Mitigation and the Consequences of International Aid in Postdisaster Reconstruction

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I hope that my observations on disaster reconstruction, in the context of post-Mitch Honduras, can serve the greater purpose of allowing us to question the consequences of international aid on a developing country, particularly regarding the development of sustainable solutions in the field of housing.

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INTRODUCTION

The Context of Disaster Relief

The aftermath of a natural disaster often poses a monumental challenge to the locals of the affected country in terms of recovery and restoration. Homeless citizens need replacement housing; water, sewage and other public services must be restored to maintain public health and support other recovery activities; and the process of reconstruction of damaged infrastructure such as dams, bridges, electric poles, and schools need immediate attention. Natural disasters also pose challenges to the economy and resources of developed as well as developing countries; however their effect on developing countries is perhaps more severe because of these countries' limited ability and resources to cope with their own losses.

Previous researchers (Barraclough, 1999; Burby, 1998; Davis, 1978) have correctly pointed out that it is the poor who primarily bear postdisaster losses, tending as they do to live in areas most exposed to hazards and in fragile structures offering little protection.

Given this context, one can begin to understand the effect of natural disasters such as hurricanes, tornados, and earthquakes on vulnerable developing countries, the examples for the present study being the hurricane-prone Central American countries of Guatemala, Honduras, and Nicaragua.

The Honduran government in its National Plan for National Reconstruction following Hurricane Mitch's massive destruction emphasized that "the relation between global climatic changes and phenomena like hurricanes be recognized," and concluded by drawing attention to the importance of hurricane warning systems and other precautionary measures that will need to be taken if massive loss to life and property is to be avoided in the future.

Geographical Location and Vulnerability

The understanding that "the vulnerability of a country is linked in great part with the inadequate style of disorganized occupation of the territory and the design and location of public infrastructure" (Government of Honduras, 1999) points out an important correlation between disaster vulnerability and geographic location.

Honduras, a nation of 6.3 million people in an area of roughly 112,087 square kilometers (Roy, 1999, pp. 1-3), is a country which, amidst its neighbours of Guatemala, El Salvador, Nicaragua, and Panama, faces extreme challenges in its efforts toward economic development. In 1995, Honduras' external debt surpassed US$4.1 billion (CNN Online, 1999). When coupled with a 20% rate of inflation, this debt poses an extremely challenging situation to a country already bogged down with economic problems such as poverty, low per-capita income, and unemployment.

The Honduran economy rests largely on banana and coffee production, as well as the harvesting of sugarcane, african palm, shrimp, and other seafood. For an economy that is so highly agricultural, its geographical location between the Atlantic and the Pacific oceans in the Central American isthmus makes it extremely vulnerable, particularly with respect to torandoes, tropical storms, and hurricanes, which have consistently and mercilessly battered its coastlines over the past few decades, destroying much agricultural production. These storms have caused widespread damage to agricultural land, infrastructure, and property, while rendering thousands homeless and setting the economic development of this country back several years.

The History of Hurricane Damage in Central America

A close look into the region's history reveals that hurricanes have posed a consistent threat to Central America, with over fourteen hurricanes affecting the Latin American coastline in the past fifty years. The chart below confirms the connection between the geographical location of Honduras and its disaster vulnerability in the past, listing the numerous hurricanes that have frequently vented their fury on this region.

FIFTY YEARS OF DESTRUCTION
Source: National Oceanic Atmospheric Association (NOAA, 1999)

Year	Date	Name of Hurricane	Location
1950	Oct. 13-19	King	Iriona
1956	Sept. 21-30	Flossy	Utila
1960	July 9-16	Abby	La Ceiba
1961	July 20-24	Ann	North Coast
1964	Oct. 8-16	Isabel	Gracias a Dios
1966	June 4-14	Alma	Gracias a Dios
1969	Aug.28-Sept.4	Francelina	Bay Islands
1970	Sept. 8-13	Elia	Gracias a Dios
1971	Sept. 5-18	Edith	North Coast
1972	Sept. 11-20	Irene	Gulf of Fonseca
1974	Sept. 4-20	Fifi	All of Honduras
1978	Sept. 3-1	Greta	Gracias a Dios
1986	Sept. 10-19	Danielle	North Coast
1987	Oct. 9-13	Floyd	North Coast
1988	Sept. 15-18	Gilbert	North Coast
1989	Oct. 14-20	Hugo	All of Honduras
1993	Aug. 10-11	Bret	Gracias a Dios
1993	Sept. 17	Gert	North Coast
1996	July 27	Cesar	Nicaragua
1998	Oct. 28-Nov.3	Mitch	Guatemala, Honduras, Nicaragua

A closer look at the above chart also shows the specific vulnerability of the northern Atlantic region - the Atlantic ocean being the point of origin for many of these hurricanes.

Because of its geology, much of Latin America is also prone to high volcanic risk. The steady subduction of the Pacific Ocean floor under the western margin of Central and South America has given rise to a chain of volcanoes on the overriding continental plate. The intense interaction of these lithospheric plates in Latin America is responsible for the generation of the almost 270 currently active volcanos (Sigurdsson, 1986, pp. 205) in this region as well as posing a signficant seismic hazard. These factors, when combined with Latin America's vulnerability to seasonal hurricanes, makes Honduras extremely vulnerable to natural disasters.

To obtain a clear understanding of the magnitude of the Mitch disaster when compared with previous hurricanes in the past, the chart below illustrates the wind speeds and destruction levels of different Central American hurricanes in the past ten years.

WIND/DAMAGE CRITERIA IN THE PAST THREE
CENTRAL AMERICAN HURRICANES

Source: National Oceanic Atmospheric Association (NOAA, 1999)

Name/Date	Landfall	Loewest pressure	Average Wind Speed	Deaths	Damage
Joan Oct. 22, 1988	Bluefield Nicaragua	932 mb	145mmph	Total: 216 Nicaragua:148 Costa Rica: 28 Colum: 25\venez:11 Panam: 4	$2 billion (Nicaragua alone $1 billion)
Cesar July 27, 1996	Bluefield Nicaragua	985 mb	85mph	Total:51 CRica:26	N/A
Mitch July 27, 1996	Offshore Trujilo Honduras	917 mb	180 moh	Total: 11,000 Hndrs” 6,500 Nicar: 3,800 ElSAl:239 Guata:256 Other:54	$5 billion +

Mapping the Mitch Disaster

Mitch struck the Central American countries of Guatemala, Honduras, El Salvador, and Nicaragua on October 28, 1998, and continued for eight days. Its torrential rains flooded villages, washed out bridges, dams and infrastructure, uprooted homes, and destroyed agricultural land and crops (October being the harvest season) all along its path (see Annex A, Map 9). Mitch's most severe damage was in Honduras, where it affected over 1,500,000 people, rendering almost 24.2% of the country's population homeless (ECLAC, 1999). An estimated 500,000 people lost their homes and had to be provided temporary shelter within the short span of one week. Mitch killed over 7,000 in Honduras alone[1], and severely affected the economy because of the sudden loss of revenue due to the destruction of agricultural produce. The fact that Mitch's most severe damage was in Honduras is not surprising, since that country is the poorest amongst its other four neighbours.

After an extensive nationwide survey, the Honduran Finance Ministry identified and declared that 73% of Honduran households could be classified as poor (using per capita income comparison) and 30% of these homes as extremely poor. It is this 30%, with their poor quality adobe and mud structures often located near riverbanks and other high-risk areas, that have borne the brunt of Mitch's damage. The United Nations Economic Commission of Latin American Countries (ECLAC) calculated Mitch's damage in Honduras as 80% of the gross domestic product (GDP), and it was the extremely poor 30% of the population that was least able to absorb this huge economic downturn.

Social, Infrastructure, and Housing Damage Associated with Mitch in the State of Choluteca

Choluteca - Geographical Location: Situated in the south of the republic of Honduras, Choluteca is bound by the provinces of Francisco Morazan and El Paraiso in the north, by the Republic of Nicaragua in the east, and by the department of Valle and the Gulf of Fonseca in the south.

Choluteca is characterized by a large number of rivers flowing through it: Rio Choluteca, Rio Texiguat, Rio Grande, Rio Negro, Rio Gaseously, Rio Nacaome, and Rio Vertigo, to name a few. Mitch passed through the state of Choluteca, rapidly creating, with its torrential rain, extreme water levels that found their outlets through the rivers, causing intense flash floods.

Importance of Choluteca's Urban Regional System: Since colonial times, Choluteca, home to almost 200,000 inhabitants, has been an active urban link of relative importance in the commercial and administrative circuit in the Republic of Guatemala. In the past few years it has undergone active developmental efforts that have resulted in the inward migration of people to this province. Yet Choluteca is limited by its poverty when compared to Tegucigalpa or the northern regions, and its rural areas, dispersed along riverbanks or on mountain terrain, are often the first to be hit during the onslaught of hurricanes in the monsoon period.

Again, in Honduras, a country of 6.3 million people, 73% of the population live in poverty and 30% in extreme poverty. Almost 60% of that 30% live in the state of Choluteca (CEPAL, 1999, pp. 178).

Social and Infrastructural Damage Associated with Mitch: Between October 25 and November 2, 1998, Choluteca was the victim of the biggest natural catastrophe in its history, suffering almost incalculable damage to its infrastructure and resources. Hurricane Mitch's impact on the various municipalities of Choluteca was an estimated US$800 million in lost agricultural production alone (Universidad Nacional Autonoma de Honduras, 1999, pp. 98); 10,043.852 quintals of basic grains such as maize, beans, and rice; a further 650.000 quintals of exportable items such as coffee; 20,872.407 quintals of bananas; 3600.000 quintals of sugarcane; and 4046.411 quintals of melon were completely destroyed.

In the educational sector, 25% of the educational centers in Choluteca were damaged; the building of the Central Ministry of Education was completely flooded, lost all of its equipment, goods (furniture), and archives. Numerous health centers were also damaged, with the Hospital of San Larynx being completely destroyed.

In infrastructural damage, 94 bridges were completely destroyed and 75 were severely damaged; in addition, 52 highways were completely destroyed, thereby seriously affecting north-south accessibility.

In the service sector, approximately 22 aqueducts between the cities of Tegucigalpa and Choluteca were damaged, affecting 70% of the potable water provided to Choluteca.

Another reason for the increased disaster vulnerability of this state is an ecological imbalance due to deforestation. The absence of root systems to hold soil in place makes it more vulnerable to landslides. It is estimated that 108,000 hectares in Honduras disappear annually due to continuous deforestation.

POPULATION DENSITY BY MUNICIPALITY IN THE PROVINCE OF CHOLUTECA

Source: Universidad Nacional Autonoma de Honduras, PLATS Survey

Municipality	Population 1988	Surface Area	Inhabitants/Area	Dwelling Units
Choluteca	88,812[2]	1,032.0	86.0	15,448
Apacilagua	8,764	205.8	42.1	1,395
Cnp. de Maria	22,547	151.4	148.9	3,504
Duyure	2,770	101.4	27.2	454
El Corpus	20,884	233.9	89.3	3,172
El Triunfo	26,813	291.2	92.0	4,315
Marcovia	29,285	465.8	62.9	4,974
Morolica	4,433	271.7	16.3	754
Namasigue	17,810	194.1	91.8	2,847
Orocuina	14,724	120.3	122.3	2,557
Perspire	22,626	326.1	68.5	3,724
San Antonio de Flores	4,786	53.4	89.6	764
San Isidro	3,325	67.9	49.0	536
San Jose	3,080	60.2	51.2	491
San Marcos de Colon	18,157	562.9	32.2	2,965
Santa Ana de Yusguare	7,057	71.8	98.3	1,176
TOTAL	295,484	4211.0	70.2	49,076

Traditional Housing in Choluteca

Existing construction in the state of Choluteca can be broadly classified into four different types according to the materials used for construction.

1) Bajareque or Wood Frame-Mud Plaster Houses: This type of housing is common amongst the poorest section. It consists of a basic frame of unfinished wooden poles or tree branches, finished using mud plaster (or cement, depending on the resources of the family) as an infilling material. Mitch greatly affected this type of construction, which, because of the poor quality of its material, was prone to collapse and disintegration with heavy rain.

2) Adobe and Tile Construction: This second type of rural house construction is found extensively in the eastern parts of the state, particularly along the mountain slopes of El Corpus, and in certain areas of Perspire, San Larynx, Choluteca, and El Triunfo. This type of construction uses adobe blocks, locally made using the area's clayish mud. As the clay content in the mud is high, these blocks are cohesively packed and are durable. Depending on the financial capacity of the family, either cement or a cement-clay mixture is used as mortar filling. These adobe walls are sometimes plastered using mud and a horse/cow dung paste. In certain cases, the exterior is plastered with cement plaster. Most foundations are set on a rubble platform3. The roof is made of timber log frames with smaller log or bamboo rafters that act as supports for clay tiles. Limited use of asbestos or zinc is found in traditional house construction, with most families preferring clay tiles because of topographical, cultural, economic, and accessibility factors.

3) Brick Walls with Tile/Zinc/Asbestos Sheet Roofing: This is the third, more expensive type of construction found in regions of Perspire and central Choluteca. The walls have a framework of concrete4 with brick infilling. Wooden roof frames are embedded into the brickwork, and the

joints are set in cement mortar. Terra cotta tiles or sheeting make up the roofing[5]. For this type of housing, it has been difficult to collect data on the connections between the beam and the brick infill and to know if the use of lateral reinforcement is common.

4) Concrete Block and Tile/Sheet Roofing: This is the fourth type of house construction, with walls being made of 400 x 200 mm concrete blocks set using cement mortar. Vertical/horizontal reinforcements are placed in the hollows of these blocks, which are then filled with cement mortar. The wooden roof, door, and window frames are set into the structure and sealed using cement. This is the strongest type of construction and is found most often in semi-urban or urban areas. This form of house construction was little damaged during hurricane Mitch[6].

Classification of Property Ownership in Choluteca

Given below are the results of the census held in the state of Choluteca in February 1999 showing the percentages and types of land ownership. From this chart one can easily see that the primary three forms of ownership are properties with and without legal titles and rented ownership. (Due to lack of a rigid legal structure, it is common to come across properties without legal titles being used and sold.)

TYPES OF PROPERTY HOLDINGS

Source: UNAH/PLATS Survey, February 1999

TYPE	NUMBER	PERCENTAGE
Property with Title	291	35.3%
Property without Title	267	32.4%
Leased Property	12	1.5%
Rented Property	218	26.5%
Lease Transfer	29	3.5%
Other	6	0.7%
No Data Available	1	0.1%
TOTAL	824	100%

The above findings show that the majority of dwelling units, that is, two out of every three, are self-owned (property with and property without title), the properties without titles representing the poorer segment's land-encroachment into rural areas and the preference towards self-ownership. The data below shows the type of construction that is popular on this type of land.

TYPES OF DWELLING UNITS

Source: UNAH/PLATS Survey, February 1999

TYPE	NUMBER	PERCENTAGE
Independent Dwelling	677	82.2%
Part of a Building	2	0.2%
Quarters	144	17.5%
No Data Available	1	0.1%
TOTAL	824	100%

It is clear from the above data that the most common type of dwelling unit is the detached, independent, self-owned housing unit. Below are the results from a survey of 824 units within the state of Choluteca, demonstrating the most common types of wall material used and thus indicating local preferences and choices.

TYPES OF MATERIALS COMMONLY USED FOR WALL CONSTRUCTION

Source: PLATS/UNAH Survey, February 1999

TYPE	NUMBER	PERCENTAGE
Brick	206	25.0%
Concrete Block	11	1.3%
Adobe	331	40.2%
Wood	90	10.9%
Bahareque (Wood, Mud)	169	20.5%
Other	15	1.8%
No Data Available	2	0.2%
TOTAL	824	100%

TYPE OF MATERIAL COMMONLY USED FOR ROOF CONSTRUCTION

TYPE	NUMBER	PERCENTAGE
Wood	14	1.70%
Tiles	751	91.14%
Cement/Concrete	2	0,24%
Manana (Thatch)	2	0.24%
Zinc Sheeting	29	3.52%
Asbestos/Fibrecement	8	0.97%
Other	16	1.94%
No Data Available	2	0.24%
Total	824	100.00%

Housing Damage Associated with Mitch

Before analyzing the distribution of the types of housing damage due to Mitch, an important factor that must be considered is the type of disaster affecting the dwelling in the first place. For although the cause of the disaster may be simple - i.e. a hurricane - damage can result due to various factors associated with the storm, such as flooding, erosion, landslides, extreme wind, extreme rain, avalanche, etc. This information is extrememly valuable, particularly for designers concerned with the construction of units that are better prepared to handle such extremities.

For example, the data below demonstrate that high wind resulted in less damage during Mitch compared to avalanches and flooding. Although one must consider seismic, hurricane, volcanic, and other factors before actually designing structures, the chart below can help one learn from the experience with Hurricane Mitch.

TYPE OF DISASTER AFFECTING THE DWELLING

Source: PLATS/UNAH Survey, February 1999

TYPE OF DISASTER	FAMILIES AFFECTED	PERCENTAGE
Structure Collapse	157	16.20%
Flooding	638	65.84%
Landslides	105	10.84%
Water Surge	46	4.75%
High Winds	1	0.10%
Avalanche	22	2.27%
TOTAL	969	100.00%

The above figures clearly show that most housing damage was due first to flooding and second to landslides.

Likewise, the figures shown below indicate the degree of damage to the dwelling units due to Mitch, also pointing out that a majority of houses were completely destroyed, thereby necessitating reconstruction7.

DEGREE OF DAMAGE TO THE DWELLING UNIT DUE TO MITCH

Source: PLATS/UNAH, February 1999

TYPE OF DWELLING	NUMBERS	PERCENTAGE
100% Habitable	13	1.6%
Habitable, But Requiring Repair	49	5.9%
Habitable, But Awaiting Evaluation	27	3.3%
Not Habitable/ Damaged	67	8.1%
Non-existing Dwelling	375	45.5%
Non-existing Dwelling/Foundation	293	35.6%
TOTAL	824	100.0%

Finally, the urgent need for reconstruction is further confirmed when one notices that as of February 1999 over 700 families in Choluteca were identified as having completely lost their houses and as requiring urgent replacement housing8.

A survey conducted by students of the Postagrado Latino Americano En Trabajo Social further indentified where these families were staying, thereby confirming that for many, finding alternate accommodation was a impossible and living in shelters with minimal facilities was the only solution.

ACTUAL LOCATION OF AFFECTED FAMILIES (FEBRUARY 1999)

LOCATION	NUMBERS	PERCENTAGE
Shelters	515	62.5%
In Their Own House	134	16.3%
At Relatives/Friends	62	7.5%
Rented Another House	18	2.2%
Other	95	11.5%
TOTAL	824	100.0%

LOCAL AND INTERNATIONAL RECONSTRUCTION EFFORTS

Government vs Municipal Involvement

A surprising amount of indifference on the part of government and local municipalities becomes obvious when one looks closely at rehabilitation of areas affected by Mitch in the states of Tegucigalpa and Choluteca. In the city of Tegucigalpa one year after Mitch, numerous families continued to live in dilapidated, unhygienic, temporary shelters, waiting for the government to clear sanctioned land for reconstruction - a promise made nine months earlier. This is an area in which international organizations do not have much say.

To take the example of the municipality of Perspire, evidence suggests that the central government there had very little involvement or interest (Audet, 1999) in the reconstruction efforts organized by the various nongovernmental organizations (NGOs) and international agencies during the initial planning stages following the disaster (January-February 1999). However there seemed to be greater involvement on the part of local municipalities, who, apart from playing an important role in the procurement and allotment of the land, also assisted the NGOs in their determination of those families who needed immediate attention. The "laid back" attitude of the government amidst of the flurry of reconstruction efforts by international NGOs in Nueva Choluteca seemed to indicate that corruption was prevalent amongst most political bodies in Honduras (Honduras This Week, 1999), inspite of (or due to) the millions of dollars of international investment9 since October 1998.

International NGOs Involved in Reconstruction

Three weeks following the Mitch disaster in Honduras, there was much international and nongovernmental organizational activity. Volunteers in Technical Assistance, a group specializing in the coordination of different NGOs in disaster situations, listed more than sixty organizations actively involved in the recovery in Honduras (VITA, 1998) within the first month alone. Since then, Honduras has had more than a hundred different NGOs and international agencies actively involved in its reconstruction process. To list them all would be beyond the scope of this report; for our purposes we will focus only on those actively involved in house reconstruction in Nueva Choluteca. Before going into the specific nature of the reconstruction efforts of these organizations, it is instructive to look at the diversity of the solutions offered.

Most international reconstruction efforts in Honduras have centered around the following issues; participatory vs imposed solutions, traditional vs imported technology, rural vs urban space creation, and costs of construction vs costs of maintenance (Atlas Logistics, 1999, pp. 4). However, the solutions provided have been extremely diverse. This diversity reflects methods of conception, housing design, technological choices, costs, interior and exterior arrangement, issues of land ownership, and extent of aid offered.

In this context, it is interesting to note the approach to reconstruction of the Canadian NGO Centre d'Etude et de Cooperation Internationale (CECI). While some organizations have preferred to benevolently offer ready-made houses, CECI has focused on people's participation in their reconstruction - on enabling people to initiate their own development, thereby working towards long-term progress. Within this context it is necessary to mention the "Auto-Construction" system followed by CECI, which provided families with building materials, requiring them to become involved in the actual building process. The system is similar to a "sweat equity" program, imparting valuable construction skills to the people10. This method of "Auto-Construction" or "Participatory Development" has proved to be a successful tool in many cases, resulting in greater occupant involvement in reconstruction.

Still, researchers have always pointed out that the most important role external agencies interested in postdisaster reconstruction can play is to help build indigenous institutions, those that will be equipped to meet the communities' needs in the future. Examples of how international aid has totally missed this mark in the past reflect foreign policies and technology that often contrasted sharply with local needs and preferences (Dudley, 1989). However, with the growing number of natural disasters in the past few years and the consequent specialization of disaster- relief, more and more organizations are trying to integrate their reconstruction efforts into grassroot development, making use of local talents, techniques, and construction practices.

An earlier example is CAAP (Centro Andino de Accion Popular) in Equador, a South American volunteer organization, active following the March 1987 earthquake, that integrated into its reconstruction plan (in a country in which it did not have much previous experience) many grassroot development strategies, such as prioritizing building education, providing a construction tool kit for every family so that they could participate in their own reconstruction process, and allocating a salary for a local master builder for a period of six months (in order to increase local capacity for reconstruction work).

As Wijkman and Timberlake have observed, "In order for any reconstruction aid to be useful, it is essential that provision should start within 10-20 days of the disaster so that the support is according to the reconstruction timetable of the survivors, not of outside agencies (Wijkman, 1984)."

The experience in Equador proved that prefabricated, prefixed, imported technology from outside countries did not contribute anything to local building practices and skills, nor did it enhance a communities' long-term sustainable development. On the other hand, self-help solutions, i.e. providing materials and requiring the people themselves to provide the labor, resulted in increased participation and local responsibility.

To summarize, in the context of international aid, true development, following a disaster or not, should and will take place through the strengthening of indigenous skills, infrastructure, and organizations. The best hope for a community's recovery in a disaster situation lies in the availability of such strong organizations.

It is towards this end that local institutions must direct their efforts. Indeed, foreign aid agencies must support these institutions in developing their local understanding and organizational infrastructure before the disaster strikes, if true recovery is to be achieved.

NGO Involvement in the Provision of Housing in Choluteca

The various organizations that were actively involved in Choluteca are listed below. While some of them were involved in house reconstruction, others were involved in peripheral issues such as child literacy, the supply of safe water, medical relief and supply, and training programs.

UNICEF: A division of the United Nations officially concerned with the Childrens Education Fund, UNICEF in Nueva Choluteca has been involved in the reconstruction of three school buildings within the Nueva Choluteca premises (negotiations for two of which are underway).

Samaritan's Purse: A charity-based international organization, Bolsa de Samaritana (local translation) has been extensively involved in Nueva Choluteca not only in the provision of permanent housing but also in the provision of water purification filters, which it has widely distributed.

Atlas Logistics: A French NGO specializing in disaster relief, transportation, and logistics, Atlas Logistics has extensively contributed to the construction of over 250 housing units in Nueva Choluteca, apart from drilling borewells and arranging water for construction and community use.

CECI: Centre des Etudes et Cooperation International, a Canadian NGO involved in the provision of housing units, latrines, kitchen stoves, has also been involved in a social organization and orientation project in Nueva Choluteca.

MSF: Medicine Sans Frontiere is a Swiss NGO involved in the provision of immediate medical relief.

Action Contre El Hambre: Action against Hunger is an international NGO that has also contributed to permanent house construction by participating in the food-for-work program.

OIM: Organization de Immigration et Migration, a United Nations division involved with refugees and migrants, has been responsible for the provision of temporary shelters for over 2,000 families in Nueva Choluteca - families who are waiting for the completion of their permanent houses.

Consulidad Espanol: The Spanish Consulate in Honduras, which has not only contributed to house construction in Nueva Choluteca, has also opened a training school "Escuela Taller Especial De Choluteca (Funes, 1999)" through which it has begun training local people in carpentry, welding, and construction. The consulate has initiated many long-term training programs involving local youth.

Save the Children/Honduras: An NGO originally working exclusively with displaced, affected children, Save the Children has diversified in Nueva Choluteca, involving itself in the construction of housing units and many food-for-work programs.

Iglesia de Cristo: A local Catholic charity organization, Iglesia de Cristo has also contributed to the provision of housing units complete with water supply and sewage provision.

Again, while the work of external agencies in the resettlement process is commendable, one cannot overemphasize the real importance of "internal aid" in a country during a disaster. While relief is mostly mobilized from outside the stricken country, "planning" for recovery and mitigation must necessarily be undertaken from within each country, taking into account available indigenous resources.

CECI Involvement in Choluteca

CECI's involvement in Honduras began in late December 1998, when the extensive destruction due to Mitch and the reconstruction efforts required were beginning to become clear. The agency's reconstruction project officially began in January 1999, with a systematic study of the areas primarily affected by the hurricane, especially the southern part of the country in and around the state of Choluteca. For this effort, there was close collaboration between CECI and the local municipal authorities[11], leading to a clear understanding of the specific areas around the region where families were most affected12. Subsequently, CECI was able to obtain funding and support from the Canadian International Development Agency, MRI Government of Quebec, and religious and private donors - a sum of approximately $800,000 (Canadian), thereby officially initiating its reconstruction project. To date, CECI has contributed $525,000 towards reconstruction, with additional funds of $165,000 from the ACDI (Assistance Humanitaire Internationale) and another $76,000 from MRI-Quebec (Secretairait a L'Aide International).

