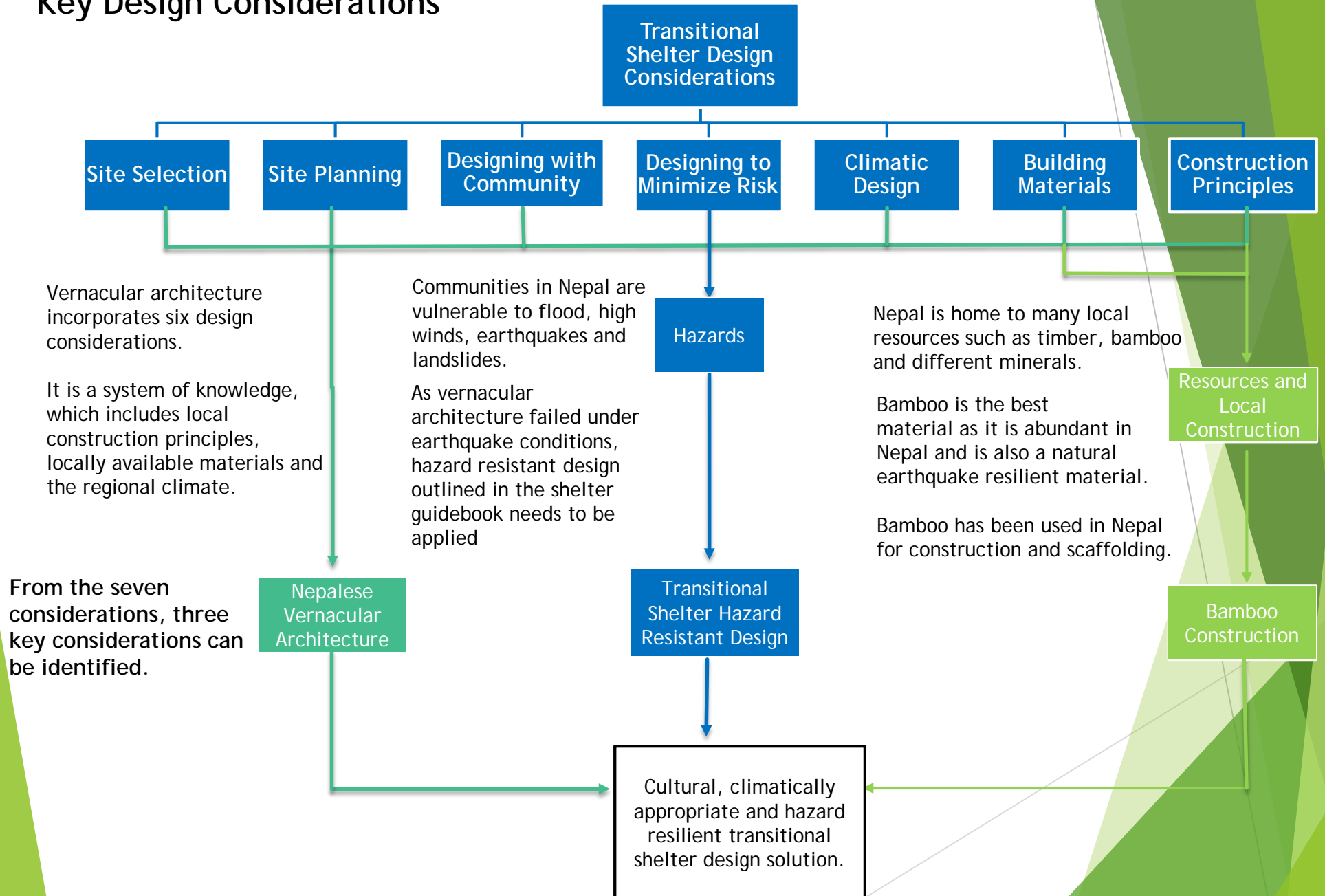
- Utilising local materials presents the opportunity to reduce costs and the impact on the environment.



