

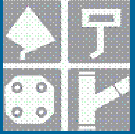


TRAINING IN SAFER HOUSING



MARIA DEL CARMEN DELGADO RAZURI
SENCICO - PERU

PERU

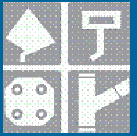


West central part of South America.

Very active seismic country. Earthquakes are generated by frictions, displacements and convergent subduction of the Nazca plate under South America plate.



PERU



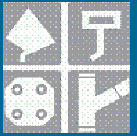
Construction Systems

Many new structures are being built today of clay bricks, concrete blocks or concrete walls cast in situ.



The oldest existing structures were built with quincha or adobe, traditional building materials from the past. Most of constructions in the Highland are built with adobe.

SENCICO



SENCICO: The National Service of Training for the Construction Industry is a Public and Decentralized Institution; belongs to the Ministry of Housing, Building and Sanitation.

The three main objectives of SENCICO are:

- TRAINING
- STANDARIZATION
- RESEARCH



1.- TRAINING

To improve the quality and the productivity in construction and to contribute in social developing programs.

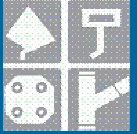


*Las Bambas – Apurimac
XSTRATA Agreement*



Covers the three levels of workforce: operative, technical and professional workers.

SENCICO



Particular training - in construction modality: “Training & Production” : on site practice.

Community people from rural areas learn appropriated technologies while they are building.



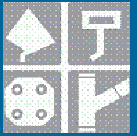
Huayllahura – Ayacucho
TGP Agreement



Camisea Gas
TGP Agreement

Advantages:

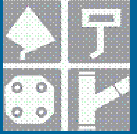
- Generation of quality local force labor
- Transference of technology
- Use of local resources
- Creation of temporary jobs



2.- STANDARDIZATION

Formulation of Technical Codes to improve the quality and to guarantee the security of the constructions.

- *Seismic Safety Design*
- *Construction with Reinforced Adobe*
- *Sanitation and Pluvial Water Evacuation*
- *Metallic Structures design*
- *Security in the Construction*
- *Reinforced Concrete Structural Design*
- *Gas Installation*



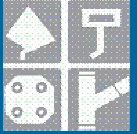
3.- RESEARCH

Projects of technological research applicable to the national reality, to improve the quality of constructive materials and systems and to obtain appropriate economies .



- *Improvement of Traditional Construction Systems (Adobe, Quincha, Sillar and Wood)*
- *New Wood Species for the Construction*
- *Alternatives of Low Cost for New Constructions (Ferrocemento)*
- *Evaluation and Reduction of Vulnerability of the Constructions*

SAFER HOUSING



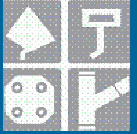
RECONSTRUCTION PROGRAM

Disasters stroke the Provinces of Lamas, Moyobamba, Rioja (north) and Moquegua (south), caused damage and leaving hundreds of families homeless.



To attend the emergency, the Ministry of Housing, Building and Sanitation, established the Reconstruction Program for housing, and transferred economical resources to SENCICO for the project implementation.

SAFER HOUSING



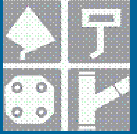
RECONSTRUCTION PROGRAM

AIMS



- To reduce the vulnerability of buildings against natural disasters
- To contribute to activate local housing industries and offer more job opportunities
- To improve the quality of building material hand crafted in each region, through training activities for local people
- To validate traditional technologies and incorporate new appropriated technologies for the construction.

SAFER HOUSING



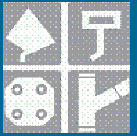
RECONSTRUCTION PROGRAM

SENCICO developed training experiences, for the communities directly affected by the earthquakes, in three constructive systems:

- 1.- Reinforced adobe in Chachapoyas (north of Peru) and Moquegua (south of Peru).
- 2.- Improvement Quincha in Rioja
- 3.- Reinforced concrete blocks in Moyobamba



SAFER HOUSING



Reinforced Adobe

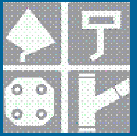


Foundations: 40 cm wide and 60 cm depth, filled with cyclope concrete.