Although CECI's initial goal was to build 800 homes, as of this writing over 990 houses have been completed in Honduras, together with 250 kitchen stoves and individual latrines in Nueva Choluteca, apart from sewage and potable water projects in Conception de Maria and Perspire. Below is a table listing all of CECI's projects in Choluteca, with the specific number of units built in each area.

In many cases, CECI worked in collaboration with other national and international NGOs. For example in Nueva Choluteca, Atlas Logistics took over the actual construction of the 52 CECI units, although the financial responsibility of these was CECI's.

PROJECTS OF CECI IN CHOLUTECA WITH THE NUMBER OF UNITS BUILT

(Source: Project Status Report, 13 October 1999, CECI office, Choluteca)
(Refer to Annex B for location details)

LOCATION/REGION/AREA	NUMBER OF DWELLINGS	
Perspire	151	
San Lorenzo	188	
Truinfo	13	
El Corpus	533	
Choluteca (Nueva Choluteca)	52	
TOTAL	925	

The following summaries provide some idea of the financial partnerships between CECI and other organizations that made the realization of the 925 housing units in Choluteca possible. They describe the different projects and financial involvement of CECI in the diverse cities and towns of Choluteca, and provide details of collaboration with the other agencies (CECI, 1999).

Perspire (semi-rural): Located in the northern tip of the state of Choluteca and approximately 105 kilometers southwest of Tegucigalpa, the municipality of Perspire included many populations living in close proximity to the rivers of Perspire, St.Juan, and Tapaloca. This vulnerability, combined with the intense poverty in this region (mud and adobe houses are very common), made these communities extremely vulnerable to Mitch's onslaught. Many houses close to the river were completely destroyed by inundation, and entire village settlements were completely flooded. CECI is involved in nine different areas of Perspire, three of which the author had the opportunity to visit personally. These areas consist of many reconstructed houses and some relocated ones. Almost 65% of these reconstructed houses have been built at the same site as the original damaged houses, often on the existing foundation of the old buildings13.

CECI has extensively used concrete frame, brick infill construction, together with wooden frames and tiled roofs. However, as discussed in the next chapter, the primary issue of mitigating the effects of future flooding remains14 - i.e. site location has been under severe constraint in this area - first because of municipal limitations, second, because of the unavailability of purchasable land. Therefore it seems only a matter of time before another hurricane-induced flood will endanger these homes. Still, the new houses are well-constructed; they are concrete beam frame and brick infill structures replacing, in many cases, adobe and poor quality brick structures that easily collapsed during the three days of intense rain and flooding brought on by Mitch in October 1998.

A small percentage of the units here have been built anew, including a group of 15 houses that are the only ones that have been relocated. One can see how the siting of these houses (staggered alternately along the upper slopes of the mountains) has definitely lessened their vulnerability to flooding, should the adjoining river overflow. Given that this community represents the poorer segment of Perspire, with virtually no public facilities to boast of, CECI's project of building a 100-cubic-foot septic tank, using the natural slope of the site to drain recently laid pipes from these newly constructed units, definitely serves an important public need, apart from being an important step in promoting the community's self-sufficiency.

Conception de Maria (rural): The housing units provided by CECI in the El Corpus and Conception de Maria regions are different from those mentioned above and below because they have been built in a unique area with its own set of restraints. Located close to the Nicaraguan border, the El Corpus region is characterized by its high altitude, and it is not uncommon to find most shelters built into the mountain slopes. This region of Choluteca has a high population and is one of the poorer segments of Honduran society, most of the local structures being made of adobe and tiles. During Mitch, part of the loss of housing units in this region was due to landslides and flooding that often brought down entire structures. One of the biggest constraints in this extremely rural, inaccessible part of Choluteca involves the transport of building materials[15], and the use of concrete blocks was not justified due to the high cost of transportation. Hence, after much consideration of local preferences, adobe has been extensively used in reconstruction. Almost 50% of the 533 units built here have been reconstructed in the same area as the damaged structures - over the previous building's foundation or close to the original building.

Again, an important issue in this project is mitigating the effects of future disasters through reconstruction. This region, due to its geographical location and the use of adobe construction locally, will continue to be vulnerable to disasters, and it is only a matter of time before history repeats itself. However, since relocation would be a difficult and complex alternative[16], this problem remains and will require further careful analysis by professionals and housing specialists in this field.

El Triunfo (rural): Located southwest of the El Corpus region, El Triunfo is geographically similar to El Corpus, and most of the reconstructed houses are characterized by adobe and tile. CECI has undertaken a small project and has constructed twelve units here.

San Lorenzo (urban and semi-rural): In San Lorenzo CECI has been involved in the provision of 188 housing units, with the support of Save the Children/Honduras and the construction involvement of Atlas Logistics. The houses have been built using bricks and tiles, and close to 70% of these reconstructed houses have been relocated to a safer spot, often within a few meters of the original site, away from the path of possible landslides.

Nueva Choluteca (urban): The project in Nueva Choluteca (also called Limon de la Cerca) involves approximately 1,300 units built by various organizations on a site of 117 hectares, 15 kilometers away from the city of Choluteca. The land belonged to a bank, Bank Occidental, that allowed the residents involved in this project to purchase the land on a monthly installment basis. This project is the only one amongst the others previously described in which there is large-scale relocation of the units into new area, with the idea of initiating growth of the city (thus the name Nueva Choluteca). However, CECI has constructed only 52 units on this site, the site having 2,154 lots available with approximately 1,100 units built so far. An important factor in CECI's involvement in providing just 52 houses, but also in its involvement in providing over 250 latrines and kitchen stoves, is the organization's recognition that the most pressing need at this site is facilities that can make this community sustainable in the long run, and not in just the provision of more and more housing units.

For the 1,300 units constructed (and, potentially, for approximately 850 more), the provision of water supply systems, sewage, latrines, electricity, and potable water has not been adequate. CECI's recognition of this fact has resulted in its becoming involved in raising the general standard of life here by constructing latrines and kitchen stoves[17], and in also promoting the environmental development of this area by supplying hundreds of tree saplings to be cared for by those occupying these new units.

CASE STUDY

Nueva Choluteca/Limon de la Cerca

One of the reasons why the Nueva Choluteca or Limon de La Cerca project was specifically chosen as a case study is that it is the only project in Choluteca wherein a postdisaster community was actually planned in a new area on a large scale and with the ultimate goal of relocating residents to a safer zone (the project is also the biggest, with 2,154 lots allocated). In order to examine and discuss a sustainabile reconstruction project, it is important to choose a community project wherein the reconstruction involved mitigation and was initiated "from scratch" - particularly if one is keen on studying the sustainability of relocation.

Another important consideration was that this site includes approximately 1,300 units built by seven or eight different organizations, resulting in five different housing types within the same site area, all involving interesting variations in designs, materials, costs, and construction.

Lastly this site was chosen because these units represent typical "disaster reconstruction," i.e., houses specifically built for Mitch victims, without the limitation of having to adhere to the previous house profile. Following is a description of the present project in Nueva Choluteca.

Location and Project Details

Located 15 kilometers from central Choluteca, this 117-hectare site was thought ideal for relocation, first, because a single-owned, large acreage of land is hard to obtain in Choluteca (this land, belonging to Bank Occidental, was located eight kilometers from the old city), and second because the land is relatively flat ground, naturally protected by a barricade of mountains on three sides. This project allocated 2,154 housing lots, together with space for primary, secondary, and tertiary roads, as well as for collective areas such as markets, schools, health centers, parks, etc.

The site plan includes two principal streets of 12 meters width, facade to facade, 3 meters on each side, green space inclusive, the houses on either side having to respect this setback. Within this total available area of 6,400 sq.m., eight blocks of 32 strips of 10 x 20 meters became possible. Therefore each nongovernmental organization involved in reconstruction has a 10 x 20 meter lot specification they must adhere to. Honduran code requires that 3 meters of setback from a main road. All the houses constructed respect these criteria and are also located on the right-hand side of the plot, thereby allowing 4 meters of space between each unit. The list of NGOs involved in Nueva Choluteca includes Atlas Logistique, Caritas, CDM, IHNFA, ALCALDIA Municipal, Cooperation Espanola, CECI, United Nations OIM, DGIC(Policia), Policia National, Adras Area Metropolitana de Salud, Iglesia de Cristo, Cuerpo de Bomberos, Cruz de Maltaiglesia Santidad, Bolsa Samaritana, Bebiendo Del Manantial, Escula Ricardo Sorano, Help Honduras, Finca Honduras, Auxilio Mundial, Fondacion Covelo, AID-UG, Medicos Sin Frontera, Gobernacion Politica and Action Contre El Hambre[18]. (Those in italics are involved in reconstruction.)

Basic Types of Housing Provided

The existing houses provided in Nueva Choluteca can be classified into five different categories.

1) OIM-built Temporary Shelters: Since January 1999, when this 117 hectares of land in Nueva Choluteca was confirmed as the reconstruction site, OIM (Organization International of Migration, a division of the United Nations dealing with relief supplies to disaster/refugee populations) has built approximately 850 temporary shelters for families waiting for permanent houses. These temporary units consist of a basic wooden frame with plastic sheeting and gypsum panels (all materials being reusable). Zinc sheeting is used as the roofing material, and a meshed opening is provided in place of a window, which is covered with plastic sheeting (provided by the OIM) in case of rain. When a family is relocated into a permanent structure, it is common to see these materials being reused as extensions to the new housing unit, or for a small pulperia, a small common condiment store. Since the beginning of the year, 1,200 such shelters have been constructed and occupied by those awaiting permanent houses.

2) Concrete Block with Zinc Sheet Roofing: This type of house construction was used in a majority of the 1,300 existing units. The plinth is raised by 300 mm, resulting in a concrete floor. Exposed cement blocks with cement mortar joints form the four walls, with wooden window and door frames being embedded into the openings sealed with cement mortar. The roof frame is made of wooden planks, which in turn support the zinc roof. This type of construction was also used extensively for the houses provided by Bolsa Samaritana and Action Contre El Hambre.

The two disadvantages of this type of construction are first, that zinc as the roofing material is poorly suited for the extremely hot climate of Choluteca[19], and second, that during the rainy season, zinc sheets produce a deafening noise as the rain lashes down.

3) Plastered Walls with Zinc Roofing: This type of housing unit has been provided by the Catholic Church in Choluteca; it consists of cement block walls, plastered and painted using cement plaster on the outside (left exposed on the inside), with zinc sheeting on a wooden framework. What distinguishes this unit from the others is the allocation of interior space. While most NGOs, after a careful study of local lifestyles and preferences, decided not to build the kitchen unit indoors, preferring instead to provide outdoor stoves, the builders in this case elected to include a kitchen unit as well as a bathroom complete with fixtures (bath space, washbasin, w/c unit) indoors, as well as to provide for water supply (a separate tank with supply pipes has been laid out exclusively for these units). The higher cost per unit involved with this type of construction raises two important questions: first, whether or not it is better to provide more housing units catering to more families, but with (few) basic facilities, or a fewer number of units with more facilities for fewer families; and second, whether or not imposed solutions (as opposed to vernacular solutions) are sustainable on a long-term basis. Indeed, it is interesting to note that even though these indoor facilities have been provided, families still cook and wash outside, using makeshift stoves and benches (see photographs, Annex B).

Another important drawback in the plastered-wall-and-zinc-roof type of construction is the unfinished roof/wall connection, which displays a lack of construction experience on the NGO's part[20]. Also, most families have added their own grill work in front, thereby demonstrating their own priorities and preferences.

4) Cement Block Units with Tiled Roofs: This fourth type of housing unit has been provided by the CECI and Caritas (accounting for 250 out of the 1100 units built) and constructed by Atlas Logistics[21].

This type of construction involves exposed cement blocks and wooden window, door, and roof frames (similar to the elements used in the second category), but it uses terra cotta tiles instead of zinc laid on wooden rafters. The hipped edge of the roof as well as the edge tiles are fixed using cement plaster. The interior layout of these units includes four rooms, the fourth one being smaller in size (easily convertible into a future kitchen/bath area). All internal walls are 9 feet high.

5) Concrete Block, Tiled Units Provided by Consolidad Espaniol: These units, although they make use of materials similar to those just mentioned above, are different because the cost per unit is higher and they include a bathroom and a small kitchen, besides providing for two additional future bedrooms. This type of construction has been listed as a separate category, and it will be discussed comparatively further on in this report[22].

Community Infrastructure: Water, Sewage, Electricity, and Social Infrastructure

Water: Atlas Logistics and Action Contre El Hambre have each provided for temporary water supply using inflatable storage bags of 30,000 liter capacity. Both make use of a borewell (40 meters deep) and a pump capacity of 12,000 liters/hour. This system has four tap outlets with 12 taps each for rapid distribution. The average consumption in Nueva Choluteca is on the order of 30,000 liters per day. Separate water tanks in different locations have been built by different NGOs, most of them to serve their reconstructed units. Some of these NGOs, for example Iglesia de Cristo and Consolidad de Espanol, make use of their own tanks and have included supply pipes in their housing units.

Borewells with pumps and tap outlets exist in different locations throughout the site (see photogaphs, Annex B).

To conclude, regarding the provision of water, it can be said that one of the biggest problems is the lack of a centralized, organized solution to water supply[23] in this community.

Sewage System: Again, there is no common, centralized sewage connection. The unpopularity of community latrines in the past[24] has resulted in the construction of individual pit latrines, randomly located, totalling approximately 250 units, with the construction of another 500 units underway.

Each pit latrine is made using a two-meter-long, one-meter-wide plastic tube, buried into the ground. The bottom portion of this tube is finished with a 150 mm concrete base. Pit latrines are designed with a one year capacity, after which they require manual removal[25]. However, municipal sewage outlet pipes have been provided to these pits, and they can be easily be connected to the main sewer line. Common septic tanks have been provided by certain NGOs who have built toilets within their units, and all such units have been connected to this common septic tank. CECI has recently begun a 400 latrine project for those units currently lacking a sewage system.

Electricity: Currently none of the units have electricity. Although relief donations have resulted in the municipal government's erecting electric poles, and illegally tapped lines are in current use, legal supply has not yet been sanctioned. Thus electricity is another basic infrastructure element that is lacking but that has been promised in due time.

Social Infrastructure: Due to the combined efforts of Atlas Logistics and L'Order de Malte, it was possible to finance the construction of a health center for the use of the 1300 families in Nueva Choluteca, thereby making it unnecessary for them to travel 15 to 20 kilometers to the main city to find comparable services. The temporary office complex constructed by CECI and Atlas Logistics (see designs, Annex B) within the site complex serves as a common point for community meetings, discussions, and training sessions. Currently one of the CECI-designed houses is being used as a kindergarten, and four temporary cement-panel-zinc-roof units are being used as a primary school.

As this report was being prepared, UNICEF and CECI were negotiating for the construction of four more units to include the kindergarten within the primary school complex, and plans are underway for the construction of a 600-student school within an allotted acreage in Nueva Choluteca[26] (see designs, Annex B).

Also at the time of this report, no centralized market existed, although an increasing number of small shops like pulperias had opened, with people still travelling to the main city market for major purchases. Also there was no church on this sites[27], nor any other type of integral community infrastructure, the Catholic Church being integral to most Latin American cultures.

CECI's 52 Units - Type, Construction Details

CECI has been responsible for the complete funding for 52 housing units in Nueva Choluteca, the construction of which was managed by Atlas Logistics. As mentioned above, these units have been made using concrete blocks and terra cotta roof tiles.

Basic Design: Each unit measures approximately 6.15 x 6.15 meters (exterior dimension) (see plans, drawings, photographs, Annex B). Each unit consists of four rooms: two bedrooms, one living room, and a smaller kitchen/store. Every house has two doors, one main door and another back door, keeping with local customs and preferences28. Every unit has a sloped tiled roof, made of terra cotta tiles on a wooden framework, the slope being appropriate for a region having a distinct rainy season (July-November). CECI has also provided a separate outdoor kitchen stove unit as well as an individual pit latrine for most of the 250 families involved.

Foundations: The foundation of these housing units is laid on a rubble and concrete platform, raised 150 mm to prevent seasonal flooding. The edges of this platform have a horizontal reinforced ring beam running alongside, connecting the corners (see photographs, Annex B). As Choluteca is an area prone to seismic activity, these horizontal beams serve to counter the shear stresses produced during earthquakes. Each corner of these houses has larger concrete blocks (20 x 20 xx 40 mm) fitted with three 10 mm diameter steel bars through their hollows, laterally braced every 150 mm c/c and compacted with cement concrete. The foundations go into the ground upto a depth of 1.5 meters.

Superstructure: The four corner reinforced cement block columns support the load of the roof above. Apart from these four columns, the intersection of the interior walls is reinforced, thereby resulting in an integrated and strong superstructure. The walls are built using 10 x 20 x 40 cm blocks, their hollows filled with rocks and cement mortar. These blocks are also laid using cement mortar. At the lintel level, again 20 x 20 x 40 cm blocks with a special provision for lateral reinforcement are used (see photographs, Annex B). This horizontal ring beam helps in distributing the roof load, apart from dispersing the shear stresses caused.

Roofing: The roof of every CECI unit is made up of approximately 1700 terra cotta tiles - an average of 34 tiles per meter square. Fabricated with a locally available clay, this type of roof has the additional advantages of encouraging a number of small-scale, local manufacturers, being relatively inexpensive, and being easily replaceable with unsupervised labor not requiring high-skilled technicians. Due to their increased thermal efficiency in hot climates and their overall adaptability, tiles were found to be a suitable choice for roofing material in this region.

Latrines and Kitchen Stove Units: Individual latrines have been provided outside of the CECI housing units. The latrines use cement panels attached to a wooden framework and have sloped zinc sheet roofing. One meter diameter plastic pipes are embedded into the ground and their bases sealed with 150 mm of cement concrete. A vent pipe is provided from this pit area to the outside for the emission of toxic gases, and a sewage outlet is provided for future connection into a municipal sewer line. The kitchen stoves are located outside of the house, often under an extended roofline. They are built at platform level and consist of a concrete mould with a specific area for burning wood.

Materials Used and Cost Break-up

All the materials used for the construction of these units are locally manufactured; CECI's policy is to encourage local markets.

DETAILED MATERIAL/COST BREAK-UP PER CECI Unit

SAND/GRAVEL

	Quantity	Price L/m3	Total Lemp.	Total $(Can)
Sand	9	90.00	810.00	81.00
Gravel	5	155.00	775.00	77.50
TOTAL		245.00	1585.00	158.50

LAYING OF FOUNDATION

Detail	Quantity	Price L/m3	Total Lemp.	Total $(Can)
Concrete	8.5	450.00	3825.00	382.50
TOTAL			3825.00	382.50

STEEL

Size/Qty	# of 9m bars	Price L	Total Lemp.	Total $(Can)
Bars 11mm	45	31.09	1399.05	139.91
Bars 4.5mm	21	5.16	108.36	10.84
Bars 7mm	11	15.00	165.00	16.50
Mesh 10X10	3	118.75	356.25	35.63
Steel Wires	20	59.40	1188.00	118.80
TOTAL			3216.66	321.68

WOOD

Detail	Qty/Set	Price L	Total Lemp.	Total $(Can)
Reinf.wood	1	780.00	780.00	78.00
Framework	1	3200.00	3200.00	320.00
Nails	1	800.00	800.00	80.00
Kitchenwood	1	700.00	700.00	70.00
TOTAL			5480.00	548.00

BLOCKS

Detail	Quantity	Price L	Total Lemp.	Total $(Can)
15cm Block	800	6.00	4800.00	480.00
20cm Block	115	6.80	782.00	78.20
10cm Block	110	5.00	550.00	55.00
U Blocks	72	5.00	360.00	36.00
Claustra	8	12.00	96.00	9.60
Cmt. Mortar	40	62.00	2480.00	248.00
TOTAL			9068.00	906.80

ROOF TILES

Detail	Qty/House	Price L	Total Lemp.	Total $(Can)
Roman Tiles	2030	1.60	3248.00	324.80
TOTAL			3248.00	324.80

OTHER FIXTURES

Detail	Quantity	Price L	Total Lemp.	Total $(Can)
Doors	1	850.00	850.00	85.00
Metal Doors	1	600.00	600.00	60.00
Windows w/Meshwork	4	350.00	1400.00	140.00
Total			2850.00	285.00
TOTAL PER UNIT			29,272.66	$2927.28

Project Overview, Suggestions for Sustainability

Any community of housing involving 2500 or more units generates a tremendous need for related infrastructural facilities such as appropriate water supply, a sewage system, stormwater drainage, and electricity supply. For, ultimately, it is not the number or the quality of reconstruction housing provided that makes the newly built community sustainable, but the forethought and planning incorporated in the provision of related infrastructural facilities that will result in this community growing and thriving in its new surroundings.

What strikes one in Nueva Choluteca is not the different types or quality of housing provided, for indeed there are plenty of varieties and a high quality and standard of living has been attempted (Housing units provided by Espanol Consulidad - see drawings in Annex B). Rather, most noticeable is the visible shortage of adequate infrastructure for the 1300 odd families already occupying the newly built units. Water supply for this large community still relies on borewells, necessitating the use of pumps, which again need electricity that still has not been comprehensively provided. Most of the water supply system is still piecemeal; families need to carry water from wherever the outlet taps are located, and only a small percentage of homes have water pipes connected to an existing borewell and storage tank. Provision for sewage is limited to individualized pit latrines that are randomly located - all designed for a two year period, provided they are not used as a waste water system (i.e. for bathing etc., which they often are). Surprisingly there is no provision for bathing, either because the community previously lived in areas near the river, or simply because there was no easy solution to providing thie amenity.

This brings us to the important question for international aid organizations of where and how international reconstruction and aid should be focused. Is it in providing more housing or in improving infrastructure? Can the high standard of facilities provided within the constructed unit be offset or complemented by allocating resources for community infrastructure such as sewage outlets, stormwater drains, or municipal water supply?

When asked about the problems inhabitants of this new community face[29], most families cite water supply and employment opportunities as burning issues, while they almost unanimously agree that the standard and quality of housing provided in this community is far better that what they previously had.

Clearly, in order for this project to result in a truly sustainable community, i.e. a community that will continue to grow and thrive with time, it is essential to focus on the all the needs of the community and to pursue the true objectives of international aid - to empower people locally and go beyond mere restoration of the status quo. International organizations must ask whether their aim is just providing houses as a replacement for those dislocated, or developing communities that are sustainable on a long-term basis - communities aware and equipped to mitigate and deal with future disasters.

Some of the factors that require careful attention include:

- Providing stormwater drainage
- Improving transportation facilities to support employment opportunities
- Allocating areas for markets/commerce
- Establishing a coordinated, regulated municipal water supply
- Supplying sanctioned and regulated electricity
- Encouraging housing projects involving the provision of both sites and services and emphasizing participatory construction
- Promoting local/self employment
- Providing training programs in community leadership/initiative
- Promoting technical training schools
- Promoting community participation
- Promoting long-term self-help maintenance methods

- Establishing a Technical Housing Information Center exclusively for the provision of technical and implementation assistance for further reconstruction/construction
- Initiating training programs for local builders and imparting knowledge of mitigation in construction
- Promoting various schemes, including low-/no-interest longer-term options wherein families are offered resources for self-improvement with aid-giving organizations standing in as security
- Promoting savings/loan associations
- Promoting co-operatives that can raise money for housing
- Promoting government subsidized financing schemes
- Promoting revolving/"soft loan" schemes
- Locating private agencies/foundations with ability to finance housing schemes
- Encouraging participatory housing/sweat equity programs
- Creating incentives for retrofitting measures
- Promoting other innovative financial strategies

SUGGESTIONS FOR MITIGATION IN POSTDISASTER HOUSING

Resettlement as a Viable Mitigation Measure

Disaster vulnerability in Honduras is overwhelmingly related to flooding and landslides (Baird, 1976, pp.49). More crucial than the material and construction of housing is the siting of structures. If appropriately sited, houses made of even bajarique and wood are able to withstand the heavy rains associated with a hurricane, and if inappropriately sited even those built of concrete block are succeptable to destruction (Refer to the occupant survey sheet in Annex B)30. To take another example, the flooding in Venezuela in December 1999 clearly indicated that those living in the coastal areas of that country as well as those living along the slopes of Mount Alvira were the most vulnerable. The houses made of "tin, wood, and cinderblock (Moser, 1999)" were the first to bear the brunt of the December 1999 disaster.

Additional examples of flooding in Vietnam, Orissa, Belgium, and France in 1999 all point to a single conclusion: it is those that occupy and live in risky areas - areas prone to floods and landslides when storms strike - that form the most vulnerable group. Waiting for a disaster that kills thousands of people and displaces millions of others to convince us of the importance of the issue of location is absurd. The huge losses in the countries cited and in the Central American countries of Guatemala, Honduras, El Salvador and Nicaragua during Mitch, could have been avoided to a great extent if only there had existed (on the part of the public, government, and local authorities) an increased awareness on the urgency of predisaster measures.

Predisaster Measure #1: The Issue of Appropriate Siting

A dramatic increase in disasters and disaster damage continues to pose a monumental threat to developing countries. Researchers have often pointed out that it is the social, cultural, economic, and political environment in a country that makes people vulnerable to external influences (Ariyabandu, 1999, pp. 8).

Thus the increased cost of disasters is due not only the fact that disasters are occurring more often in the world, but also that they are affecting increasing populations living in risky areas, in poor quality houses. Specifically, within the context of flood mitigation, it has often been found that often little regard is given to the placement of houses in relation to danger from hurricanes. Good site location or orientation taking into account local terrain and natural cover can be, but usually is not (at least as seen in previous case studies of governmental land allotment for affected people in developing countries such as the Philippines, Bangladesh, Turkey. etc.) determined from historical hurricane data. This data provides the frequency, velocity, and direction of prevailing hurricanes, especially in their extreme form. Most importantly, if this data were taken into account, flooding damage could be averted by siting people away from risky areas such as coastlines and mountain slopes. The importance of siting cannot be overemphasized. The concept of landscape and terrain as a factor in wind-resistant design has long been formally established long since (see Burby and Snarr), although its effective use in actual postdisaster recovery and development still remains grossly inadequate. While other research has previously pointed out the magnitude of this problem, local governments still often turn a blind eye to predisaster measures, waiting until a disaster actually strikes to take action.