Construction Principles

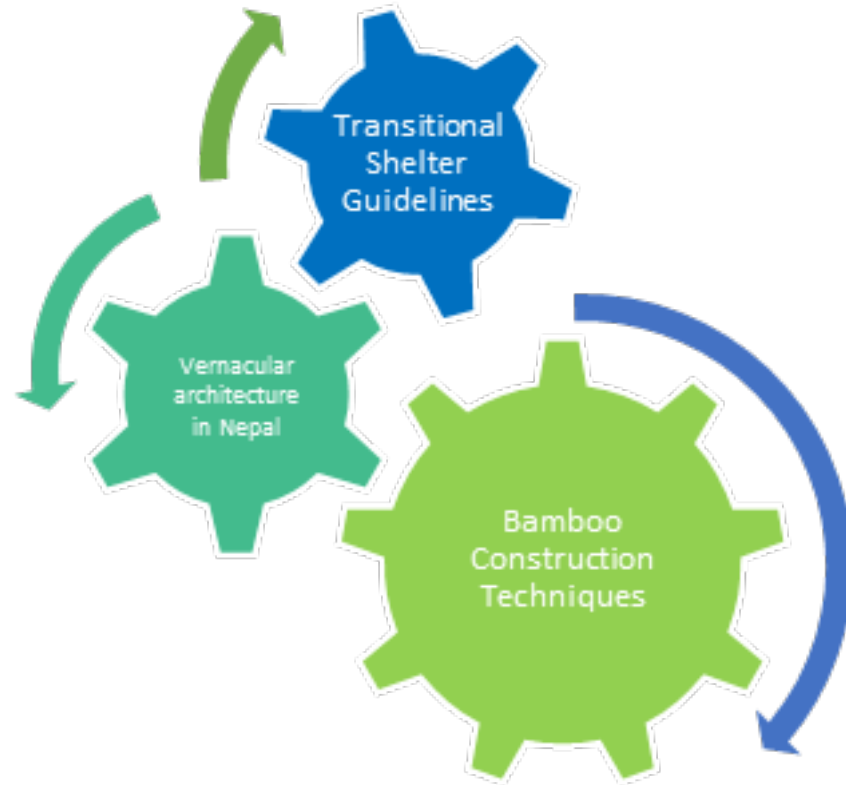
- Design is dependent on local construction techniques and available resources.
- Local construction techniques establishes a balance between the surrounding environment, community and construction process.

Key Design Considerations



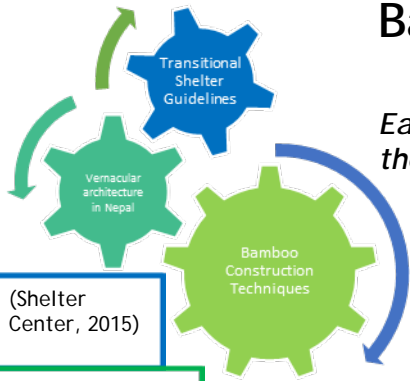
Design Process

The three key considerations have been used to form a design process that is used to develop an appropriate design solution:



Bamboo Transitional Shelter Solution

Each consideration below is colour coded to the three consideration cogs on the top left of this page.



(Shelter Center, 2015)

(Bodach, 2014)

(Janssen, 1999)

1. House sizing

Traditional Nepalese houses are rectangular

Simple Building layouts are less prone to earthquake damage.

2. Foundations

Concrete plinths are used with strong connections to keep the shelter upright and in place during strong winds.

3. Columns

Floor loading is taken directly by the column and foundation. Roof loading is taken by the secondary column that is held by shear dowels and straps.

4. Flooring

Floor is elevated to avoid flooding or extreme surface run off during the monsoon season.

Flattened bamboo is used as floor covering. This is laid on top of a timber or bamboo lath and the timber joist to be nailed or lashed.

11. Wall and Floor Insulation

Bamboo flooring and walls can be plastered with mixture of mud, hay, water and cow dung (Fig 7).

