

Design Resource

Sustainable Design and Architecture

Living Root Tree Bridges

by

Paul Anthony

IDC, IIT Bombay

Source:

<http://www.dsource.in/resource/sustainable-design-and-architecture>

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Source:

<http://www.dsource.in/resource/sustainable-design-and-architecture/introduction>

Introduction

Shillong city lies in the centre of the plateau structure in the Northeastern state of Meghalaya in India. The city is surrounded by a set of three hills, which as per the indigenous Khasi people is known as, LumSohpetbneng (Navel of the Earth), Lum Diengiei (Mount of the merciful tree) and LumShillong (Mount of Shillong, a deity). The region is known to possess many scenic elements like fast moving rivers and streams, naturally formed limestone caves, natural and artificial lakes. One of the major tourist attractions however, belong to villages in Sohra (Cherrapunji) and Mawlynnong viz. the living root-tree bridges. This is a documentation of the bridges in Nongriat which is a small village located in Shella Bholaganj of East Khasi Hills district, Meghalaya with total 31* families residing.

*Census 2011.co.in, (2015). Nongriat Village Population - Shella Bholaganj - East Khasi Hills, Meghalaya.

Ref.: <http://www.census2011.co.in/data/village/278802-nongriat-meghalaya.html>



Shillong City

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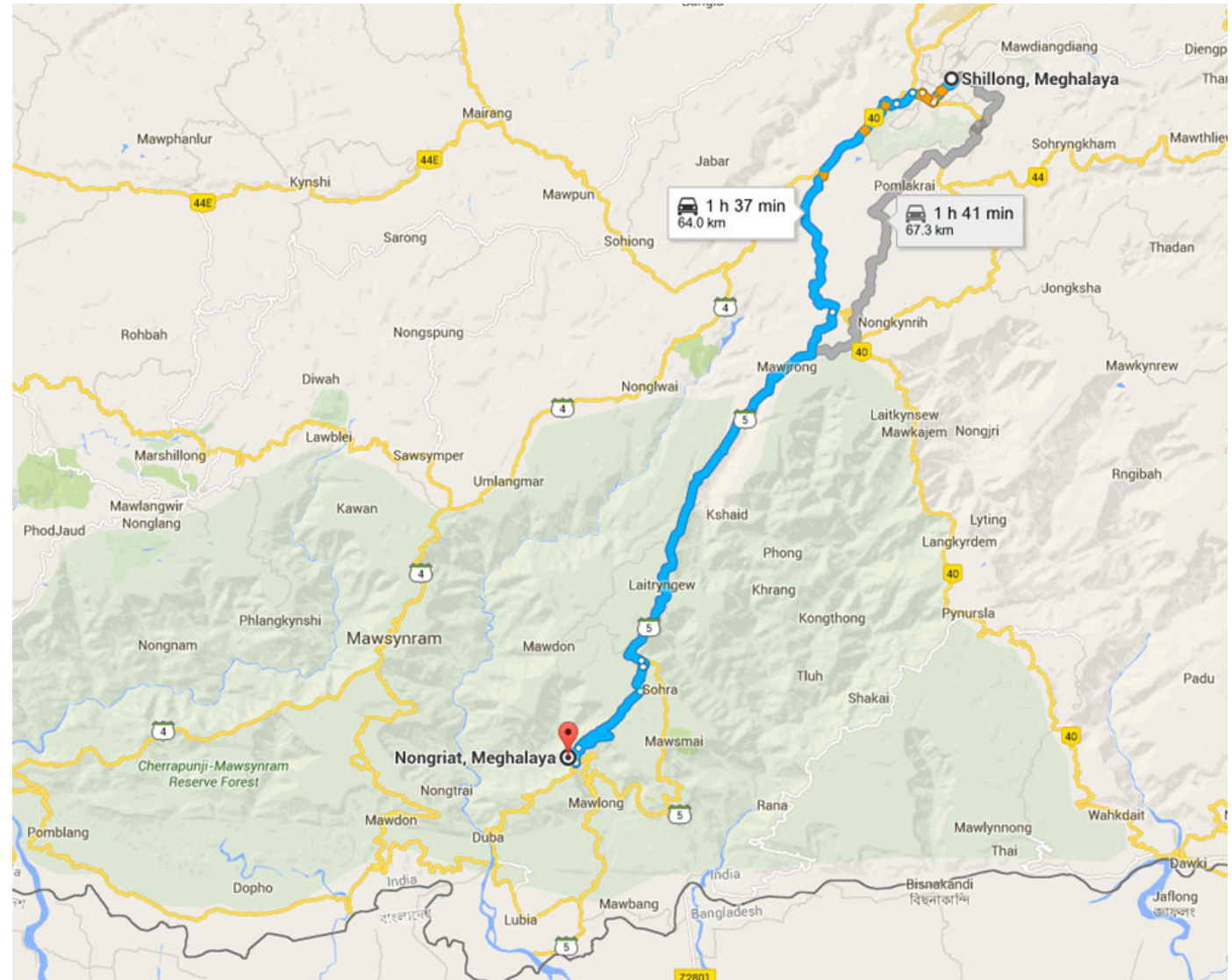
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Source:

<http://www.dsource.in/resource/sustainable-design-and-architecture/location>

Location

Nongriat Village, East Khasi Hills, Sohra (Cherrapunji), Meghalaya.



GPS Position of Nongriat Village in Cherrapunji.

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Terrain

The Sohra (Cherrapunji) Valley consists of gorges, cut through by fast moving waters, which is a result of perennial heavy rainfall received in this region. It has the old moniker of being the wettest place on Earth, though that is now attributed to the near by regions of Mawsynram. The land has been shaped by the rains here as it erodes away the topsoil. This erosion is further amplified due to encroachment in forest lands.



View of the Terrain in Nongriat.

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Fauna

Though there is abundance in rainfall, the lack of percolation of water has resulted in a majority of the plant species to be largely xerophytic or develop traits that support sustenance in wet and dry conditions and more notably in conditions hostile to growth of primary root systems.



Fern and other fauna that can thrive in both wet and dry conditions.

At the root level most of the plants fall into the family of mosses and lichens (bryophytes) and several species of Ferns.

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The forests around Nongriat is a place where many living things thrive.

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The Tree

Rubber Fig. (Ficus Elastica) - The rubber fig avoids topsoil erosion by having two sets of root systems, the primary (buttress) root systems ensure support, holding the tree upright.



Fig. Rubber (Ficus Elastica).

Whereas the secondary (aerial) root systems make sure that the tree receives additional grip and nutrition in a region of fast moving streams and huge boulders, where a permanent layer of fertile soil is difficult to come by.

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Fig. Buttress Roots of the Rubber.

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War-Khasis

The people who populate the southern slopes of the east Khasi hills are generally called the War-Khasis. They were amongst the first to notice the properties of the Rubber fig. As there was a huge need for bridges to traverse amongst the different hill spaces in the Cherrapunji and Mawlynnong valley systems, they began the growing of the bridges with the help of available resources.

The Living Root bridge in Mawlynnong between Riwai village and Nohwet village, is made by a great engineer from Nohwet village. His name is Shri Nongmuna Khongthohrem from a hundred years ago. Comment by Henry Khongthohrem in Timothy Allen, (2011). Living Root Bridges - Timothy Allen.

Ref.: <http://humanplanet.com/timothyallen/2011/03/living-root-bridges-bbc-human-planet/>



War-Khasis settlements.

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Architecture

Direction is given to the secondary root systems using hollowed out Betel nut tree trunks. The tree trunks are laid out in a horizontal orientation, along with bamboo scaffolding to make-way for a rough temporary bridge.



Aerial roots being guided by man-made scaffolding.

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Without any other direction to grow, the secondary roots grow out in length at a rapid pace. When it makes contact with soil on the other side the Wár-Khasis tend to it until it takes root.