The success or failure of postdisaster resettlements has been shown (A.O.Smith, 1992) to depend upon the four factors of siting, layout, construction, and owner participation (Oliver-Smith, 1992) (Nueva Guatemala, or the old city of Antigua, being an example to this effect). Somewhat similarly, Coburn et al., in discussing the successes and failures of resettlement in Bingol province in Turkey have suggested that three factors are crucial in determining the success or failure of a resettlement project; the physical environment of the new settlement, the relationship to the old village, and the capability of the community to develop itself (Coburn, 1992).

Coburn also maintains that viability can be assessed by examining the following factors; the number of houses still occupied, the modification of the form and internal layout of the housing provided, the degree of maintenance required and state of repair, the extent of buildings and the degree of investment, and the construction of private buildings on the reconstruction site.

Other factors highly conducive to the success of the displaced community are the proximity to gainful employment and the provision of basic social services.

Therefore it is imperative that a local government avoid hazardous areas when siting community facilities such as water, sewage, transportation, and other basic infrastructure, and that it establish a policy of issuing building permits only for buildings that are located in nonhazardous areas.

To conclude, appropriate siting can only be achieved when there is a comprehensive land-use planning approach, i.e. mitigation measures must be integrated with other community goals.

Causes for Failure in Postdisaster Resettlements

Again, a poor choice of site for resettlement is one of the most frequently mentioned causes of resettlement failures. Sites for resettlement after a disaster are often chosen with factors other than the welfare and development of the population in mind. Land is often designated for resettlement because it can be easily acquired, particularly in the case of government-owned or controlled property31. Resettlement sites so chosen have also often failed because of their distance from vital resources such as water, pasture, labor, and commodity markets. Social factors such as distance from kin or from the old village (in cases where partial resettlement is attempted), are also cited as major factors determining the success or failure of such resettlement projects (Oliver-Smith, 1992; Kronenburger, 1984; Lamping, 1984; UNDRO, 1982; Razani, 1984).

Housing design and construction are also often blamed for the rejection or failure of postdisaster resettlement projects. Faulty construction and inferior materials become quickly evident when housing units are occupied; they create difficult living conditions, particularly with respect to thermal protection in different seasons (Oliver-Smith, 1992; Razani, 1984; Coburn et al., 1984; Lamping, 1984). Disaster reconstruction in the same disaster-prone location using the same unsafe building techniques is not uncommon. Even if relocation takes place, the design of resettlement houses is often inappropriate for domestic activities that require different kinds of spaces for different uses according to the seasons. Failures often occur because the people for whom structures are built are not consulted, with the consequent lack of understanding of their socially and culturally derived needs and values, as well as of their intimate knowledge and long experience in the local environment.

Compounding this lack of understanding of local needs and values is the frequent importation of outside labor to construct the settlement itself, which not only robs the people of a sense of participation in their new village but also deprives them of the opportunity to gain new and relevant skills for jobs in a developing economy (Oliver-Smith, 1992).

Criteria for Success in Postdisaster Resettlement

A successful resettlement project supports the long-term development of the community in question. To use Cernia's definition, resettlement is a "multi sided opportunity for the reconstruction of systems of production and human settlements that . . . represent a development in the standard of life of those affected, as well as in the regional economy of which they are a part (Cernea, 1990)." Cernia further maintains that the major objective is to ensure that "settlers are afforded opportunities to become established and economically self-sustaining in the shortest possible period (Cernea, 1990)." Further, to be successful, resettlement schemes should effect a "transfer of responsibility from settlement agencies to the settlers themselves" (Oliver-Smith, 1992; Cernia, 1988; Dudley, 1984).

Ultimately, successful postdisaster resettlement is far more than just the construction of stronger concrete block or cement housing. How reconstruction takes place is perhaps more important than what, or how much, is done. For post-Mitch Honduras it is clear that when reconstruction is seen largely as an economic and technological problem (i.e, when the principal concerns are the efficiency of the building system, either as a mitigation measure or as a construction technique), the chances of success of the project are reduced. On the other hand, when postdisaster reconstruction and resettlement are approached as sociocultural, as well as material, problems, and when the victim population participates in planning and implementation, the chances of success are greatly enhanced. Additionally, if the importance of viable employment for victims is recognized, the chances of successfully moving on to a post-resettlement stage are also improved. A close look at the resettlement community at Nueva Choluteca shows that well-constructed strong housing does not necessarily constitute sustainable architecture. There are at least two other prerequisites for this community to become sustainable. First, the 2,100 lot housing community must have public infrastructure that is designed to meet the needs of the 1,750 families that have already occupied their new houses. Stormwater drainage, an efficient sewage system, provision of electricity, and the supply of municipal water are all important prerequisites that go hand in hand with a growing community. Second, it is imperative that opportunities for gainful employment be created close to the new area as opportunities for those people who lost their previous source of income due to their displacement.

In conclusion, disaster recovery and relocation must embrace a a comprehensive approach if it is to result in a sustainable community; it should include not just house reconstruction but all other elements of individual and community development.

Mitigation Using Appropriate Construction Techniques

Although we have seen that construction techniques are only of secondary importance with respect to resettlement success when compared to the participation and involvement of the postdisaster community, it is still important to include sound mitigation techniques in disaster reconstruction. It is also important that information about these techniques be actively dispersed to local bodies. Below are a few of the design considerations for storm and wind construction, offered by the U.S. National Bureau of American Standards (and the Department of Commerce).

Design: It is possible to make buildings more storm resistant by improving their connection details. By learning more about the effects of wind on buildings and by avoiding certain shapes or groupings of buildings one can also avoid undesirable aerodynamic effects.

Obviously, one must consider possible inundation, particularly in areas that experience an intense rainy season. The nature of flood and landslide destruction can be understood by closely studying partially destroyed buildings immediately following a disaster.

Certain design elements can increase resistance to high wind and rain. Sharp edges, low-pitched roofs, large overhangs, and improper grouping of buildings can cause problems (see figures 1 - 9, Annex B). The aerodynamic behavior of buildings is often improved by providing rough surfaces or ribs on the exterior of the walls. Grass roofs have allegedly served to relieve pressures, as have smooth transitions between building surfaces. Unfortunately, internal pressures in buildings with openings are usually not sufficiently considered in design. Roof failures have been caused by wind that penetrates a structure and presses up on the roof from beneath.

Certain configurations (such as cylinders and igloo-type designs) are far more stable than box-like structures, but in the few places where they have been tried, local cultural attitudes have led to their rejection and abandonment. In most developing countries, it is often hard to separate design and construction, most houses being constructed by local masons and contractors.

Characteristics - Foundations, Walls, and Roofs:

Foundations: In low-rise buildings, load transmission to the soil becomes less critical since dwellings of one or two stories do not generate a high dead load. Where flooding is not common, rectangular footings of plain or reinforced concrete or gravel are commonly used. In flood-prone areas, houses may be built on poles or stilts (e.g., bamboo) (see Annex B, Figure #3) driven into the ground to the appropriate depth. Mat footings are sometimes used in unfavorable soils.

Walls: Walls can be either structural or nonstructural elements of a dwelling. Walls often serve as infill for a framed structure, and hence their contribution to the overall structural resistance of a building to wind pressure can be minimal. Structural walls of wood, concrete, burnt clay, or soil-cement composition are the most common in low-cost housing construction. Walls are either monolithic or small unit masonry type (where units are laid in staggered courses, usually in beds of mortar). Clay, brick, tile, adobe brick, and concrete block are the most commonly used masonry units. Quality control in making these units, as well as the mix used for the masonry mortar bed, can be critical to the structural strength of the total wall.

Wind stresses on walls are either out-of-plane bending or in-plane stresses. Out-of-plane pressures (when winds act directly at right angles to a wall) cause deflection and eventually failure. Tornadoes, for example, which are common in Bangladesh, create pressure drops so strong and sudden that walls are actually pulled outwards. In-plane stresses are developed in walls that act as shear resisting elements within a building, the plane being parallel to the wind direction. In this case, incorrectly planned wall openings may be critical, especially at corners. In any case, where two walls intersect, or where walls and foundations or walls and roof meet, special design is required due to the high stresses created at these joints.

Roofs: Roof pitch is an important consideration for good wind resistance. The magnitude of positive or negative wind pressure on roof surfaces is directly related to roof pitch. Wind affects roofs in two ways, direct and indirect. Direct local effects are made up of high positive or negative pressures over local areas of the roof. This pressure may lead to roofing damage to shingles, tiles, corrugated sheets, etc. Overhangs, common for sun protection, are especially liable to wind damage as they undergo positive pressure from below and suction from above.

Indirect effects occur when wind loads are transferred to lateral walls, causing stresses. If these pressures are strong enough, the capacity of connections will be exceeded and the roof will be lifted off. Since every roof has a structural role as a horizontal diaphragm, such pressures bring additional danger. This diaphragm behavior of a roof transmits windloads from the front to the side walls. If a roof is blown off, both frontal and lateral walls may collapse due to loss of diaphragm stiffening. Flat roofs with overhangs are more subject to damage than steep pitch roofs.

The Issue of Stormwater Drainage: An important problem in the reconstruction efforts in Nueva Choluteca is the lack of provision for adequate stormwater drainage. This observation is not to establish or direct blame (many complex issues limit NGO involvement), but it is imperative that careful attention be directed to this particular issue. Experience has shown that this community is vulnerable to heavy rains during the rainy season (August-December) in Choluteca. The soil here is not porous, thereby increasing the likelihood and incidence of flooding. Indeed, during the rainy season in 1999, this reconstruction site was flooded - a crucial indicator of things to come (see Annex B, photos 26 and 27). One and only wonder what another Mitch-scale hurricane may bring. Hopefully, local authorities will soon address this important issue, and an efficient and functional stormwater drainage system will be established.

USING RECONSTRUCTION AS A TOOL FOR SUSTAINABLE DEVELOPMENT

Sustainability and International Aid

Disasters often afford an opportunity for to pursue sustainable development in disaster-prone areas, thereby reducing their long-term vulnerability or susceptibility to future damage. Researchers have pointed to the strong link between damage and vulnerability (Barraclough, 1999; Burby, 1998; Fernandez, 1979; Davis, 1978) and have confirmed that highly vulnerable areas are often the more neglected areas of a country - areas that have low/inadequate delivery systems[32] and that are occupied primarily by the poorer populations of a society. Again, high-risk areas, be they coastal areas (hurricane risk), the sides of mountains (landslide risk), or floodplains (flood risk), are often the sites of squatter settlements; in their extreme poverty the inhabitants have occupied the available risky land for the short-term benifits that it offers. Such vulnerable areas attract very little (if any) national resource investment toward mitigation and preparedness prior to disasters, and when disasters strike, the government often finds it has no choice but to invest in such measures. Again, disasters can provide an opportunity to pursue long-term, sustainable development (Fernandez, 1979).

Disasters clearly draw international funding supporting risk-analyses that incorporate estimates of the probability of various levels of injury and damage and provide a more complete description of the risk due to the full range of possible hazards affecting a given area. Disasters, as detailed below, also draw attention to the state and quality of low-income housing and can influence international as well as national reconstruction funding dealing with housing and disaster mitigation.

Seeing Disasters as Opportunities for Development

The most important contribution that a foreign or a nongovernmental organization can offer communities affected by natural disasters is reconstruction efforts that act as a tool for sustainable development. Before going into details of how this can be done, it is important to define what constitutes "a sustainable community" or "sustainability." Researchers have often linked a community's sustainabilty to its inherent ability to face natural threats, saying that "a sustainable community is clearly one that seeks to avoid exposure of people and property to natural phenomenon like hurricanes, floods and earthquakes"; communities are "sustainable" when they can "survive and prosper in the face of major natural events" (Beatley, 1998).

As observed by Godschalk, Kaiser, and Berke, sustainability in the predisaster period seeks to avoid "saddling future generations with sprawling wasteful land patterns that not only reduce the social livability and economical viability of the communities but also undermine the ability of the natural environment to absorb natural forces and expose people to significant hazard risks" (Godschalk, pp.85-86).

Mitigation, within this context, is defined as a statement of intent or a plan of action to reduce such significant hazard risks while incorporating sustainable values; this includes seeking opportunities to relocate inappropriate land uses out of hazard areas and to rebuild damaged homes and infrastructure in more resilient ways instead of replicating brittle, unsustainable development practices. Sustainable communities also recognize the interconnectedness of social, economic, and environmental goals, and strive to break down the defacto zoning of urban and rural living space, which has previously resulted in the poor occupying the more hazardous regions in frail dwelling units.

Also, as previously mentioned, during disasters, the frequency of transactions with outside systems often increases. Affected people perceive their value; linkages develop among various government departments and among official and voluntary agencies. This factor, coupled with the sense of urgency that disasters often generate, tends to foster a coordinated and efficient approach to addressing the problems of disaster-prone areas (Bhatlacharya, 1975; Fernandez, 1979).

Disasters also collectively motivate people, leading to cooperation for public good and, in some instances, institutionalizing newly experienced power. Another opportunity afforded by a disaster event is the chance to alter the physical development patterns to reduce future hazard vulnerability.

Finally, disasters often lead to a comprehensive survey of vulnerable areas that provides a more complete understanding of the dangers at large, thereby easing the initiation of long-term measures within the context of overall development plans for that area. Support for hazard mitigation is typically strongest in the immediate postdisaster period (Rubin, 1985; Berke, 1992); with appropriate construction, repair, and land-use standards, a rebuilt community can be at lower risk to future disasters, compared to predisaster conditions. Moreover disasters can promote the resolution of long-standing community problems through reconstruction.

Therefore, the conclusions are clear: for mitigation measures to result in sustainable development it is imperative that land-use planning promote the avoidance of high-risk areas, for land-use planning and hazard mitigation are concerned with anticipating tomorrow's needs rather than responding to yesterday's problem. Together they can be powerful tools for reducing the cost of disasters and increasing the sustainability of communities.

Again, although the circumstances can be tragic, disasters do often offer opportunities to develop social resources, and the goal of international agencies should be to strengthen the local capacity to recover and undertake sustainable economic, physical, and social development projects once the recovery is complete.

The Role of NGOs in Promoting Sustainable Development

Several issues deserve consideration when assessing the role of outside NGOs in promoting sustainable development in a developing country - specifically with reference to Choluteca, Honduras.

The Central American governments' treatment of the crisis brought about by Mitch as something new fails to recognize the strong relation between this crisis and the almost permanent internal crisis experienced by the poor in the less-developed regions of Honduras and other countries. Many internal, as well as external, agencies (international organizations, NGOs) have made the mistake of viewing Mitch aid as exclusively addressing hurricane damage and repair and not viewing it as indicating and dealing with the more basic causes of this ongoing social tragedy (Barraclough, 1999).

An important problem that Hurricane Mitch revealed was the weak links between outside NGOs and regional governments. It also showed NGOs the importance of building and strengthening local infrastructure, if their reconstruction was to make a long-term impact. Moreover, for international agencies interested in strengthening community organization, Mitch showed that it was wiser to identify and seek local partnerships, if solutions were to result in sustainable communities.

Below, the reconstruction efforts in Honduras are analyzed using an important set of questions basic to long-term sustainability and growth. These are fundamental questions that any international agency or NGO interested in offering reconstruction aid should address. Although there are no easy answers, the issues can serve as pointers to help an agency determine the consequences of aid on a developing country, particularly with respect to the development of sustainable solutions in the field of housing.

Has the hurricane reconstruction in Choluteca been seen as a vehicle for improving rural building techniques by the international agency involved in the provision of the postdisaster permanent housing?

A careful observation of the practices of the many international agencies and NGOs in Nueva Choluteca shows that, although many NGOs have provided substantially in the form of reconstructed housing, few have actually seen their reconstruction efforts as primarily for improving rural building techniques.

An exception and a noteworthy example is the Spanish Consulate in Choluteca, the Consulidad Espanol, whose reconstruction efforts in Nueva Choluteca began with the establishment of a training school on site that offers courses in carpentry, welding, and construction. This school was planned as a resource and training center for the work generated by the construction of the new housing units.

This center has not only generated local manpower for reconstruction but has also imparted valuable skills to the local people, skills that will hold them in good stead in the future and strengthen their capacity for future construction and reconstruction.

Was the international agency involved with the local framework; were solutions integrated with existing resources and talents?

A study of the construction methods used by Atlas Logistics, Consulidad Espanol, CECI, Bolsa Samaritana, and other NGOs in Nueva Choluteca points to the growing use of local resources and talents in present day relief and reconstruction measures - at least the ones in this region. Atlas Logistics in particular used concrete blocks, cement, wooden frames, and tiles that were locally made, thereby encouraging many small-scale enterprises in the process. CECI also particularly encouraged the use of tera cotta tiles manufactured locally for their reconstructed units, thereby providing business for a great number of small-scale tile manufacturing units.

Although there seems to be a strong emphasis on the use of local resources in present day relief aid, the important issue is not just the use of local resources, but how local manpower can be created. In most developing countries, the challenge is to organize and initiate measures that promote talent-building. With specific reference to Honduras (Choluteca in particular), the need to provide specialized training that mobilizes the youth is of a higher importance than, perhaps, in other countries such as Guatemala and Mexico, where highly trained local resources are more readily available.

How can international reconstruction direct the community toward greater autonomy and self-sufficiency as it struggles with disaster recovery?

Inferring from experiences in postdisaster reconstruction both in Central America and other parts of the world, one can see that the community can be geared towards greater self-sufficiency by:

Providing skill-training, so that people can participate in their own reconstruction;

Encouraging participatory construction initiatives, i.e sweat equity programs, self-help measures, site and service programs, etc.;

Emulating the example of NGOs that mobilize local resources - specifically by initiating programs such as allocating a salary for a local mason for a period of six months;

Providing training in community development for local leaders and other participants from the community to raise local leadership potential and particularly to involve locals in the planning stages of reconstruction;

Providing awareness, leadership, and initiative training.

How can disaster relief be geared toward assisting communities with "their" reconstruction processes?

Both external and internal agencies involved in relief should consider the long-term effects of the aid being offered and view their reconstruction aid as a vehicle that should be integrated with the developmental objectives of the community.

How were past construction techniques technically inadequate (to resist high-wind and other hazard conditions)? What mitigation measures could be incorporated into the disaster relief housing that would render them safe from the onslaughts of subsequent storms and hurricanes?

As discussed previously with regard to appropriate siting, relocation of poor settlements away from vulnerable areas is the most important consideration. Another is to reduce the incidence of poor quality structures close to high-risk areas by relocating sites and services away from vulnerable zones. A third consideration is the integration of special technical measures into house construction - for example, the inclusion of special hurricane fasteners for roof/wall connections, the addition of extra vertical and horizontal reinforcements to deal with lateral and shear stresses, the integration of roof and wall attachments, the raising of the floor level as a precaution against inundation, and the provision of an efficient stormwater drainage system to drain excess water during the monsoon season.

How can international disaster aid fill in the gap between where its reconstruction efforts end and the country's self development begins?

While much disaster relief originates outside the stricken country, planning for preparedness and mitigation must, necessarily, be undertaken within the country, taking into account available resources. This precautionary planning and mitigation should rely heavily on the indigenous resources of the country so that autonomy and self-sufficiency are encouraged.

Therefore, again, the most important goal of international aid agencies should be sustainable solutions within the community and the integration of the agencies' developmental measures with the goals of the local residents.

To sum up, in the words of Oliver-Smith, the success of postdisaster reconstruction is much more than a matter of delivering and constructing houses and towns (Smith, 1989). It is as much a matter of how that work is done. From the analysis of the reconstruction efforts in Nueva Choluteca, it is clear that victims do need significant material assistance, but when the problems are conceptualized as largely economic and technological (that is, in terms of efficiently building dwellings that get people minimally sheltered as quickly as possible), the chances of success are greatly reduced.

On the other hand, where postdisaster reconstruction and resettlement are approached not simply as logistical problems but as sociocultural processes integrating communal living and infrastructure, encouraging the victim populations' participation and involvement, the chances for success are greatly enhanced.

Successful reintegration of a community does not depend upon well-built housing alone. When reconstruction is not seen solely as house building, independent of the construction of related, necessary environmental systems for water, electricity, sewage, security, education, employment, greenery, and sociocommunal living, there is every reason to believe that reconstruction may begin to bridge the gap between where external aid ends and local sustainable development begins.

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ANNEXE A

Map 1: Location of Honduras in the World

Map 2: Political Map of Honduras

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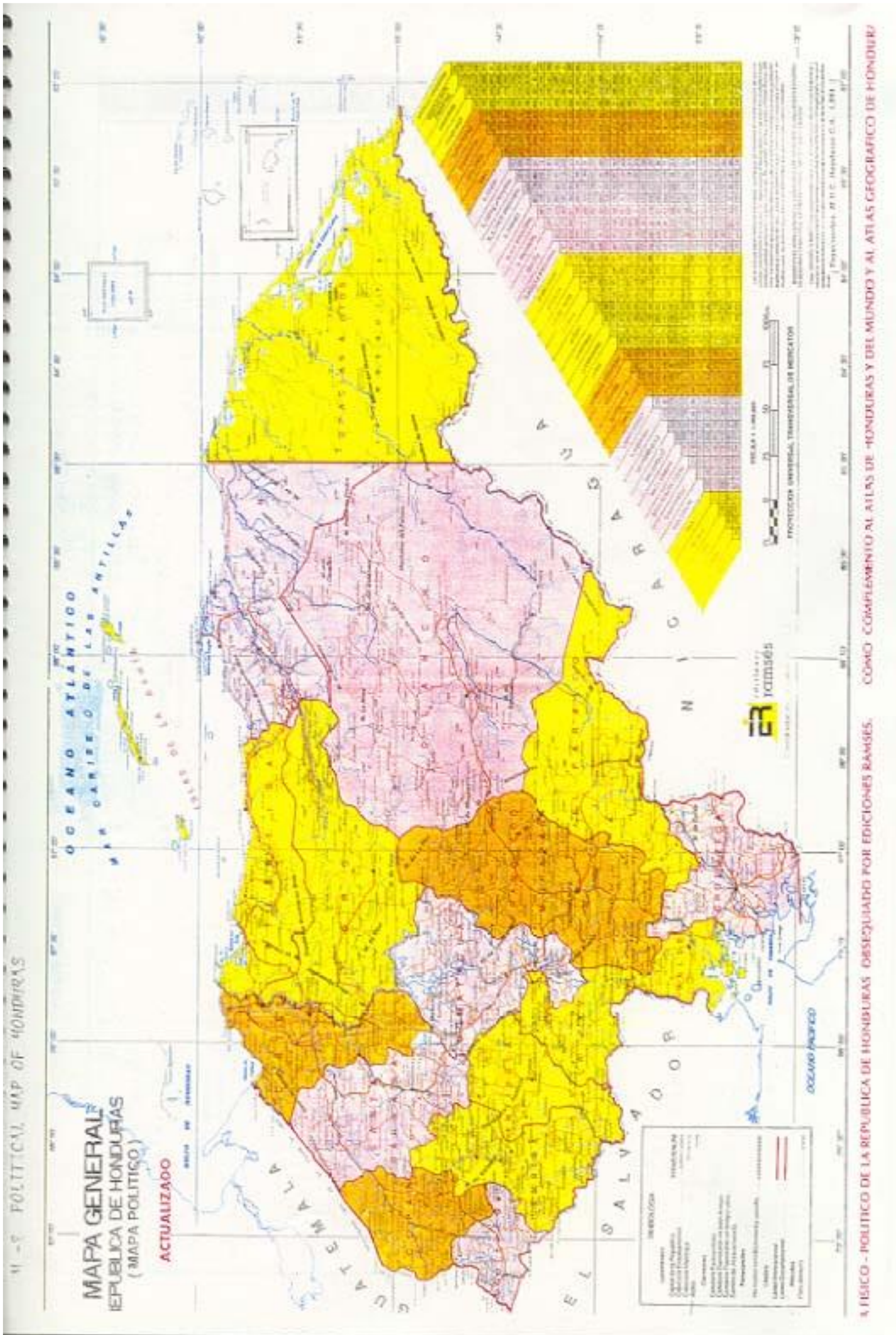

Map 3: Physical Map of Honduras Showing Elevated Regions

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Map 4: Geological Map of Honduras