10. Doors and Windows

Doors and windows should be placed in the three open sections where bracing is not present.

Doors are to be side-hinged and have a bamboo or timber frame. Panels can be made from woven bamboo.

9. Walls

Woven bamboo walls or flattened bamboo walls can be used (Fig 6) and attached to bamboo columns.

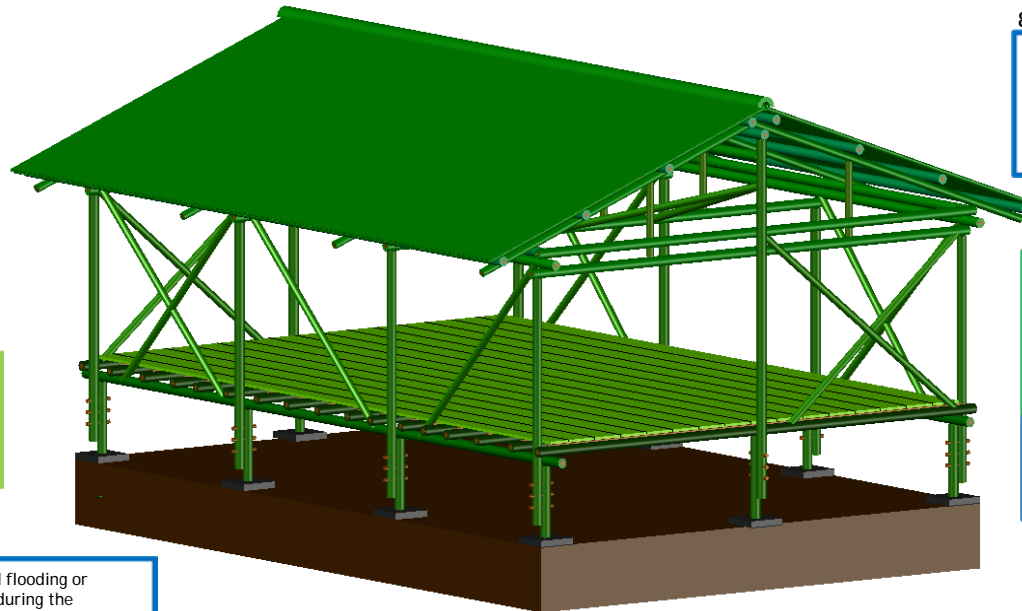
8. Simple Improvements

Plastic sheeting given as part of an emergency shelter kit can be used to provide a simple waterproof membrane in the flooring.

7. Roof

Roof overhangs a minimum of 500mm, providing a veranda. Veranda provides a workspace and defence against solar penetration from the sun.

A Gable roof is used because hipped roofs are complex and time consuming to construct.



6. Connections

Connections are reinforced by using straps.

5. Bracing

Bracing is connected well to the main structure and tied well.

Bibliography

BBC News, 2015. *Nepal earthquakes: Devastation in maps and images*. [Online]
Available at: <http://www.bbc.co.uk/news/world-asia-32479909>

The Straits Times, 2015. *Rush to build shelters in Nepal as monsoon looms*. [Online]
Available at: <http://www.straitstimes.com/asia/south-asia/rush-to-build-shelters-in-nepal-as-monsoon-looms>

Bodach, S. , 2014. *Climate responsive building design strategies of vernacular architecture in Nepal*. [Online]
Available at:
https://www.researchgate.net/publication/263812612_Climate_responsive_building_design_strategies_of_vernacular_architecture_in_Nepal

Shelter Centre, 2012. *Transitional Shelter Guidelines*. First Edition ed. Geneva: Shelter Centre.

Janssen, J. J. A. , 1999. *Building with Bamboo*. Southampton: Intermediate Technology Publications Limited.

The Telegraph, 2016. *Nepal earthquake anniversary: one year on, not one home rebuilt by government*. [Online]
Available at: <http://www.telegraph.co.uk/news/2016/04/25/nepal-earthquake-anniversary-one-year-on-not-one-home-rebuilt-by/>