The Basic Structure of the Bridge



Longevity



Strength

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The Basic Structure of the Bridge

Base might consist of planks of wood or bamboo with railings for hands across the entire span and cross guards to add to the tensile strength and load bearing capacity of the bridge.



Other elements that become one with the bridge.

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A more recent Root-Bridge.

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Source:

<http://www.dsource.in/resource/sustainable-design-and-architecture/architecture/longevity>

Longevity

Once the understructure and the root-carriages are set, the entire formation of roots and strengthening would take around ten to fifteen years on average.

In contrast to the modern day mantra of planned obsolescence, these bridges are nurtured (rather than made) to get stronger over the years and can last centuries. As it consists at times, multiple trees that grow and form the bridges, the strength and durability is awe-inspiring.



Bridges that get better with age.

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A day in the life-in Nongriat.

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Strength

Nongriat village in Cherrapunji, is the location for the now famous double-decker bridge (originally: Umshiang bridge).



Umshiang Bridge - Aka The Double Decker.

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The root bridge over the years have wooden planks and stones, which line the base or the path of the bridge.



Robust example of arboreal architecture.

It can, at a time hold around fifty or more people, whilst spanning 53 to 100 feet long. (For more data regarding the architecture and longevity of these bridges please refer: <http://www.sanjeevshankar.com/pdf/Living-Root-Bridges-by-Sanjeev-Shankar-IABSE-Conference-Geneva.pdf>)

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Contemporary Bridges

Nongriat village in particular, has both cable-suspension bridges as well as the living root bridges. Over the course of a decade, the influx of local and global tourism has increased the need for accessibility.



Contemporary cable bridges.

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Villagers in Nongriat and Mawllynong, are incredibly conscious about the forests they inhabit and tend to it, with a great deal of care, ensuring the longevity of the bridges and the overall absence of trash that might have been left over by the careless tourist.



Villager looks on as part of daily maintenance.

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Most of the villagers practise subsistence farming and other various modes of livelihood selling the crops that they cultivate or the produce like pepper, oranges, wood and areca nut and beetle nut leaves.



A villager walks on with a huge saw.

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It is observed that whilst approaching the lesser-known Mawsaw living root bridge, the roots from the existing Mawsaw Bridge have extended across the cable suspension bridge that leads to it.



Contemporary root bridges with cable suspensions.

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Eventually it will form yet another, longer more durable living root bridge, using the quicker to execute-cable suspension bridges. This paves the way for a new mode of bioengineering where the immediate need for access is solved by cable suspension bridges, which though relatively easier or standardized in construction is often not feasible in the long run considering the region's weather and tendencies of metal structure corrosion.



Coexistence of living wood and man-made metal.

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The living root bridges seen at Nongriat and those that exist in Mawlynnong are examples of centuries worth of arborsculpture, architecture and design knowledge in sustainability and showcase an amalgamation of metal and arboreal materials.



Nongriat is an example of civilizations who work with a design-inspired nature.

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Conclusion

“ Here’s to a new age of design, a new age of creation, that takes us from a nature-inspired design to a design-inspired nature, and that demands of us for the first time that we mother, nature.”

- Neri Oxman

Designer and Architect (Coined the word ‘material ecology’ to define her work of placing materials in context).

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Contact Details

This documentation was done by Paul Aanthony, IDC, IIT Bombay.

You can get in touch with him at [paulanthony.g\[at\]gmail.com](mailto:paulanthony.g[at]gmail.com)

You could write to the following address regarding suggestions and clarifications:

Helpdesk Details:

Co-ordinator

Project e-kalpa

Project e-kalpa

Industrial Design Centre

IIT Bombay,

Powai

Mumbai 400076

India

Phone: 091-22-25767820/ 7801/ 7802

Fax: 091-22-25767803

Email: [dsource.in\[at\]gmail.com](mailto:dsource.in[at]gmail.com)

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