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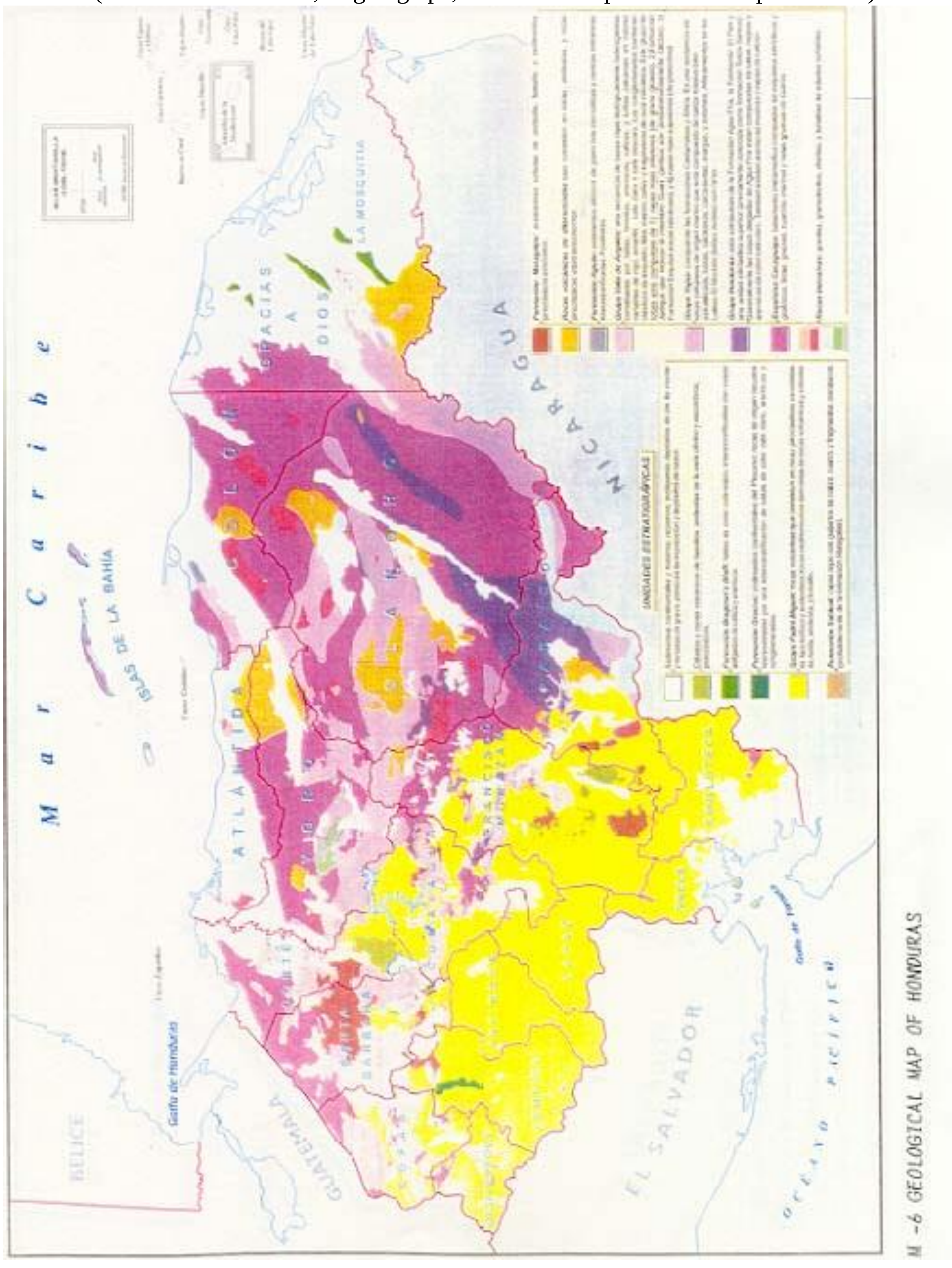
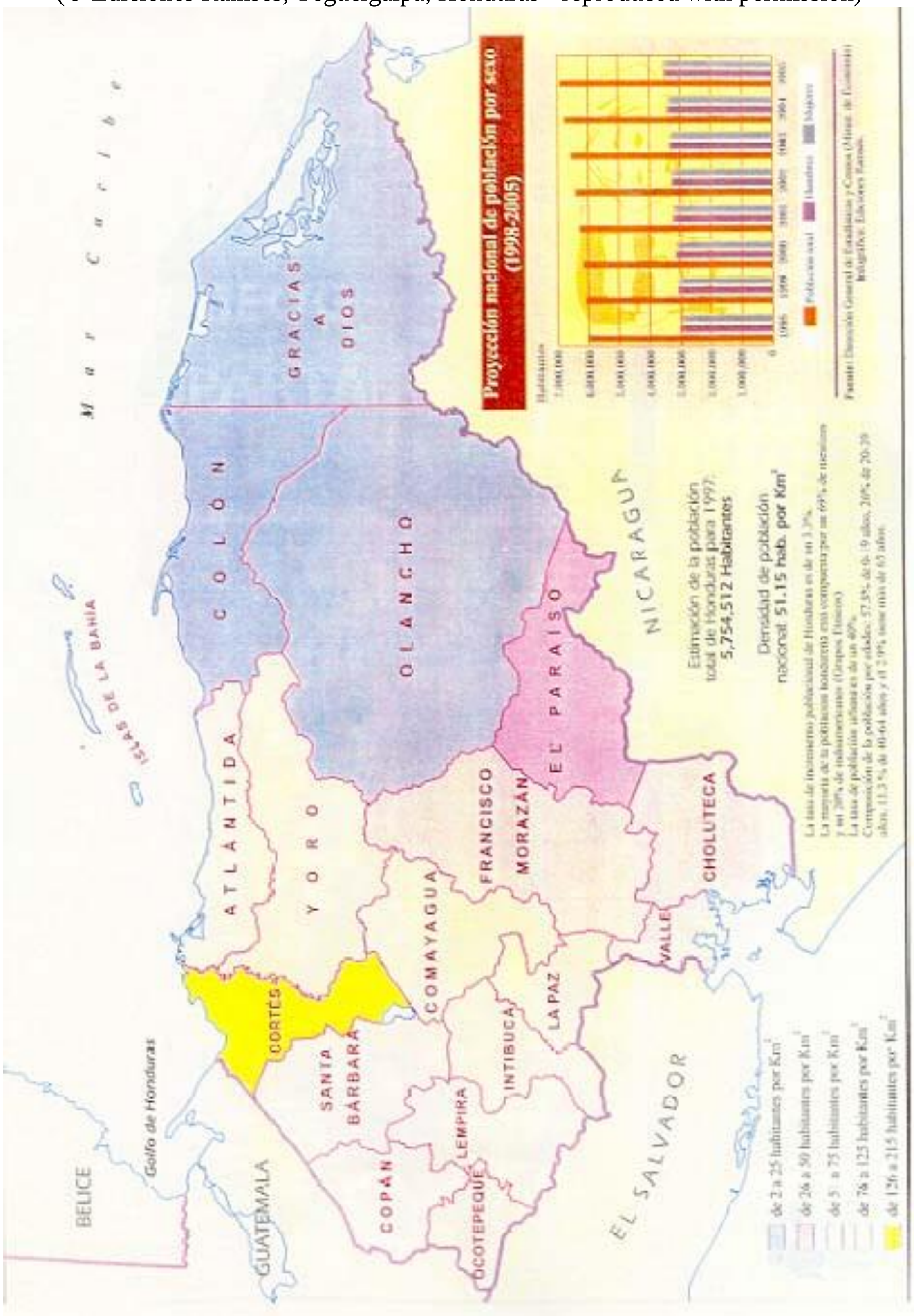


Map 5: Population Density in Honduras



Map 6: Map Showing Average Annual Precipitation

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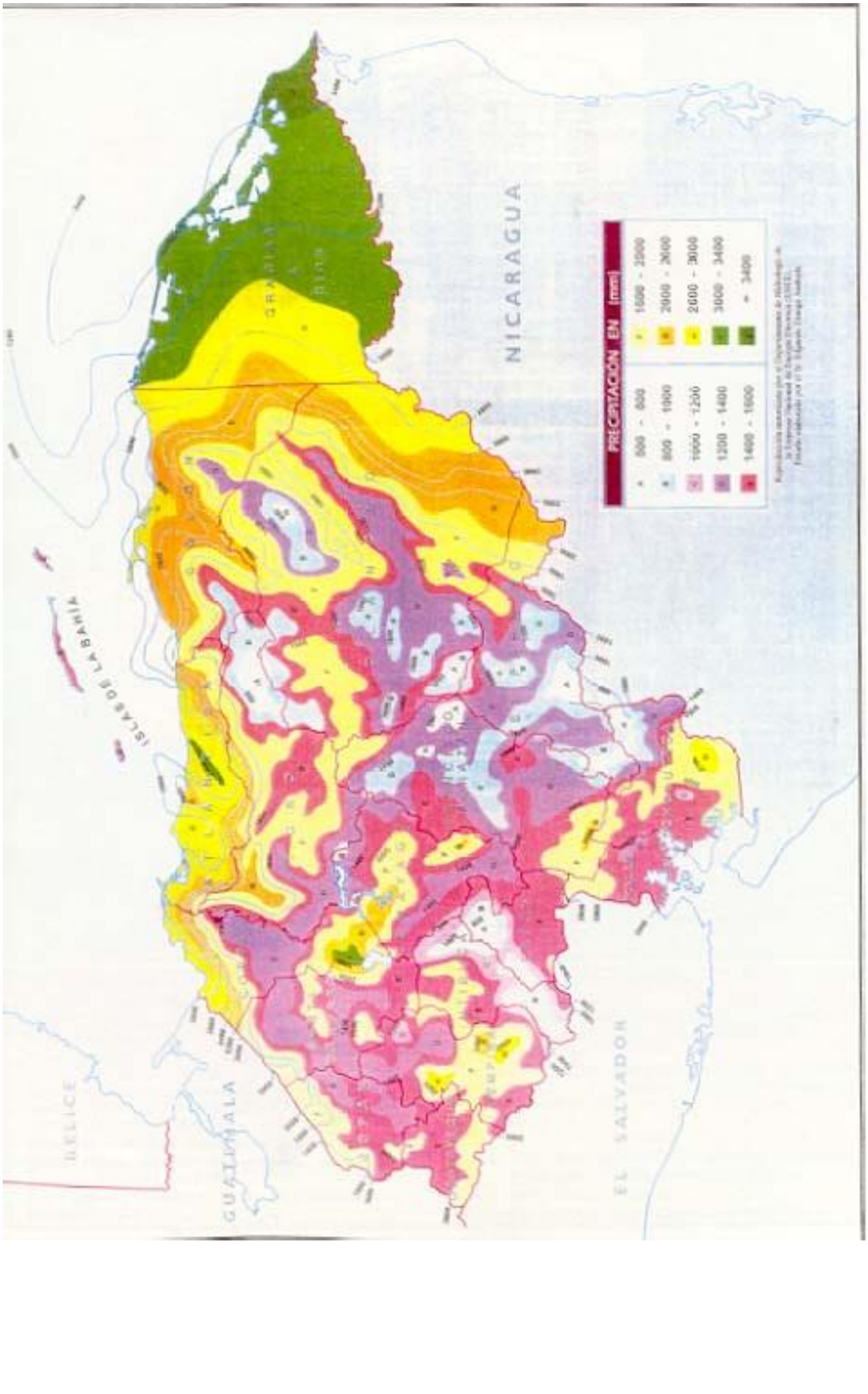

Map 7: Map Showing Department of Choluteca

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Cabecera Departamental: Choluteca
Extensión Territorial: 4,360 Km².
Población Actual: 386,098 habitantes.
Fecha de su Creación: Junio 28 de 1825.
Municipios (16): Apacilagua, Concepción de María, Choluteca, Duyure, El Corpus, El Triunfo, Marcovia, Morolica, Namasigüe, Orocuina, Pespire, San Antonio de Flores, San Isidro, San José, San Marcos de Colón, Santa Ana de Yusguare.
Principal Actividad Económica: Cultivo de caña de azúcar, melón, sandía, maíz, maicillo, sorgo forrajero, camarón, algodón. Ganadería.
Ríos: Grande o Choluteca, Grande, Negro, Guasaule.
Bahías: de San Lorenzo.

Puntas: Condega, Guatales, Ratón.
Esteros: Los Barrancones, La Perra, Las Doradas, El Pedregal, Las Conchas, San Bernardo, de los Comejenes, El Garcero, La Diabla, La Jagua, Purgatorio, San José.
Golfos: de Fonseca.
Parques Nacionales: Manglares del golfo de Fonseca (propuestos). Nota: estos manglares actualmente son explotados para el cultivo de camarón, salineras y por la ganadería.

Límites

Norte: Departamentos de Francisco Morazán y El Paraíso.
Sur: República de Nicaragua y Golfo de Fonseca.
Este: República de Nicaragua.
Oeste: Golfo de Fonseca y el Departamento de Valle.

Map 8: Choluteca - Physical Features

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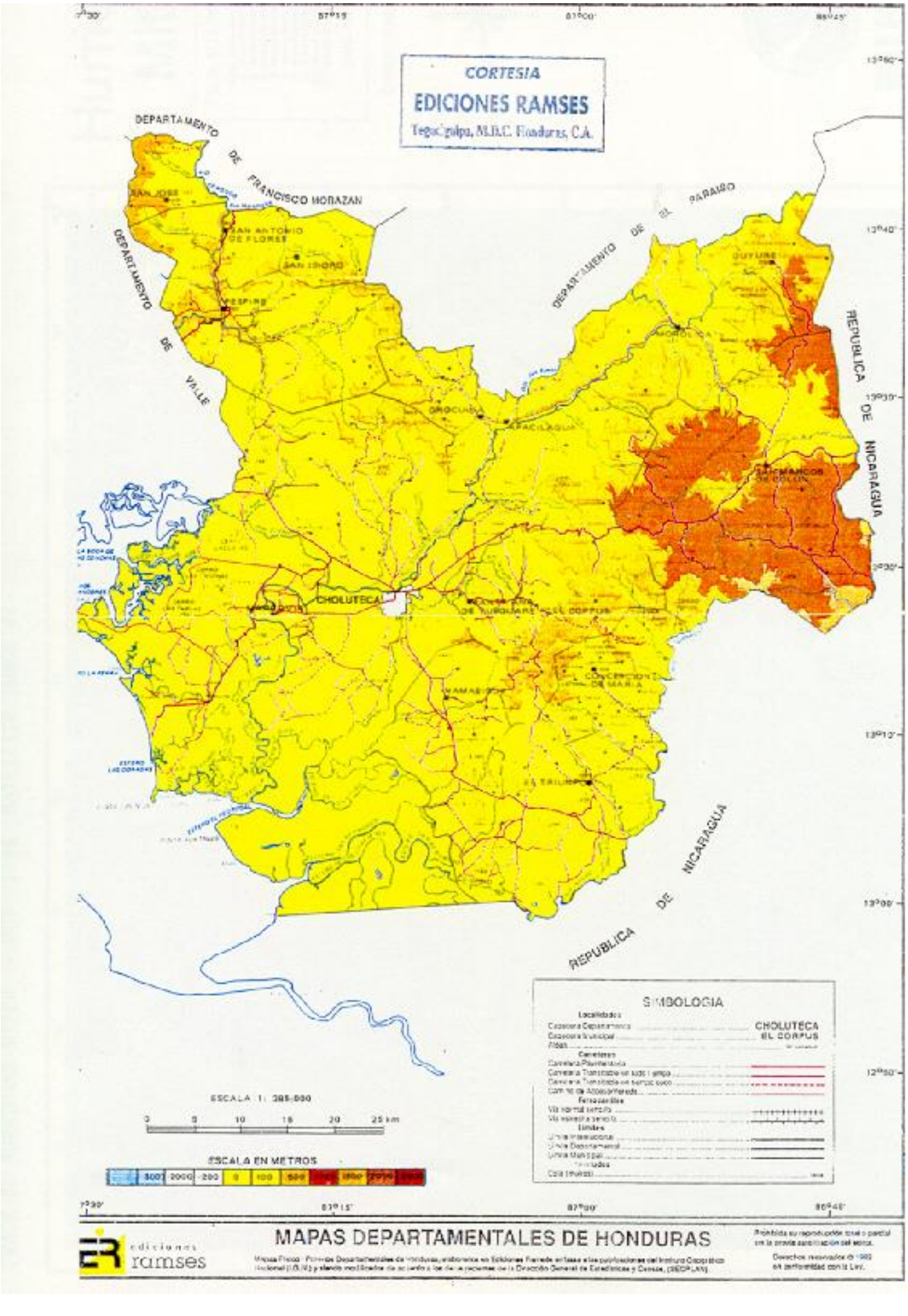
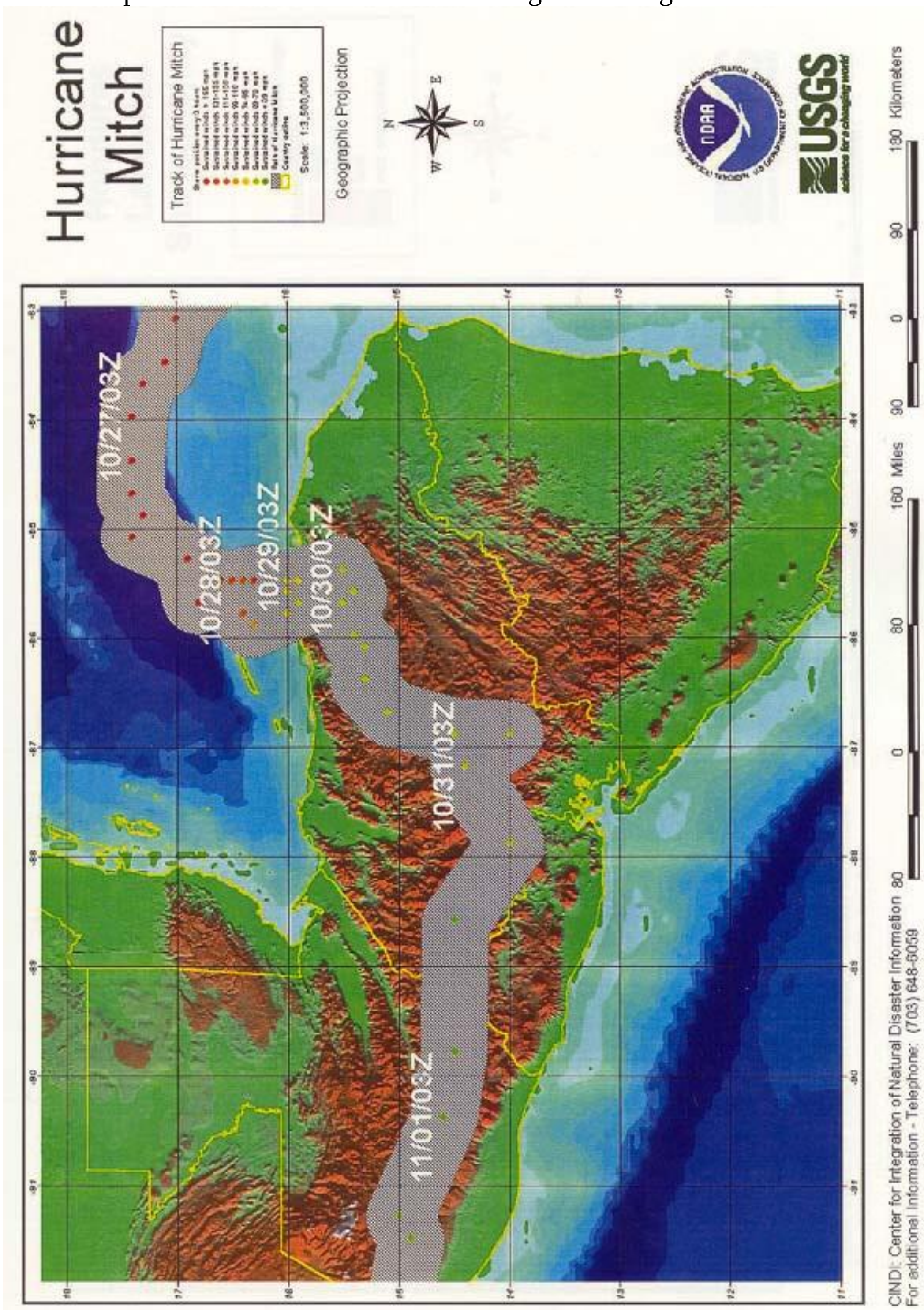
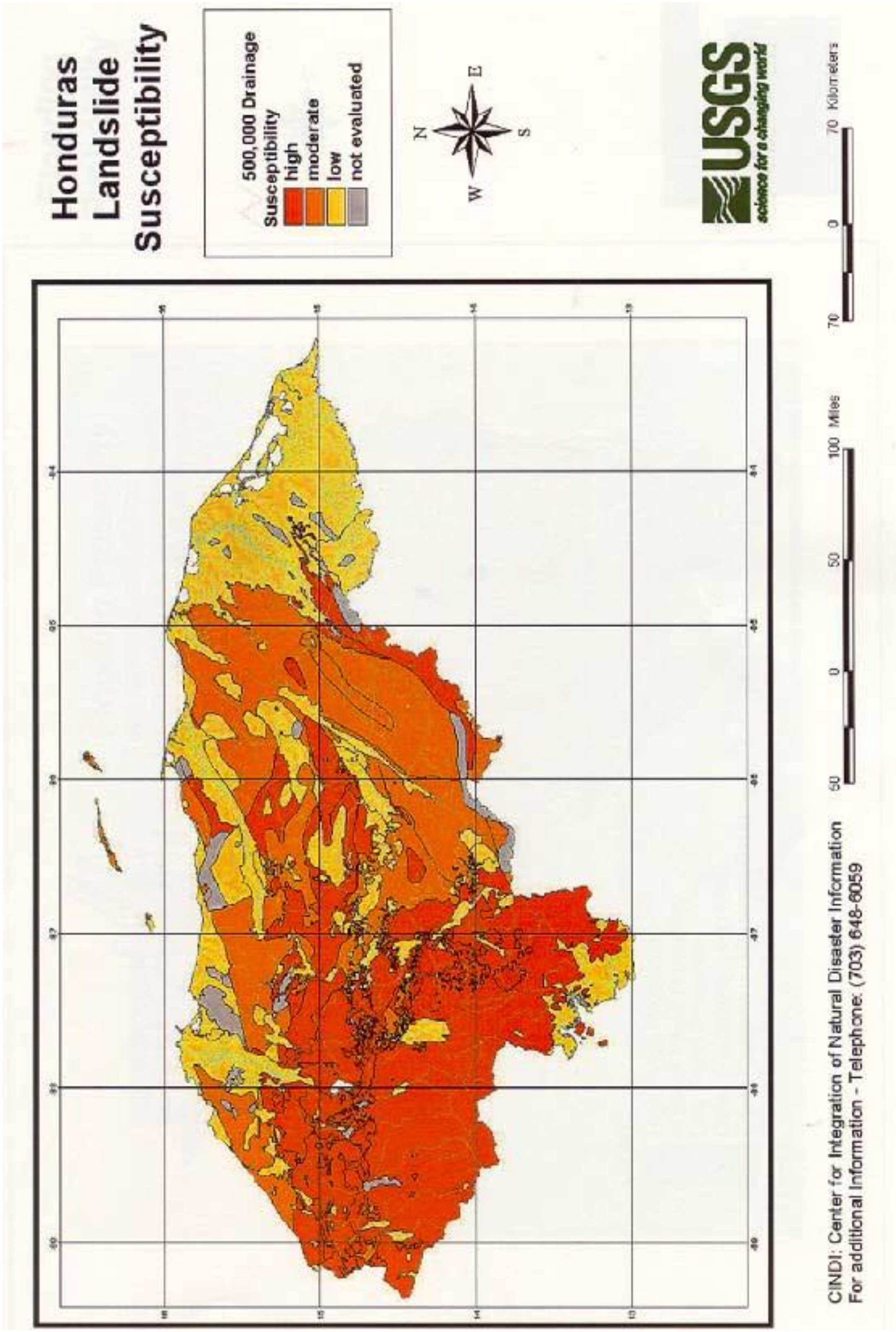


SATELLITE IMAGES

Map 9: Hurricane Mitch - Satellite Images Showing Hurricane Path



Map 10: Satellite Image Showing Landslide Susceptibility in Honduras



PHOTOS

Photo 1: House Construction in Tegucigalpa: Dwelling Units Built Along Mountain Slopes Are a Common Sight in Honduras

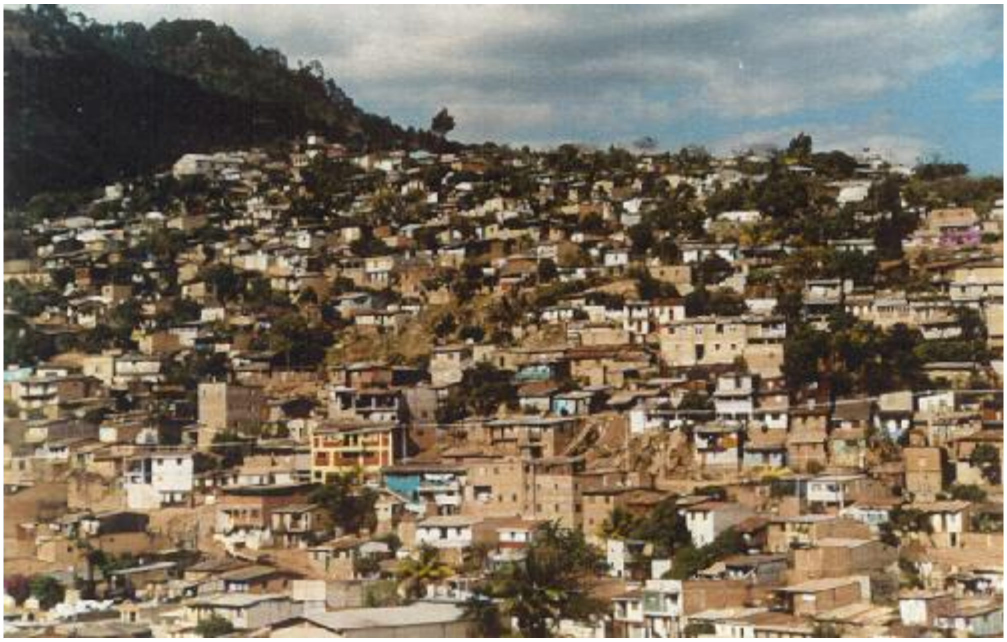


Photo 2: House Construction in Tegucigalpa

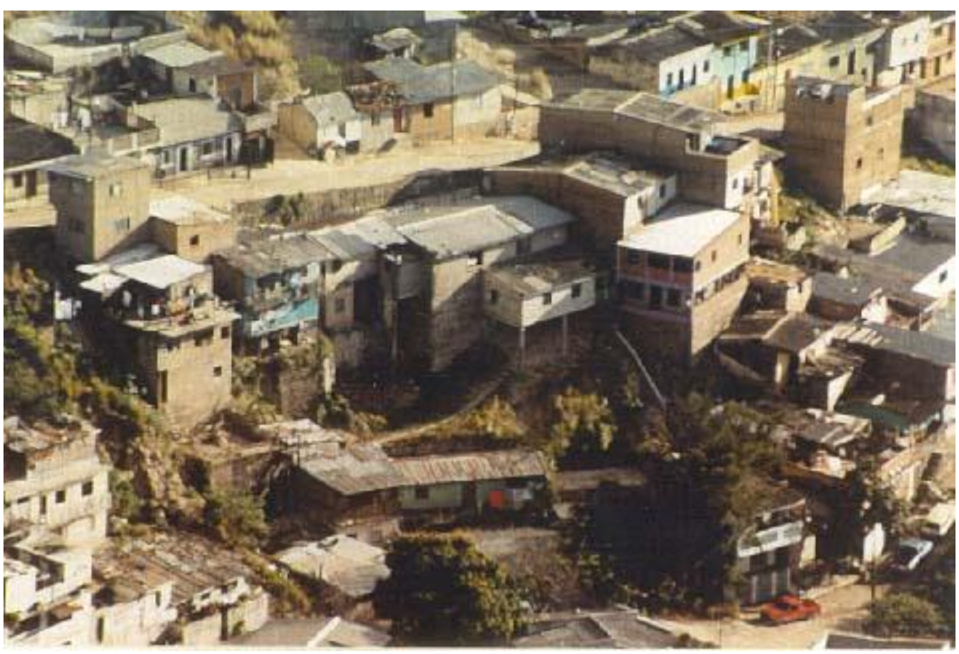


Photo 3: Damage Inspection, Choluteca, January 1999: Many Houses Destroyed by Flooding and Landslides

