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ASSAM CONSTRUCTION

For more than 200 years Assam has remained a common form of construction in the northeastern region of India (Kaushik, 2009). These structures have proven resilient in past earthquakes due to their lightweight nature, regular plan dimensions, and low number of openings. The World Housing Encyclopedia cites them as "Very Low Vulnerability" (Kaushik, 2009). When built on hillsides, the long slender supports though, these well performing structures can be susceptible to asymmetric shaking, and excessive deformations in their weak understory.

CALIFORNIA PLAN SET-A

Plan Set A is a prescriptive tool developed for California homeowners to retrofit their homes. It targets homes with cripple walls between the foundation and the first story. In many existing buildings built before the 1960’s these cripple walls can be a weak point for earthquake resistance due to poor connections and inadequate bracing. During an earthquake, the flexible cripple walls can deflect a great deal under the house, even swaying over and collapsing.

WHAT MAKES PLAN SET-A SUCCESSFUL

It addresses a distinct issue that occurs on a large scale.
- It targets only single or two family homes, with cripple walls under 4 feet, and meet certain construction type requirements.
- This deficiency is very common in older homes. In the Bay Area alone, approximately 200,000 homes have weak cripple walls (SEU Fact Sheet).
- It offers a fast and cost effective solution.
- It is set up like a worksheet, so that the homeowner needs only to fill in certain details, and sketch out a plan specific to their home using pre-qualified construction details.
- The building department is familiar with the plan set, and can quickly review it and issue a permit.
- The home owner saves on the expense of hiring an engineer, and in many cities they qualify for tax incentives.

A STANDARD PLAN SET

A standard plan set for retrofitting hillside Assam homes in Aizawl, India was developed. The design incorporates strong, ductile steel straps to anchor the structure to the hillside along the uphill edge, as well as additional wood cross bracing to control the sidesway of the understory. The standard plan set is modelled off the California Plan Set-A, to be simple and straightforward to fill out so that contractors or homeowners can use it to quickly and effectively create a retrofit scheme.

ASSAM CONSTRUCTION IN AIZAWL

Corrugated Sheet Metal Roof
Asbestos Wall Infill Panels
Tall Slender Post Supports on Downhill Side
Short Stiff Post Supports on Uphill Side
Moisture Post Support Bracing

Images courtesy of Winterfeldt, Detlof, et al.

CALIFORNIA PLAN SET-A

Images courtesy of Janise Rodgers at GeoHazards International.

CALIFORNIA PLAN SET-A

A STANDARD PLAN SET

Schematic east-west cross section of the earth's crust showing the megathrust faulting under Aizawl (above).

Images courtesy of GeoHazards International.

CALIFORNIA PLAN SET-A

A STANDARD PLAN SET

EARTHQUAKE BEHAVIOR OF HILLSIDE HOMES

The behavior of homes built on hillsides during an earthquake has been most extensively documented after the 1994 Northridge Earthquake in Los Angeles. Many hillside homes are built with their living space level to the uphill edge, and tall slender supports along the downhill edge. These slender supports are often inadequately braced, and can lead to collapse. Also, the structure's orientation on the steep hillside can cause it to twist and "unzip" itself from the hillside.

Images courtesy of Winterfeldt, Detlof, et al.