Super foundation: 25 cm height minimum with medium size stones.



SAFER HOUSING



Reinforced Adobe

Walls

Adobes were laid using a lime mortar.

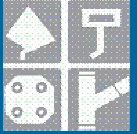


Roof

Wooden ring beam and trusses of tornillo wood.

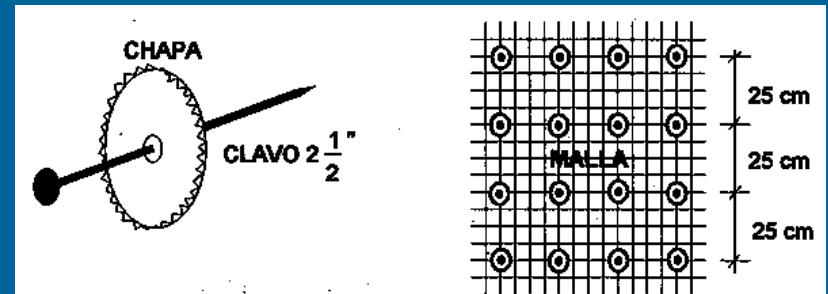
Corrugated plastic sheets (0.80 x 3.00 m) were installed with galvanized roofing nails.

SAFER HOUSING



Reinforced Adobe

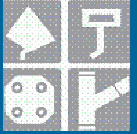
For a best stability of the walls, the corners were reinforced with electro welded wire mesh in both directions, directly nailed on the wall.



Mesh was placed in horizontal and vertical strips (simulating beams and columns, respectively) in the critical parts of the building, and then spreading cement mortar over them.



SAFER HOUSING



Reinforced Adobe

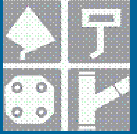
Each house measures 28.24 m².
The total cost was US \$3,000,
which includes interior finishing,
doors, windows and bathroom.

Advantages

- *Local building material and easy to produce.*
- *Low cost and the raw are readily available.*
- *Excellent sound insulating properties with thermal performance.*
- *Fire proof, durable yet biodegradable, non toxic building.*



SAFER HOUSING

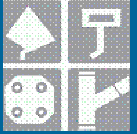


Reinforced Adobe

Researches were undertaken under an agreement with the Catholic University of Peru, in seismic test laboratories, with a non reinforced building.



The first floor was built in adobe and the second floor, in quincha. The module was subjected to several earthquake simulations with input accelerations of 1.0 g, and it suffered minor fissures in the corners.



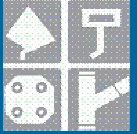
Reinforced Adobe

Reinforcement technique: nailing electrowelded wire mesh along the insides and outsides of adobe walls, connecting the two sheets of mesh using **wire** and then spreading cement mortar over them.



Their purpose is, together with the applied mortar, to prevent the abrupt loss of lateral rigidity that occurs when cracks form in non-reinforced buildings

CONCLUSIONS

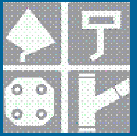


SENCICO has technical and social responsibilities with communities from rural areas.



Is necessary to develop technological research through experimental projects.

CONCLUSIONS

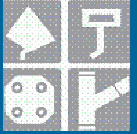


The achievements and results of the researches should be presented to the people through courses or training workshops with easy to understand guides.

To contribute to mitigate disasters, it's important to develop appropriate technologies and implementation of achieved knowledge into practice, validating and spreading technological researches.



CONCLUSIONS



Learning appropriated technologies for construction also let owner builders to learn how to strengthen their house structures, as no costly tools or equipment are necessary and the essential know how can be easily acquired developing specialized skills and becoming a valuable skilled employee to any construction business.



Is very important to share information on building construction practices and strengthening technologies with national and international organizations.