Photo 4: Housing Damage: Partly Damaged Houses Often Were of Adobe Construction

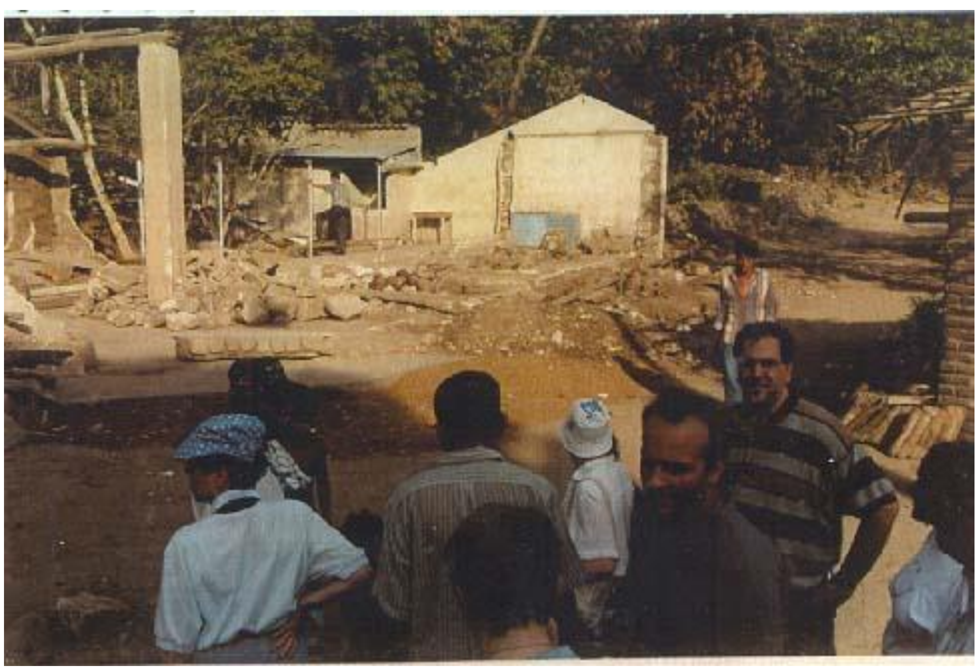


Photo 5: Property Damage: Mitch Caused Extensive Damage to Personal Property

Photo 6: Property Damage

Photo 7: Temporary Shelters: Temporary Plastic Shelters for Those Rendered Homeless Were Donated by the OIM

Photo 8: Indigenous Solutions: Makeshift Solutions Were Used by Many Families with Damaged Houses

Photo 9: Road Damage

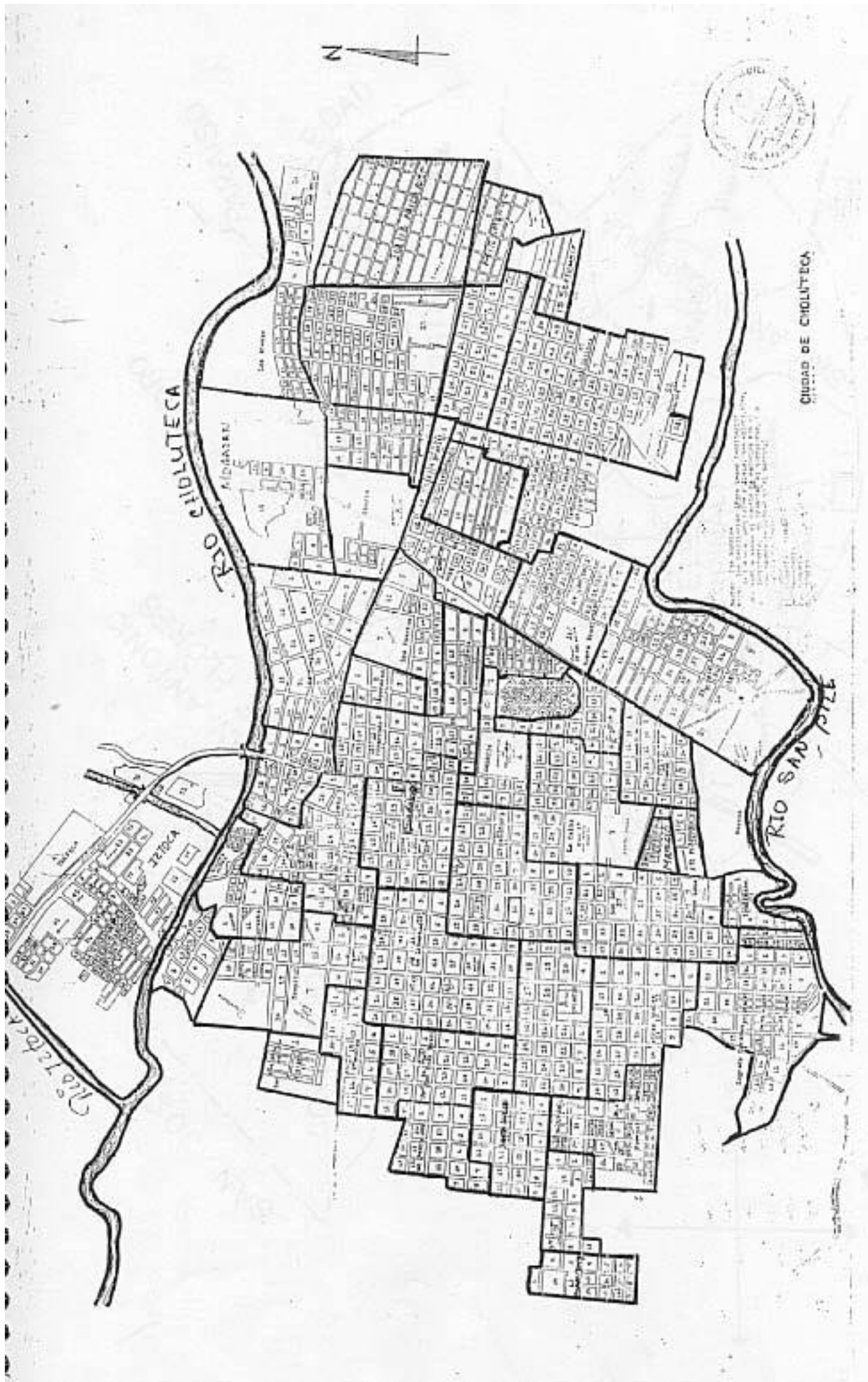
Photo 10: Roofing Framework: In Many Cases the Wooden Roof Framework Was Left Intact Requiring Only Tile Replacement

Photo 11: Roofing Framework Awaiting Repair

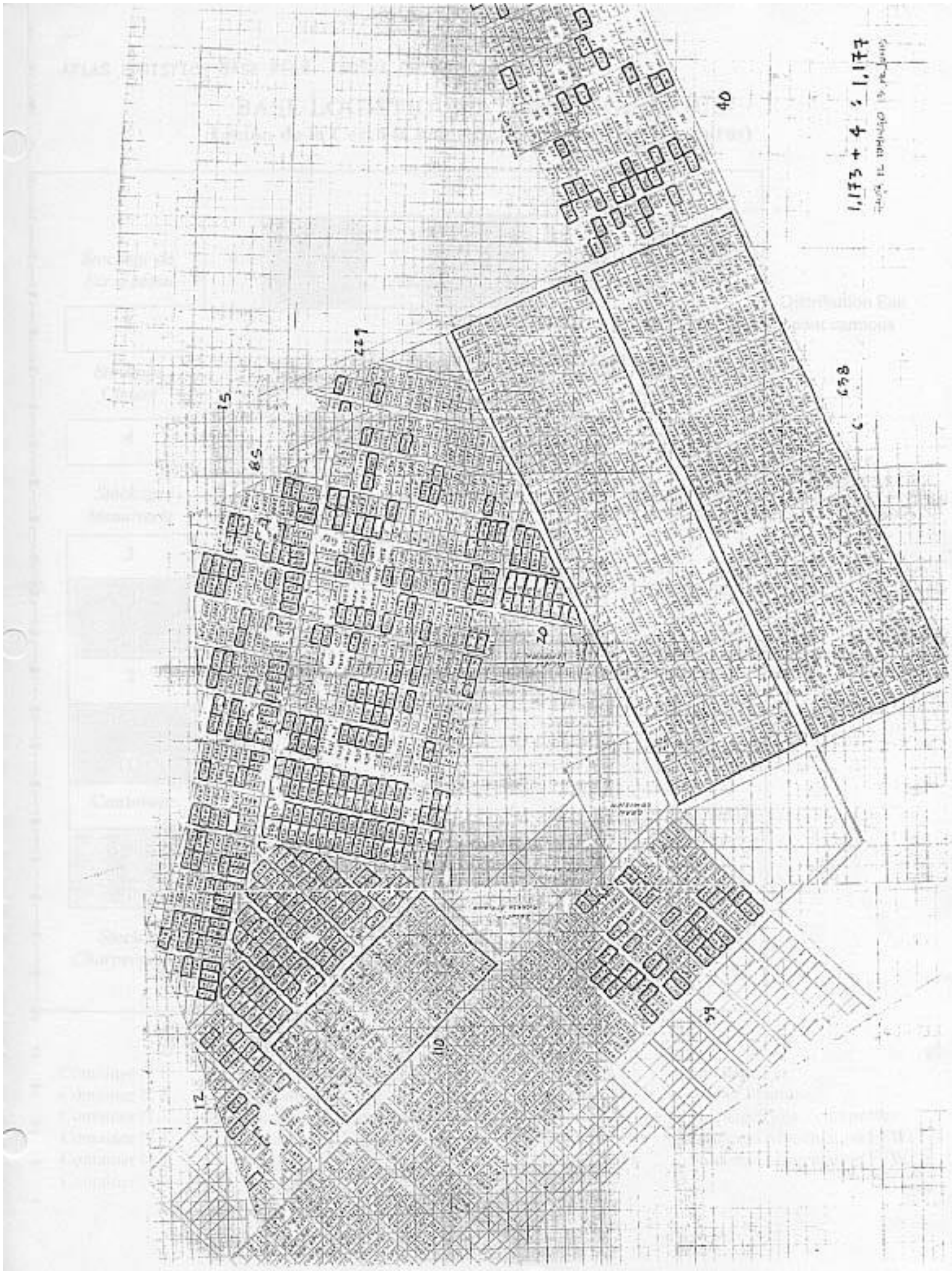
Photo 12: Reconstruction: After Having Their Homes Classified as "Mitch Affected Housing," Families Often Have to Wait for Relief Measures

ANNEXE B

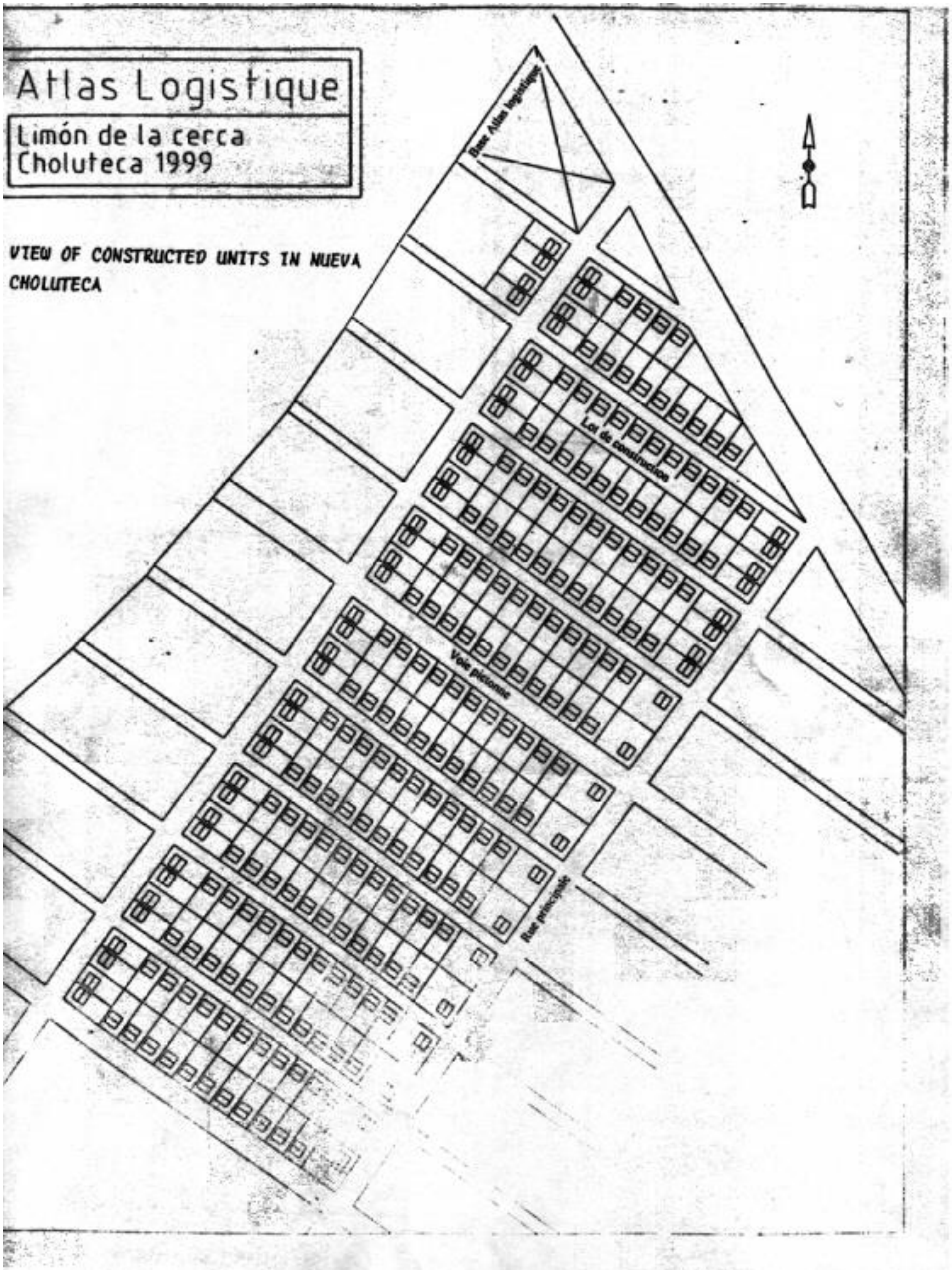
Map of Choluteca and Site Plans for Nueva Choluteca



Site plan of Nueva Choluteca

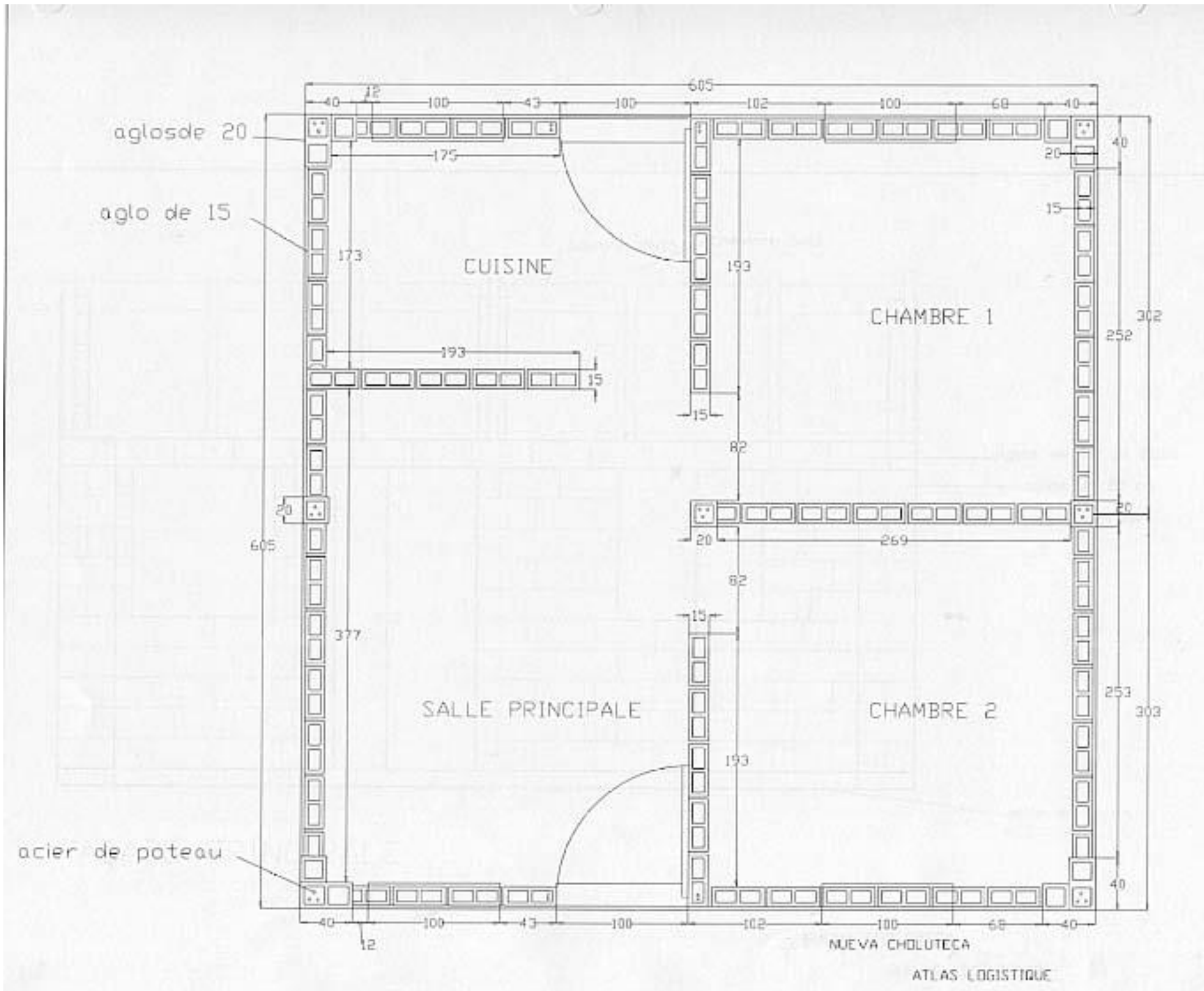


Site Plan of CECI/Atlas Construction in Nueva Choluteca

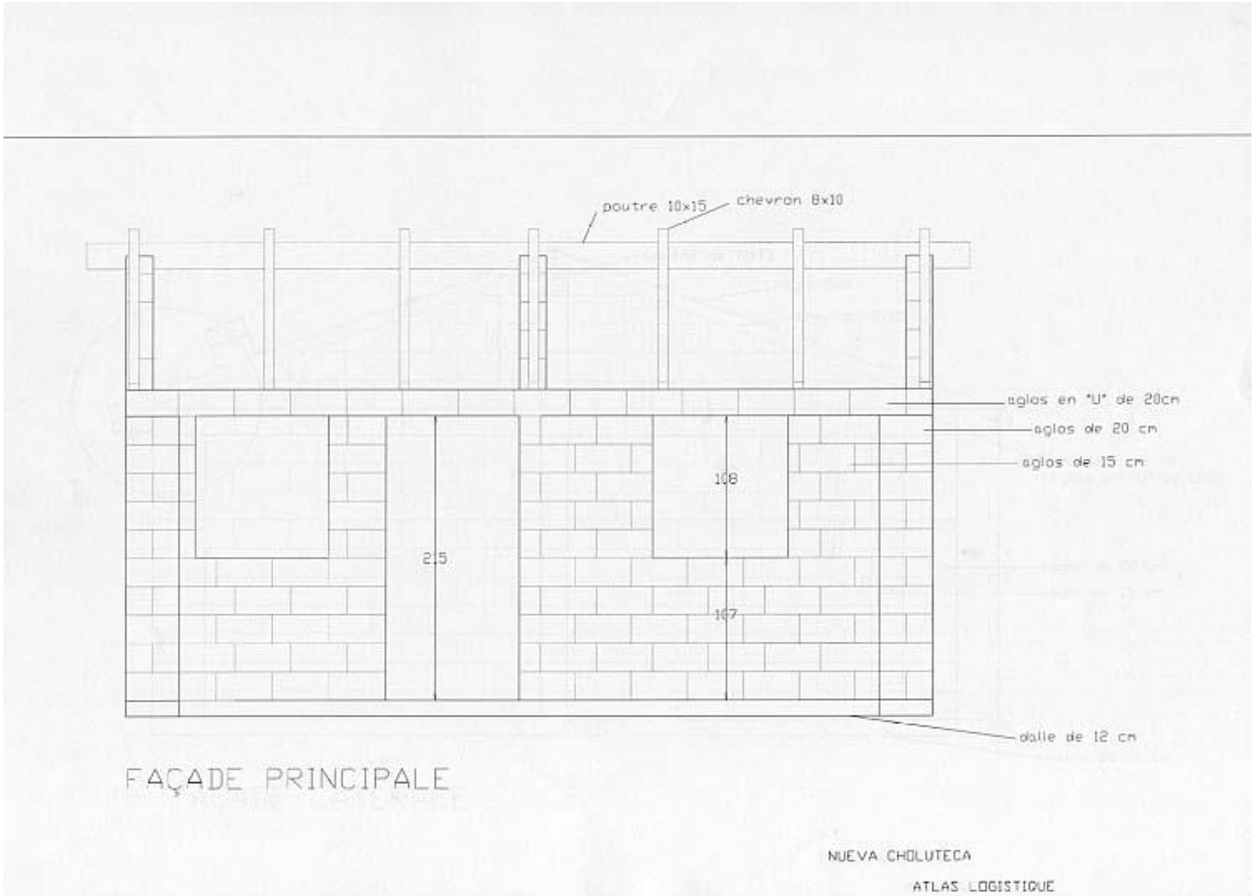


Design Details of Reconstructed Units, Materials Used, Local Employment

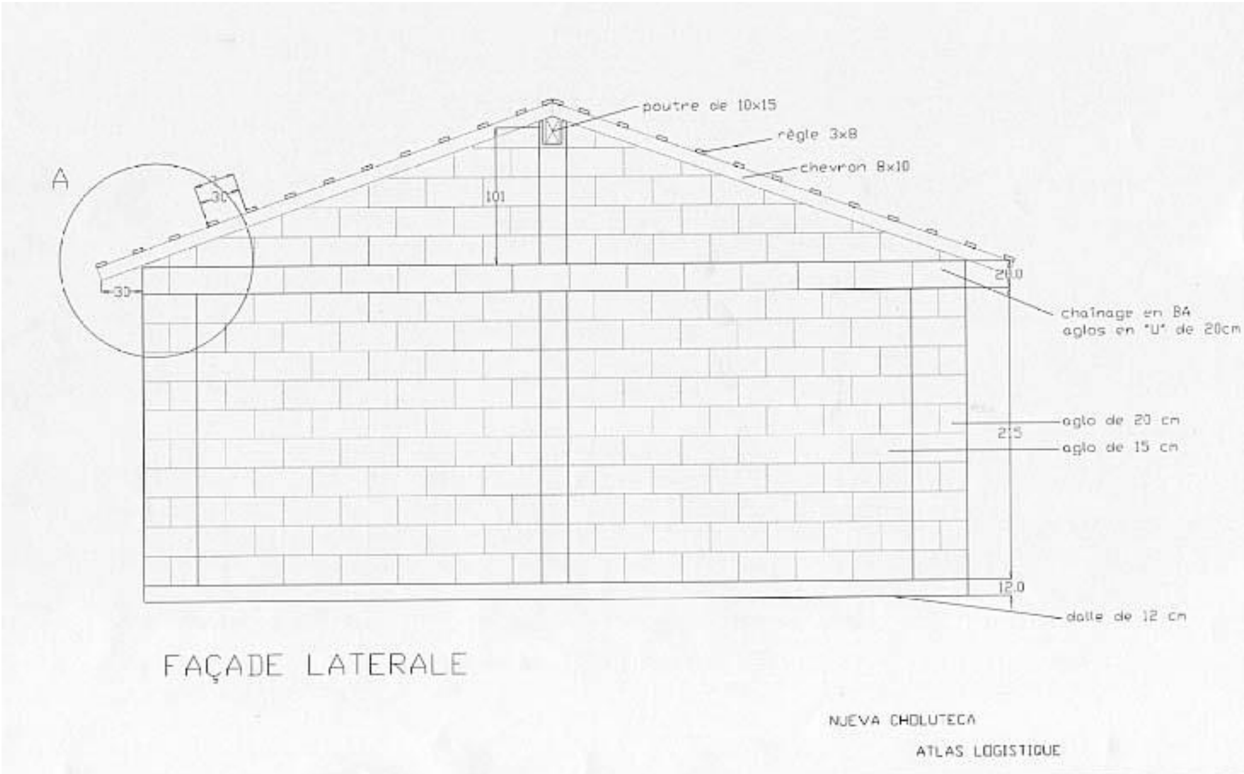
Design Details of Housing Unit Type Proposed and Constructed by CECI/Atlas: 1



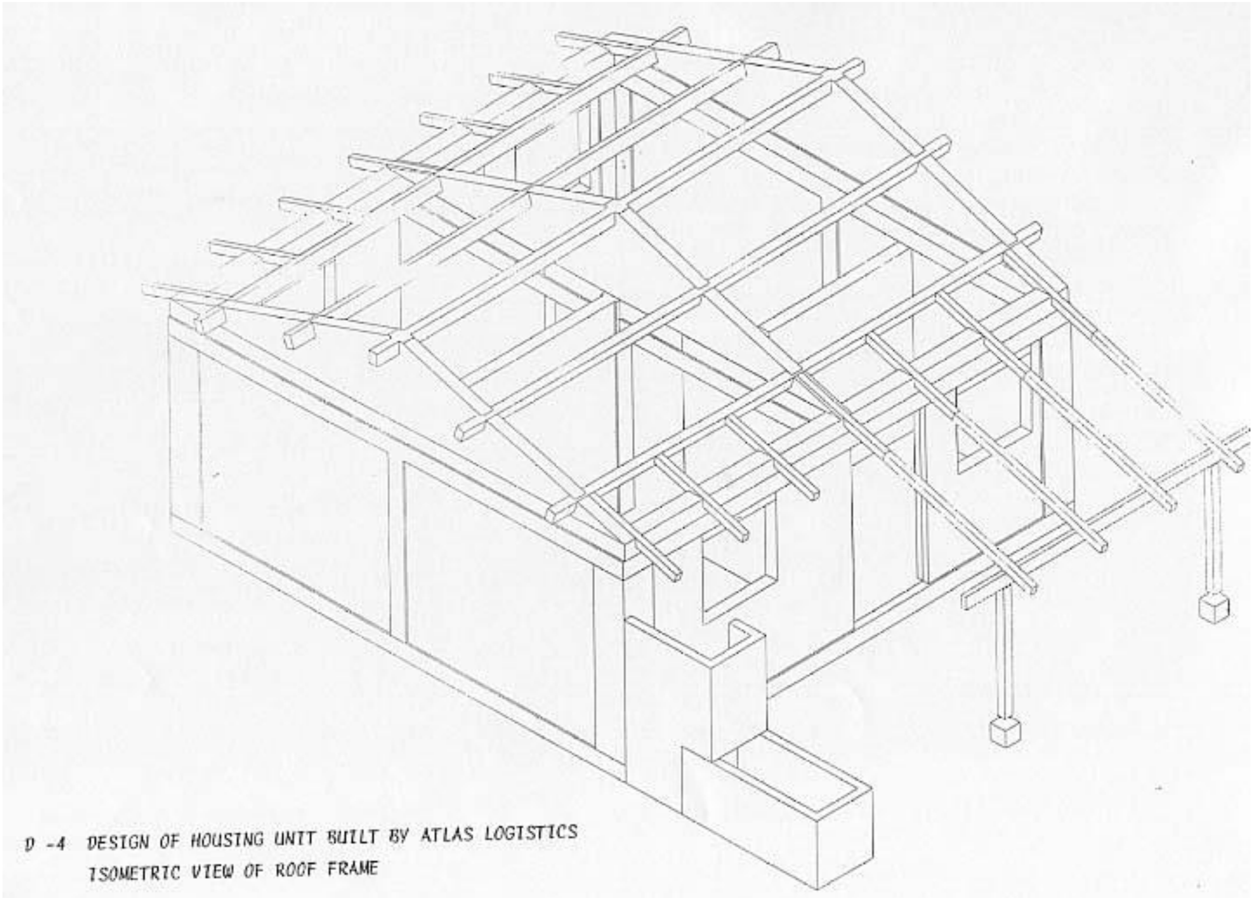
Design Details of Housing Unit Type Proposed and Constructed by CECI/Atlas: 2



Design Details of Housing Unit Type Proposed and Constructed by CECI/Atlas: 3

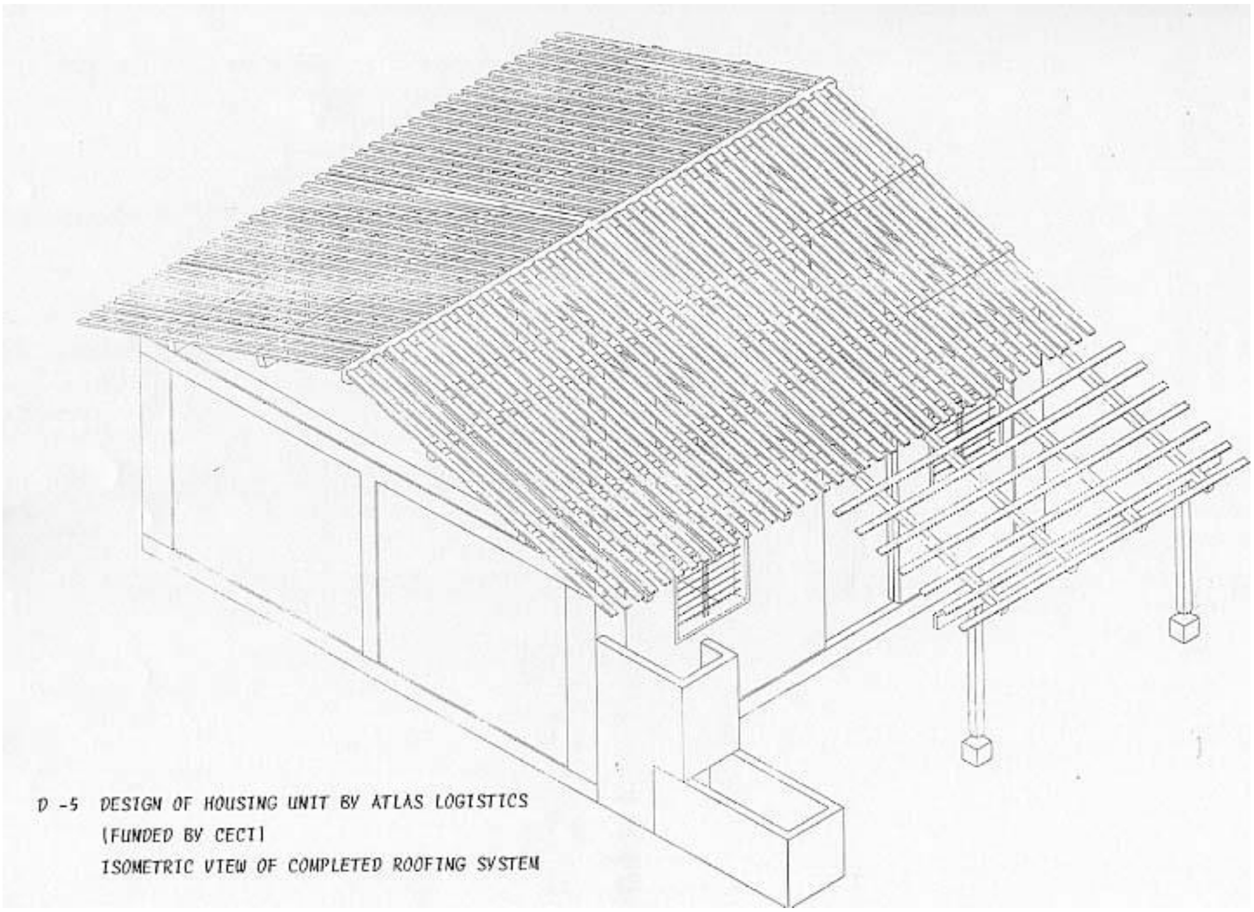


Design Details of Housing Unit Type Proposed and Constructed by CECI/Atlas: 4



D -4 DESIGN OF HOUSING UNIT BUILT BY ATLAS LOGISTICS
ISOMETRIC VIEW OF ROOF FRAME

Design Details of Housing Unit Type Proposed and Constructed by CECI/Atlas: 5

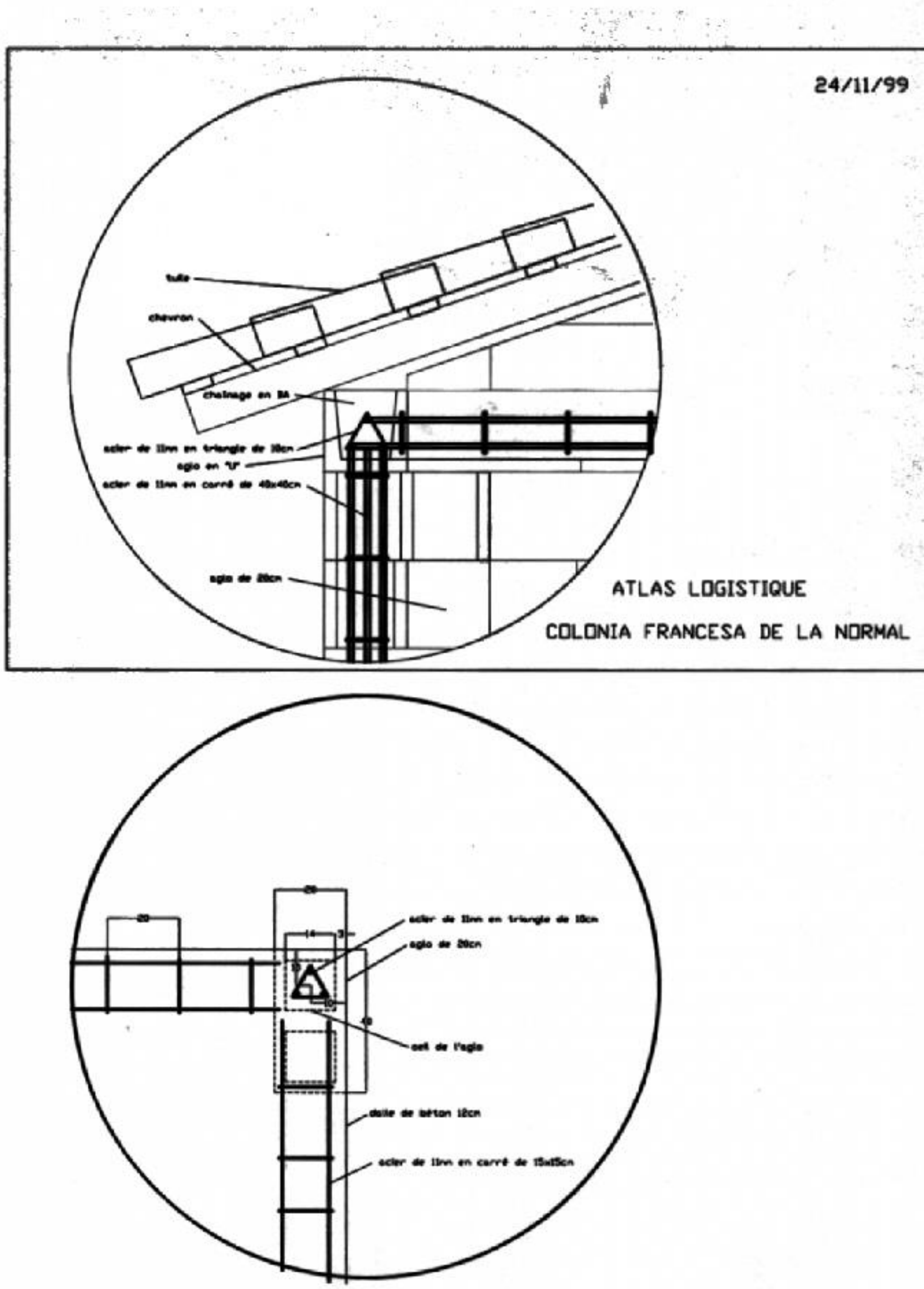


D -5 DESIGN OF HOUSING UNIT BY ATLAS LOGISTICS
(FUNDED BY CECI)
ISOMETRIC VIEW OF COMPLETED ROOFING SYSTEM

Wall-Roof Connection Detail Employed by CECI/Atlas

EXAMPLE OF MITIGATION IN CONSTRUCTION

DETAILS OF ROOF-WALL CONNECTION BY ATLAS LOGISTICS IN NUEVA CHOLUTECA



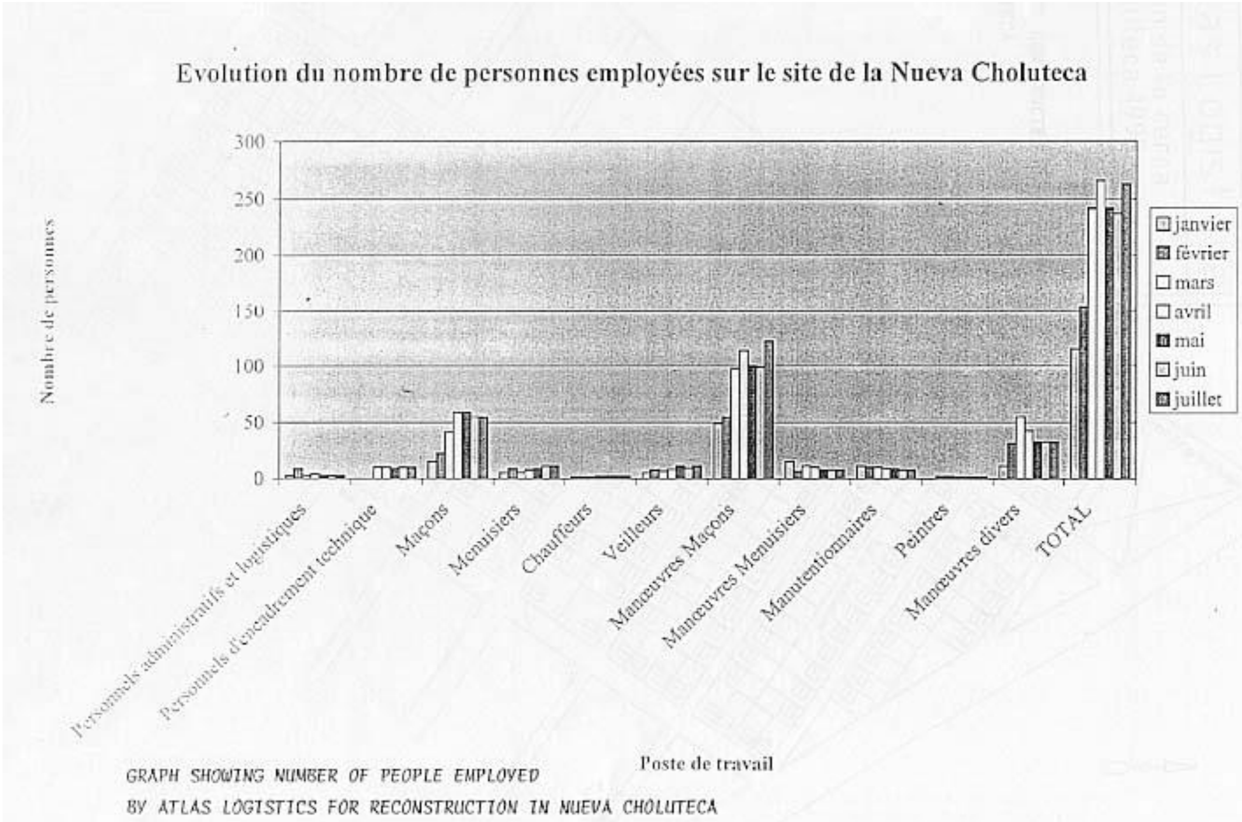
Total Materials Used per House Unit Constructed by CECI/Atlas

MATERIAL POR LA CONSTRUCCION DE UN (1) HOGGAR INFANTIL EN CHOLUTECA (CECI / ATLAS)

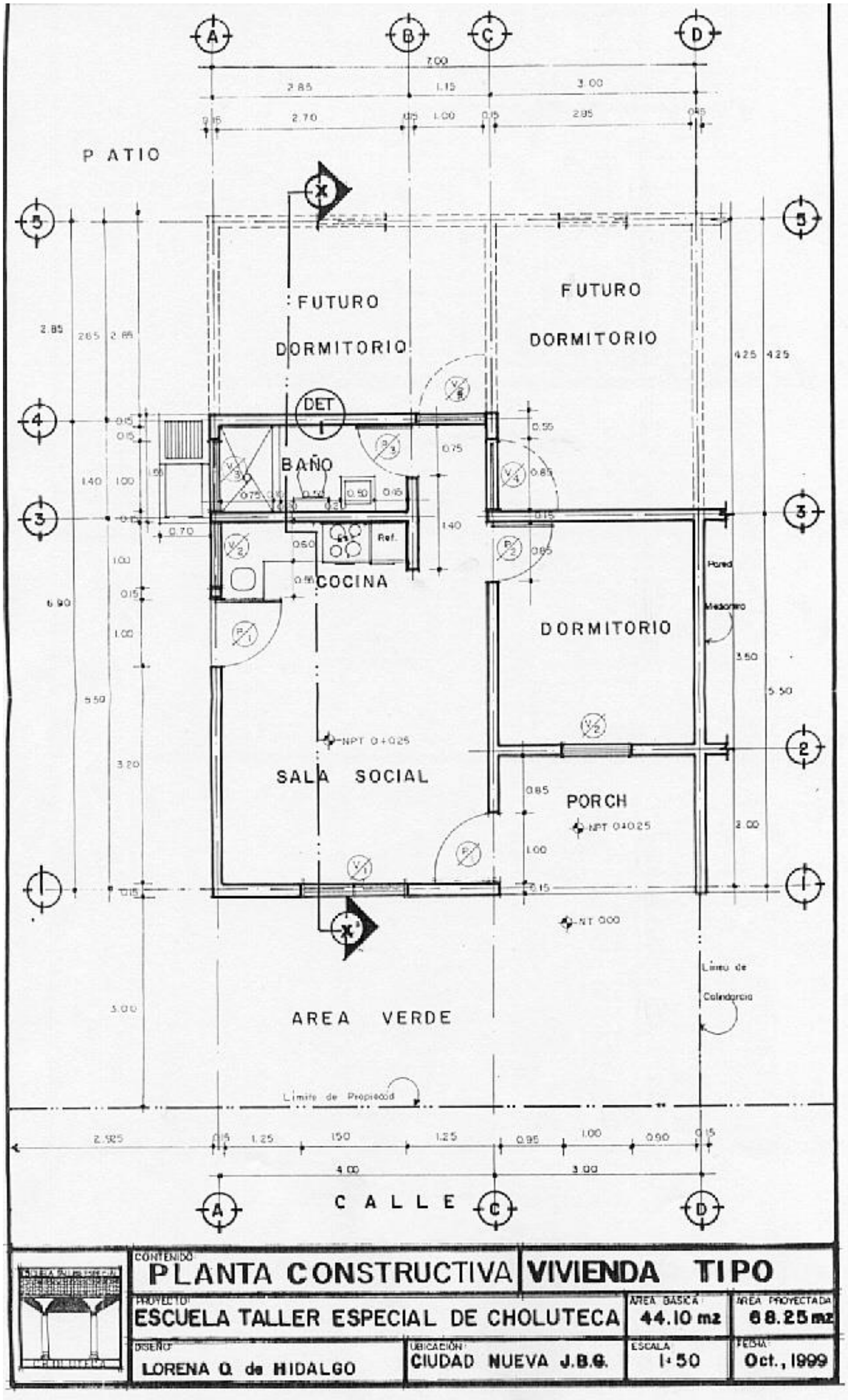
Equipo y material Descripción		cantidad por los dos hogares de unión	cantidad kit	cantidad kit x 3	costo/unit fuera kit unicef	total lps fuera kit unicef	total $ US
blocs de 15	un	700			5,50	3850,0	$ 269,04
blocs de 20	un	150			6,50	975,0	$ 68,13
blocs en U	un	70			9,0	630,0	$ 44,03
Madera.							
postre de 5"x5"x12'	un	2			160,0	320,0	$ 22,36
madera de 2"x4"x10'	un	8	20	60	60,0	480,0	$ 33,54
reglas de 2"x4"x8'	un		66	198	34,0		
reglas de1"x 3"x10'	un	85	24	72	20,0	1700,0	$ 118,80
reglas 1"x4"x8'	un		1	3	31,70		
tabla de 1"x10"x18'	un		4	12	95,0		
tabla de 1"x8"x18'	un		2	6	75,0		
tabla de 2"x2"x18'	un		6	18	36,0		
madera de encofrare 1"x8"x10'	un	4		0	46,50	186,0	$ 13,00
Duraplexe (isolacion)	un	185			42	7770,0	$ 542,98
aluzinc grise de32" x 10	un	20	18	54	70,0	1400,0	$ 97,83
puertas dobles de hierro	un	2		0	800,0	1600,0	$ 111,81
celosías (naco con mosquitero,1m2)	un	4		0	340,0	1360,0	$ 95,04
celosias igual del kit de 1.78 x 0.66	(2x4celosias)	8		0	520,0	4160,0	$ 290,71
Hierro				0			
varilla de 11mm (3/8)	m/l	400		0	6,11	2444,0	$ 170,79
varilla de 7.5mm(semelle)	m/l	38	18	54	2,66	101,1	$ 7,06
malla electrosoldado de 600x250cm		6	3	9	120,0	720,0	$ 50,31
clavos de 3"	libras		6	18	13,50		
clavos de 4"	libras		6	18	13,50		
clavos de 3"	libras		8	24	13,50		
clavos de 2"	libras		8	24	13,50		
alambre de amarre	libras	10	5	15	3,50	35,0	$ 2,45
Cemento				0			
bolsa de cemento para paredes	bolsa	20		0	63,0	1260,0	$ 88,05
piso de cemento (350kg/cm2)	bolsa	104	25	75	63,0	6552,0	$ 457,86
castillo y viga fundido	bolsa	12		0	63,0	756,0	$ 52,83
repellado y pulido	bolsa	5		0	63,0	315,0	$ 22,01
incal	bolsa	3		0	37,0	111,0	$ 7,76
				0			
Materiales de construcción				0			
grava	m3	16	3,42	10,26	60,0	960,0	$ 67,09
arena	m3	8	1,71	5,13	110,0	880,0	$ 61,50
gravon	m3	3	0,81	2,43	50,0	150,0	$ 10,48
TOTAL MATERIAL						38715,1	$ 2 705,46

LIST OF MATERIALS USED PER HOUSING UNIT BY ATLAS LOGISTICS IN NUEVA CHOLUTECA - COST PER UNIT/

Graph Showing Local People Employed in Nueva Choluteca

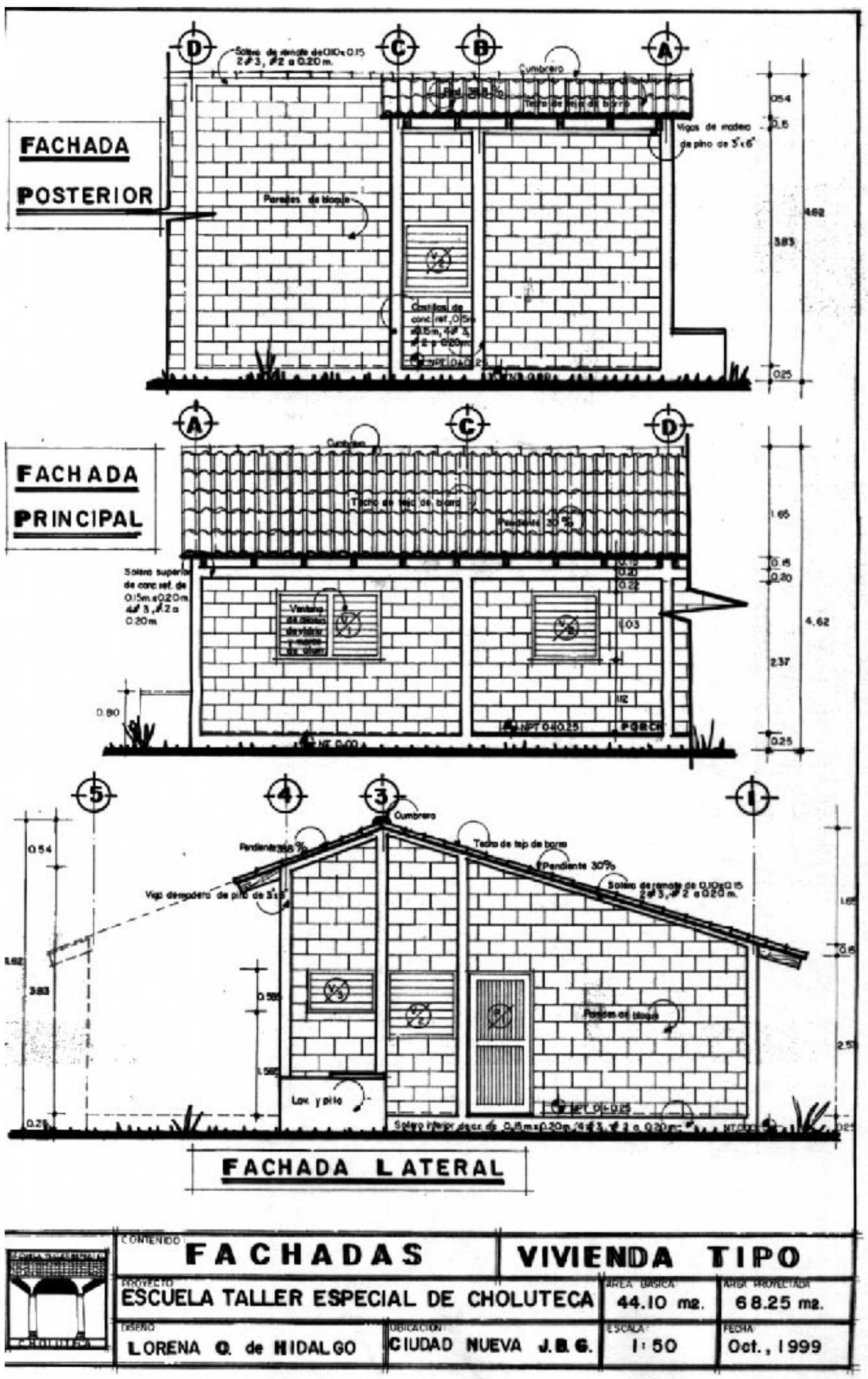


Design Details of Housing Unit Type Proposed and Constructed by Consolidad Espanol: 1



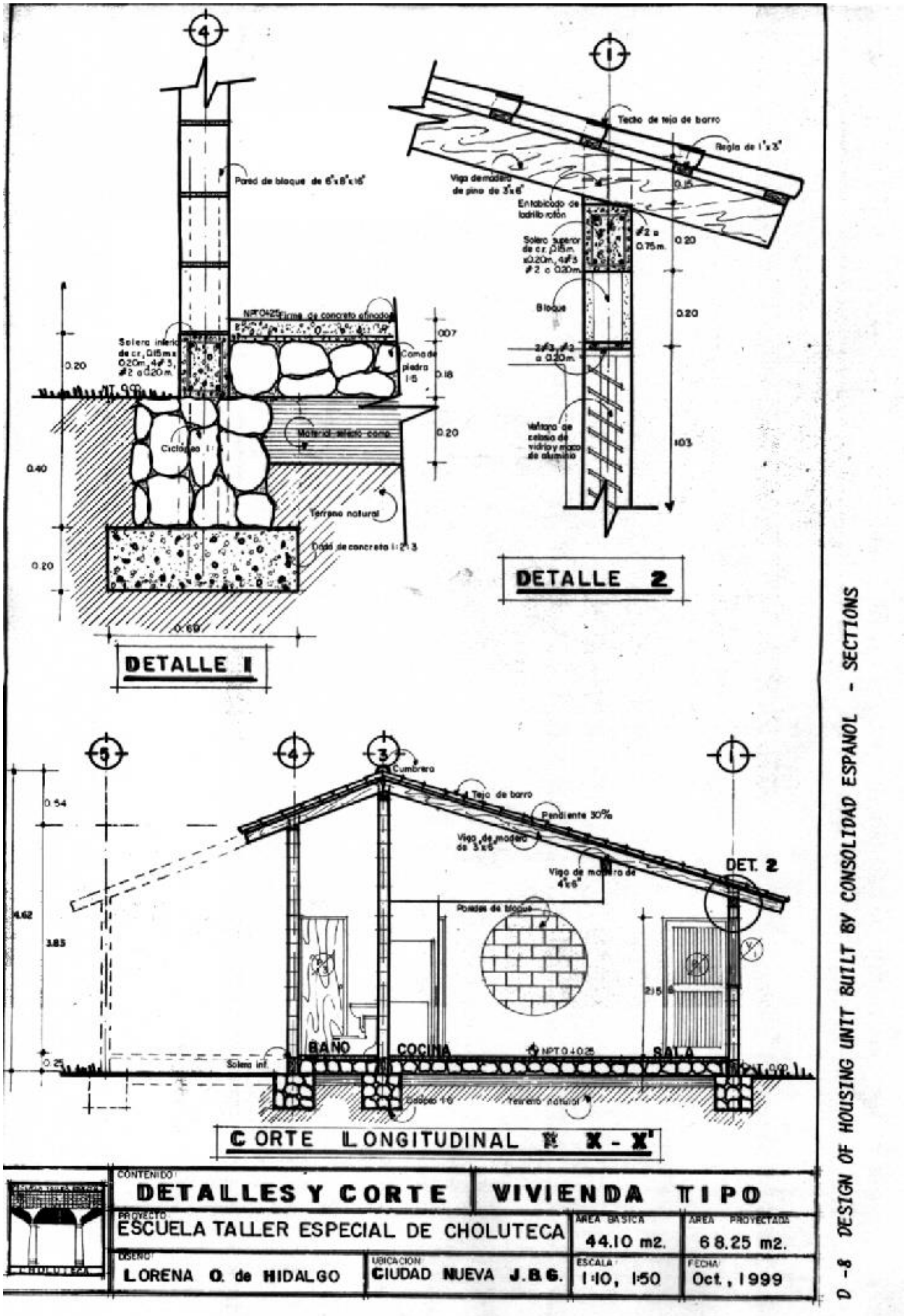
D-6 DESIGN OF HOUSING UNIT BUILT BY CONSOLIDAD ESPANOL
GROUND FLOOR PLAN

Design Details of Housing Unit Type Proposed and Constructed by Consolidad Espanol: 2

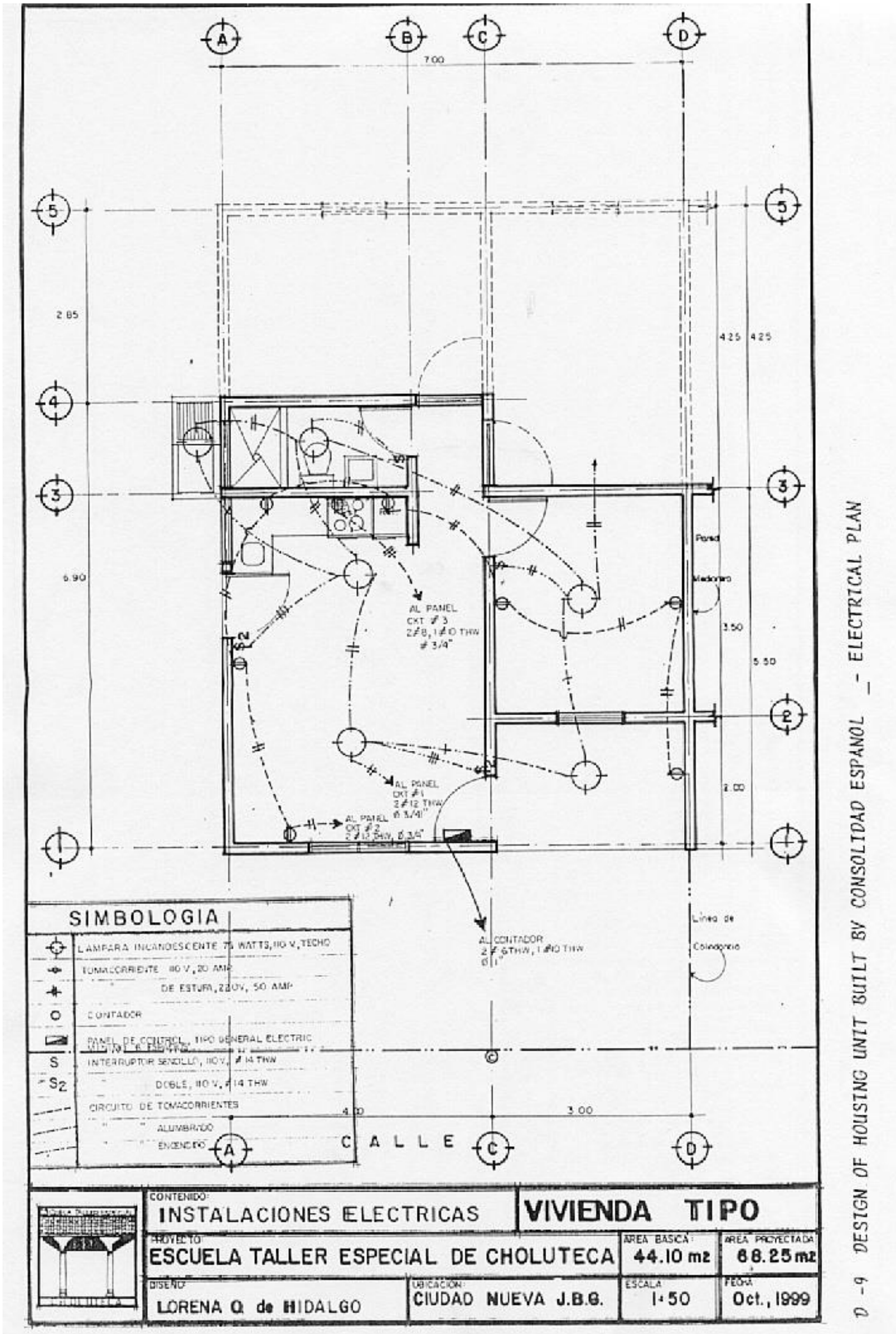


D -7 DESIGN OF HOUSING UNIT BUILT BY CONSOLIDAD ESPANOL - ELEVATIONS

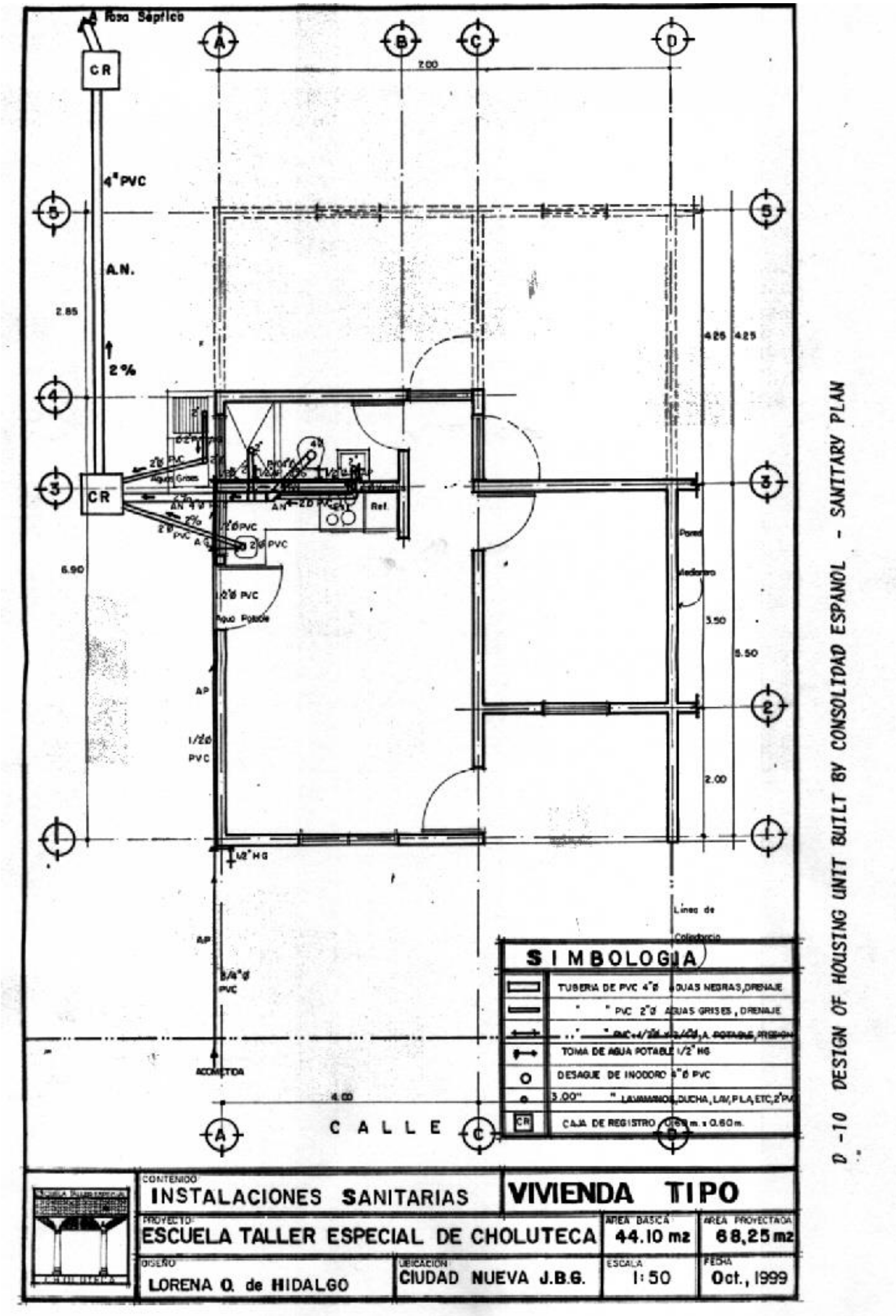
Design Details of Housing Unit Type Proposed and Constructed by Consolidad Espanol: 3



Design Details of Housing Unit Type Proposed and Constructed by Consolidad Espanol: 4



Design Details of Housing Unit Type Proposed and Constructed by Consolidad Espanol: 5



Photos of the Reconstruction Process in Nueva Choluteca

Photo 1 - View of Typical Unit Under Construction for CECI by Atlas Logistics

Photo 2 - View of Typical Unit Constructed for CECI by Atlas Logistics: Concrete Block Construction with Corner Reinforcements, Raised Plinth, Wood-framed Tile Roofing

Photo 3 - The Concept of Auto-Construction Sweat Equity: Occupant Families Were Encouraged to Participate in the Construction of Their Own Homes

Photo 4 - Construction of Foundation: Rubble Platform with a Ring Beam Along the Site Edge for Load Bearing Purposes

Photo 5 - Construction of Foundation

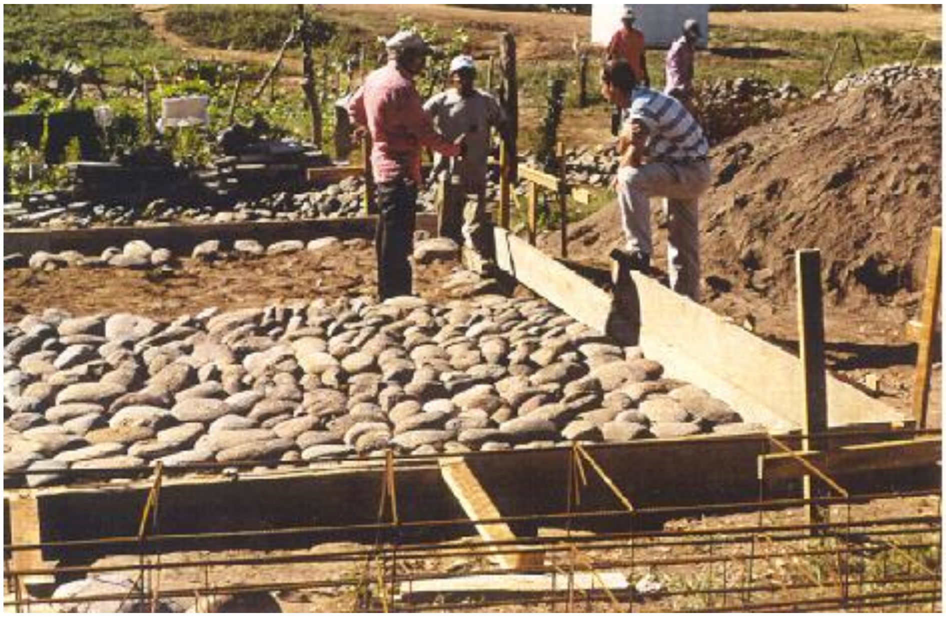


Photo 6 - Construction of CECI Units: Raising the Plinth Using 150 mm Thick Rubble Platform Base

Photo 7 - Mitigation in Construction: Reinforcing Concrete Columns

Photo 8 - Mitigation in Construction: Use of Corner Bonding Using Reinforced Concrete Columns

Photo 9 - View of Corner Reinforcement: Three Steel Bar Reinforcement with Lateral Ties Fixed into Hollow of Concrete Block and Sealed with Cement Concrete

Photo 10 - View of Construction: Fixing the Roof Frame to the Vertical Walls and Integrating this Vertical-Horizontal Connection.

Photo 11 - Roof-Wall Connection Detail: Wooden Roof Frame Embedded into Niche in Concrete Block Wall and Gap Sealed with Cement Concrete

Photo 12 - Ring Beam at Lintel Level: Use of Reinforced Concrete Block Ring Beam at Lintel Level for Horizontal Shear Stresses

Photo 13 - View of Construction

Photo 14 - View of a Typical Door: A Wooden Frame Door

Photo 15 - View of a Typical Window: Mosquito Mesh Is a Local Necessity in Choluteca

Photo 16 - Encouraging Local Production: Concrete Blocks Were Locally Produced/Purchased Thereby Generating Employment

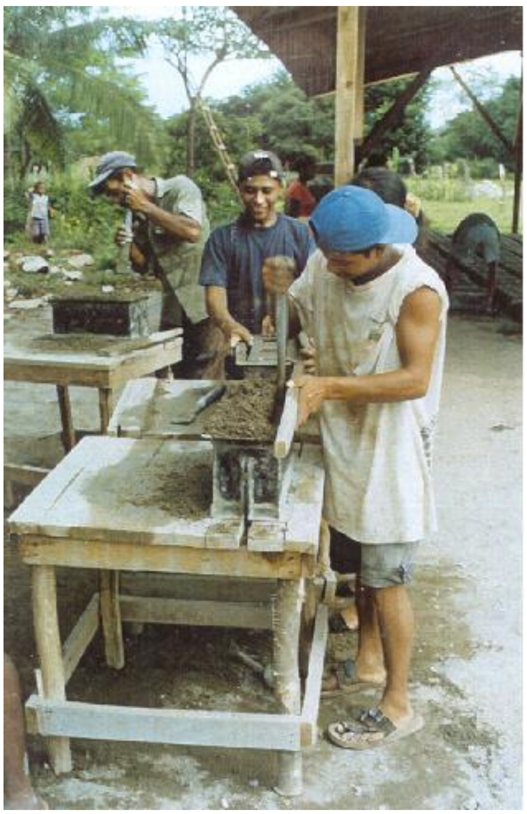


Photo 17 - Use of Local Labor: Locally Trained as Well as Manual (Untrained) Laborers Were Employed

Photo 18 - Use of Local Labor

Photo 19 - View of Roofing: Alternative Arrangement of Tiles Interlock and Seal Against Water and Rain

Photo 20 - View of Roofing

Photo 21 - Use of Concrete Seal for Edging Tiles: Roof Tiles Along the Hipped Portion of the Roof are Sealed Using Cement Mortar to Prevent Displacement

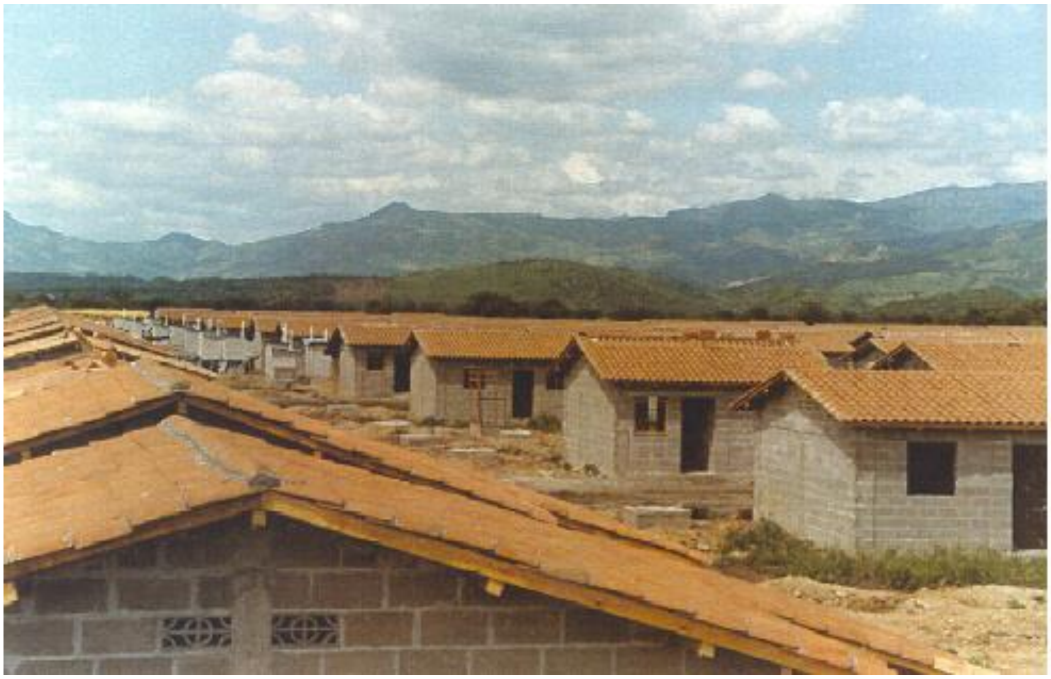


Photo 22 - Outdoor Kitchen Stoves: View of an Extension to the House Containing a Raised Concrete Stove Platform

Photo 23 - View of Latrine Pipe: Two Meter Tall and One Meter Wide Plastic Pipe Used as Septic Pit for Latrine Construction

Photo 24 - Interior View of Latrine Pipe: Interior View Together with Details of Sealing the Base with a 150 mm Thick Cement Concrete Layer

Photo 25 - View of Finished Latrine

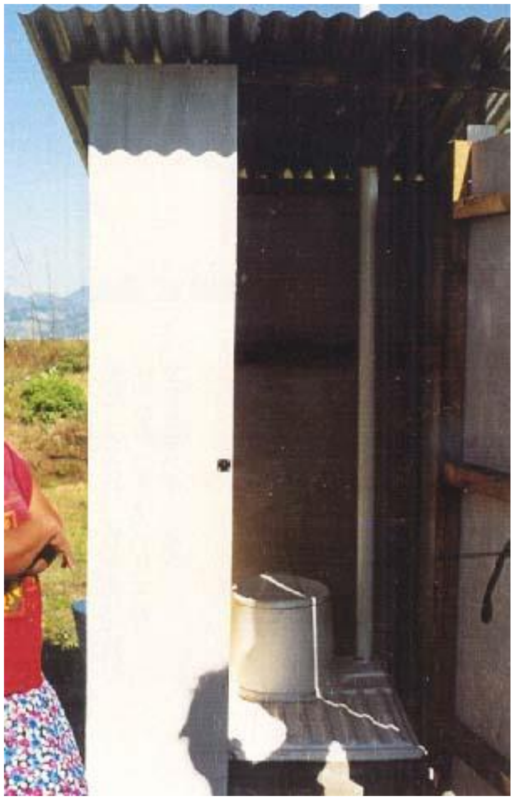


Photo 26 - Lack of Proper Storm Water Drainage

Photo 27 - Lack of Proper Storm Water Drainage

Photo 28 - Reconstruction in Perspire, Choluteca: Most Reconstruction Efforts Involved the Use of Concrete Frame, Brick Infilled, Tile Roofing Type of Construction

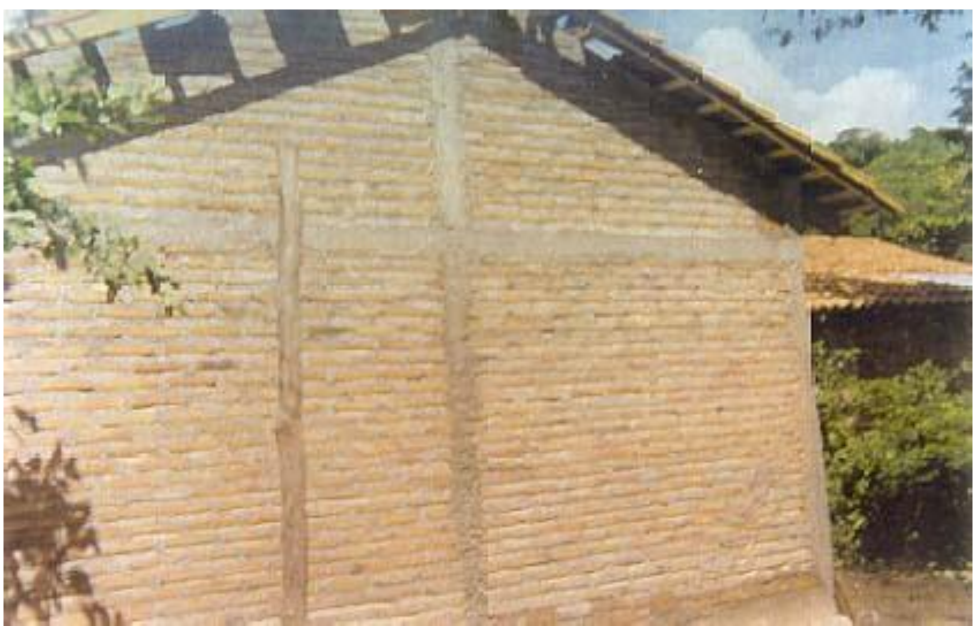


Photo 29 - Reconstruction in Perspire, Choluteca

Photo 30 - Provision of Sewage Connections: Relocated Reconstructed Units in Perspire Were Connected to a Mainline Sewer Pipeline

Photo 31 - Nueva Choluteca: View of the Reconstruction Housing

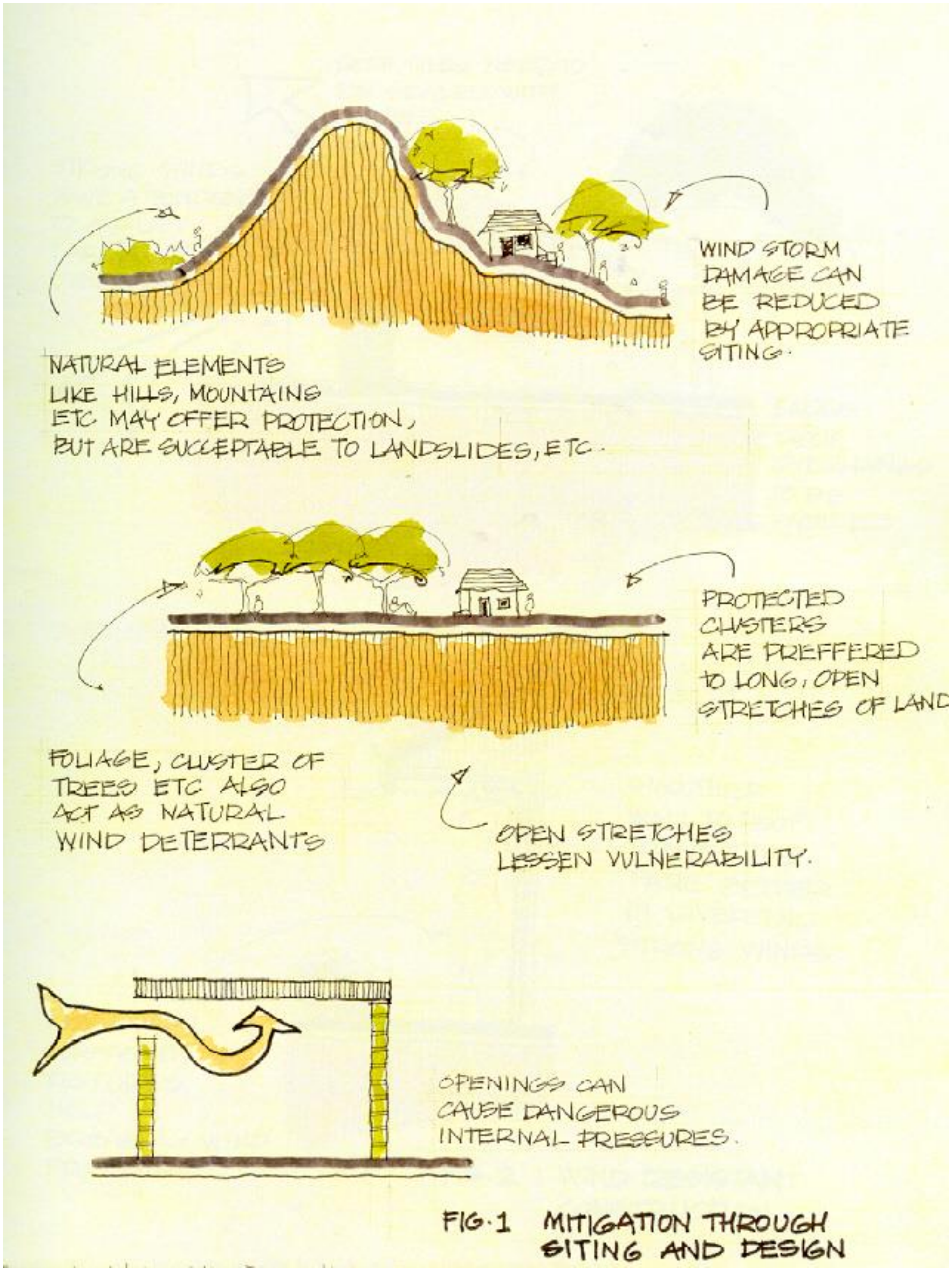
Photo 32 - Nueva Choluteca: Majority of the Houses Built Have Made Use of Concrete Block Construction - Here Asbestos/Zinc Sheet Roofing is Used

Photo 33 - Nueva Choluteca: A Post-Mitch Housing Community

Hurricane Mitigation Options in Construction

Figure 1 - Mitigation Through Siting and Design

(Hand Drawn by Priya Ranganath, December 1999)



[Figure 2 - Wind Resistant Construction](#)

(Hand Drawn by Priya Ranganath, December 1999)

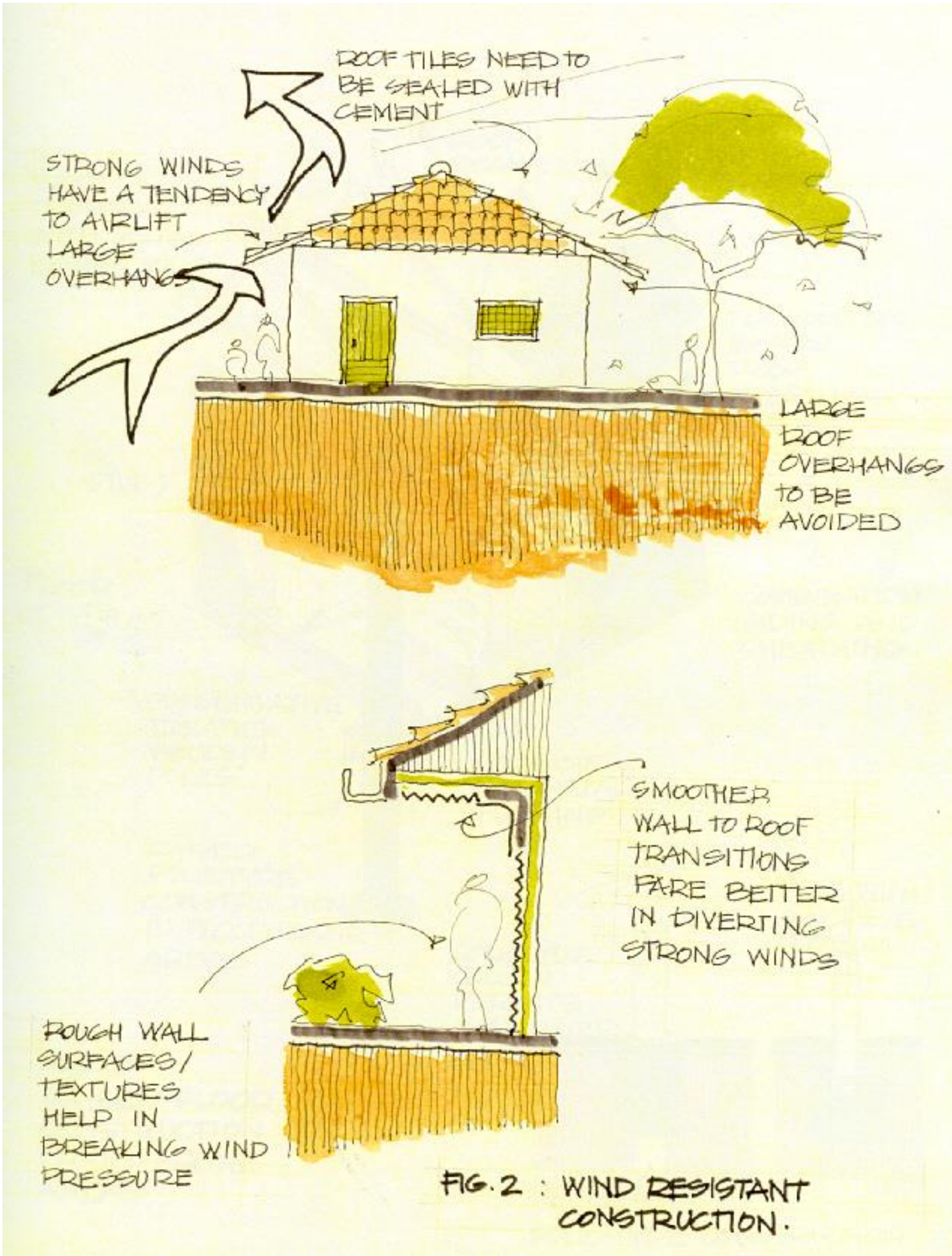


Figure 3 - Raised Floor Construction for Flood-Prone Areas

(Hand Drawn by Priya Ranganath, December 1999)

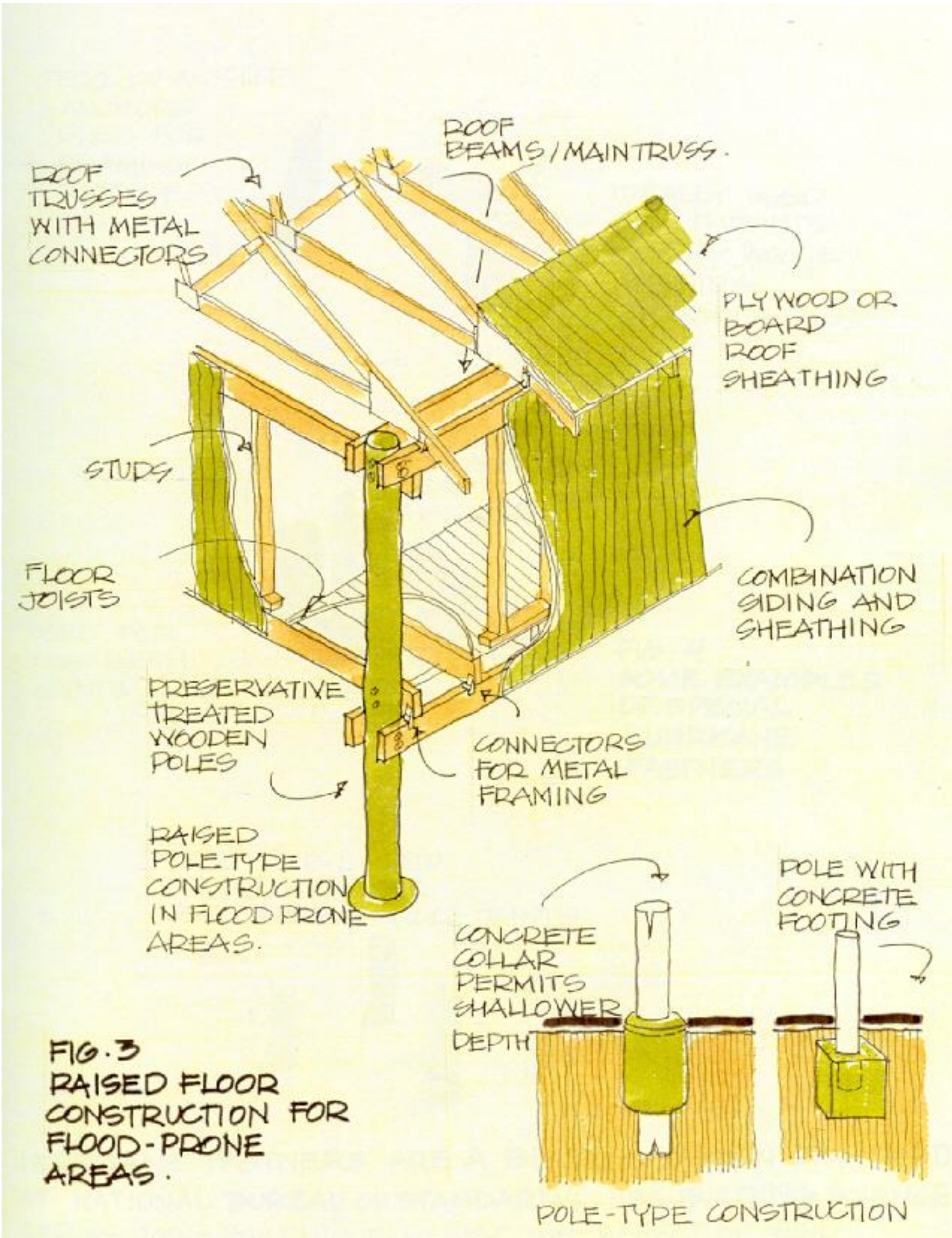


Figure 4 - Some Examples of Special Hurricane Fasteners

(Hand Drawn by Priya Ranganath, December 1999)

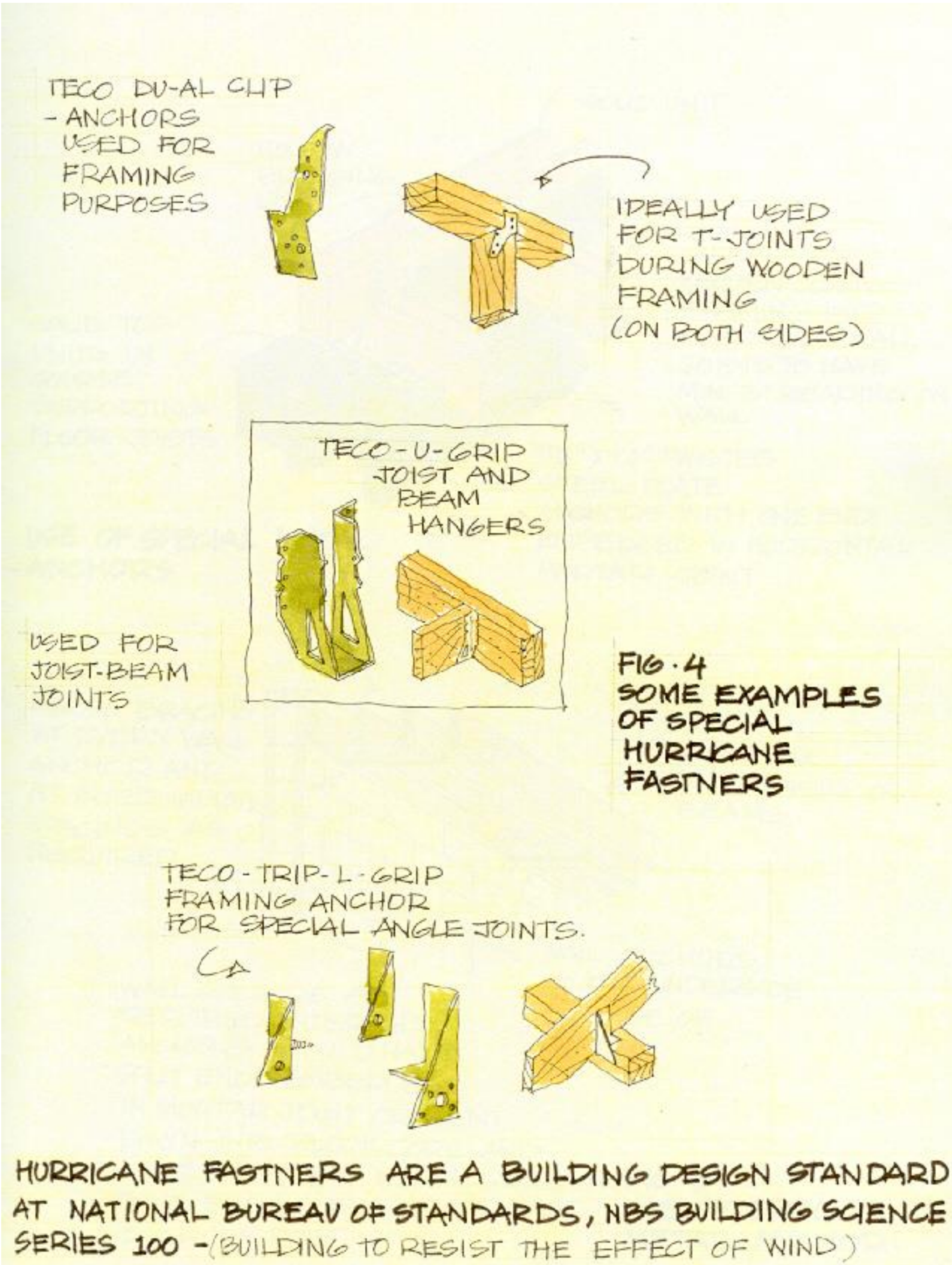


Figure 5 - Use of Special Metal Anchor
(Hand Drawn by Priya Ranganath, December 1999)

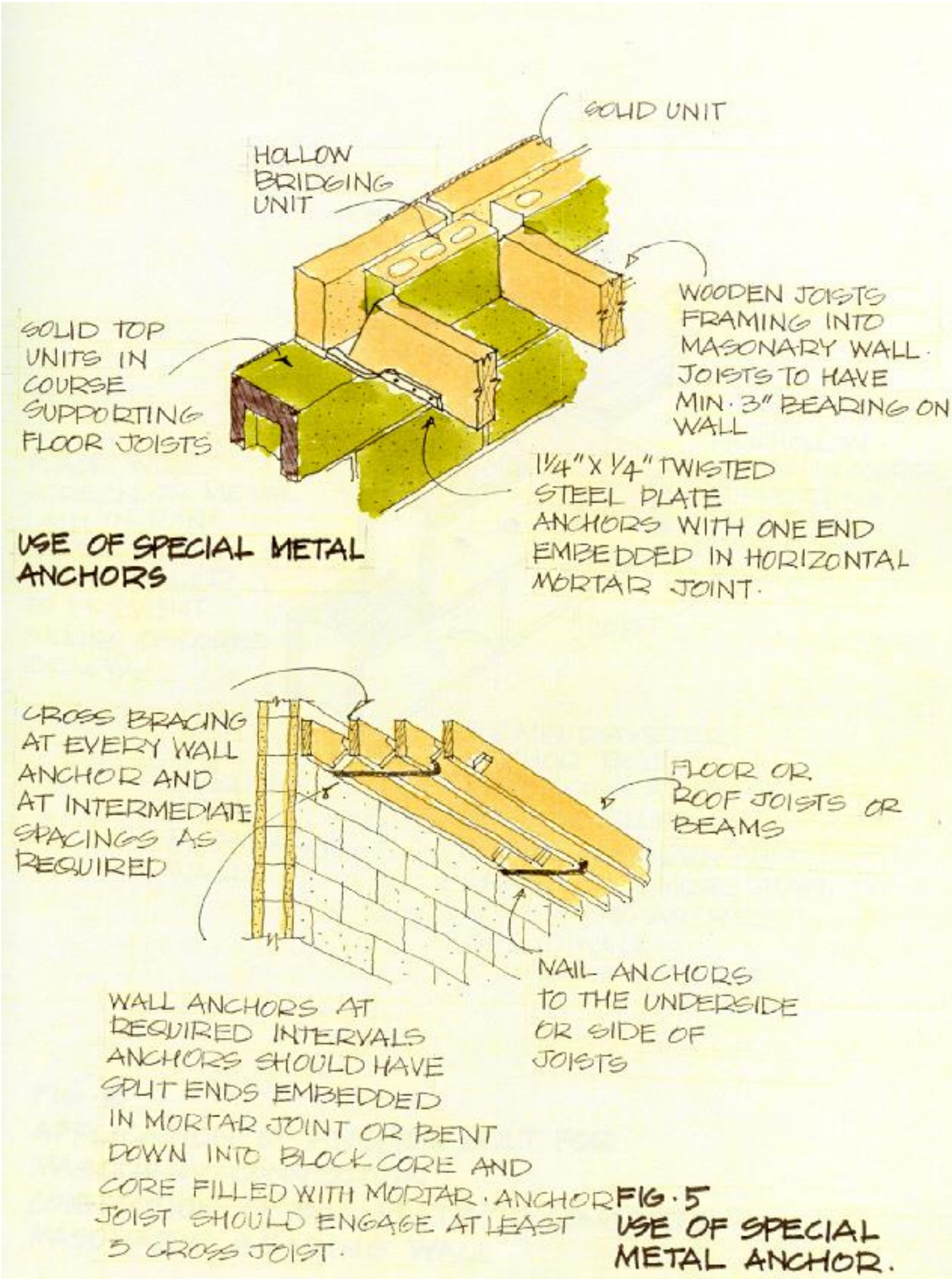


FIG. 5 USE OF SPECIAL METAL ANCHOR.

Figure 6 - Application of Anchor Bolt for Masonry Connection - Connection of Sill Plate to Concrete Masonry Bearing Wall

(Hand Drawn by Priya Ranganath, December 1999)

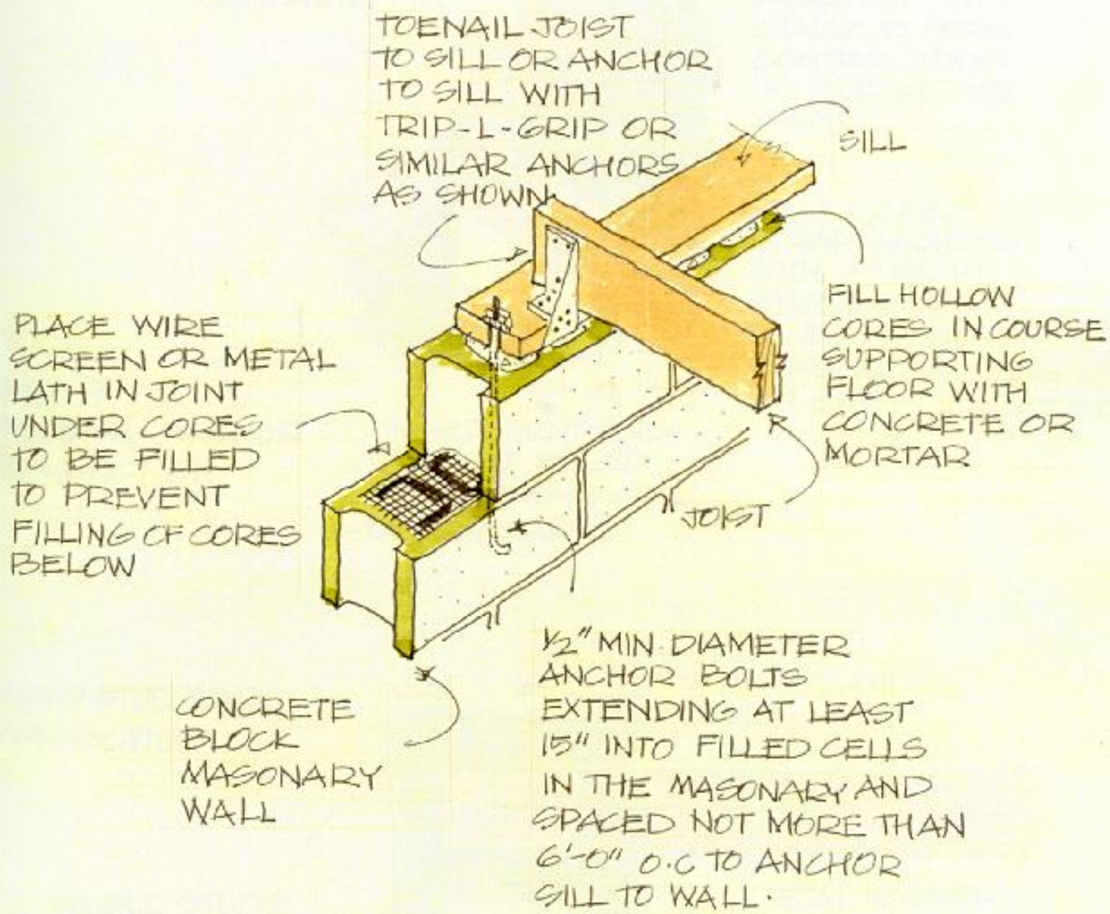


FIG. 6

APPLICATION OF ANCHOR BOLT FOR MASONARY CONNECTION - CONNECTION OF SILL PLATE TO CONCRETE MASONARY BEARING WALL.

Figure 7 - Tie Bar Anchor Connection
(Hand Drawn by Priya Ranganath, December 1999)

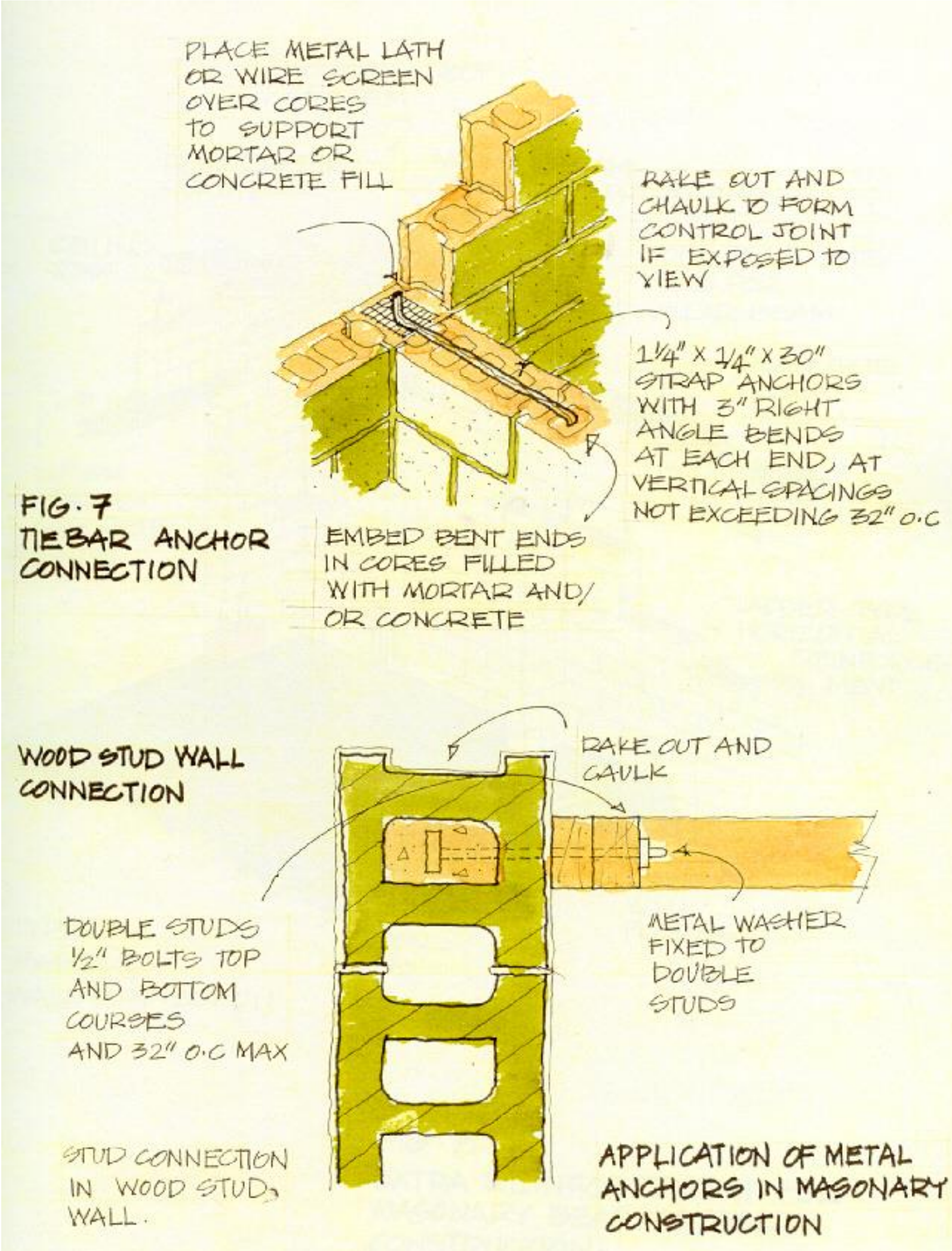


Figure 8 - Extra Reinforcement for Masonry Bearing Wall Construction
(Hand Drawn by Priya Ranganath, December 1999)

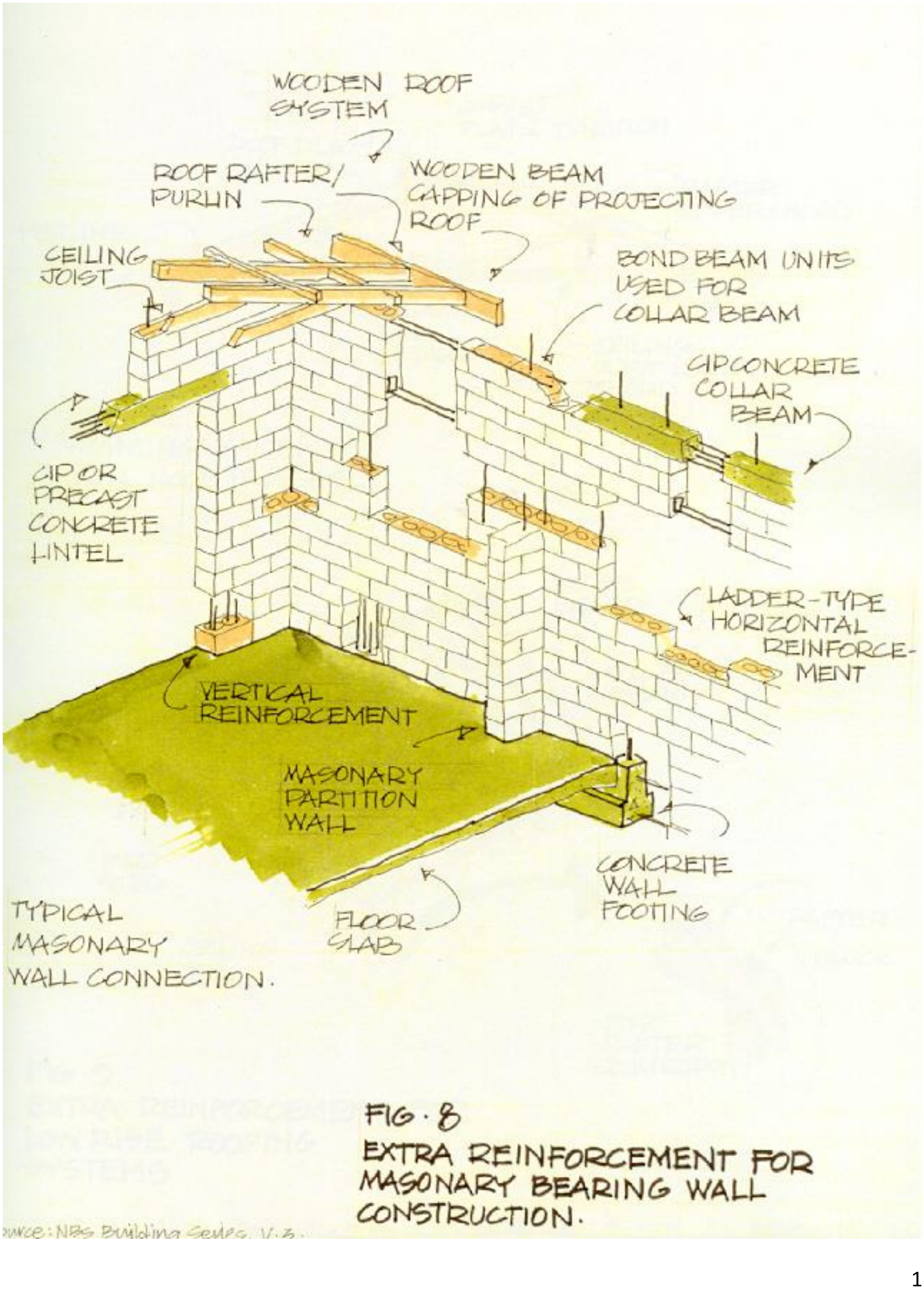


Figure 9 - Extra Reinforcement for Low-Rise Roofing Systems

(Hand Drawn by Priya Ranganath, December 1999)