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SOLOMON ISLANDS BUILDER EDUCATION PROGRAMS:

WHAT HAS BEEN SUSTAINED?

DRAFT FOR REVIEW

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EXECUTIVE SUMMARY

This research was conducted as part of an international study of the success of housing education programs in promoting disaster mitigation construction practices that are sustained over a long period of time. The Solomon Islands offered an opportunity to review a number of these programs aimed at reducing housing vulnerability, all carried out within the past decade. This study did not attempt to evaluate the individual programs but rather to decipher what has and has not been sustained -- their ongoing impact on construction practices. Because of fairly regular cyclonic activity resulting in considerable housing damage in the Solomon Islands, builder education programs have existed in the past and will continue to exist in the future.

The chronology of housing education programs in the Solomon Islands began in 1983-84 and continues today. The following table summarizes their names, primary financial sponsors, status and central focus.

BUILDER EDUCATION PROGRAM	PRIMARY \$ SPONSOR	STATUS	FOCUS
1. PIDP/ INTERTECT	Bi-/Multi-lateral aid	Completed 1984	Vulnerability analysis/reduction; Training
2. RHRP	Bi-/Multi-lateral NGO aid	Completed 1989	Post-disaster reconstruction
3. SIDT	NGO with local and international aid	Ongoing	Training/Community building efforts
4. Hybrid Technology	NGO, primarily local	Ongoing	Training/Community building efforts
5. CHE	SIG, augmented by bilateral aid	Ongoing	College-level builder training
6. TTD	SIG, augmented by bilateral aid	Ongoing	Trades-level builder training
7. RTC	NGO with local and international aid	Ongoing	Village-level training

The initial 1983-84 PIDP/INTERTECT housing vulnerability reduction program, which included strategizing workshops with government and non-government representatives involved in housing issues, made a number of recommendations centered around the following major points:

- The NDC should take a leadership role in promoting housing vulnerability reduction activities among line ministries, local authorities and NGOs involved in housing.
- Disaster resistant building techniques should be incorporated into all construction curricula.
- Public awareness programs should be fully utilized to stress the importance of housing vulnerability reduction initiatives.

Almost ten years after this initial study and training, considerable progress has been made. The major areas of improvement in housing vulnerability reduction include the following advances:

1. An urban building code is in place that is enforced to protect home loan investments.
2. A national building code and design manual, adopted in the capital city, Honiara, is used by public and private sector architects for permanent buildings constructed throughout the Solomon Islands.
3. Construction curricula have been adopted, on both the college and trade levels, which include disaster resistant building techniques. Students are tested on these skills.
4. The government has moved away from constructing homes and towards promoting home financing opportunities and urban land access. This movement has increased the lending sector's insistence on safer housing and decreased a dependency on government initiatives to do so.
5. The Development Services Exchange (DSE) has grown in stature because of the key role they play in providing development and disaster assistance throughout the Solomon Islands. With this enhanced stature, they are promoting the two local NGOs most involved in safer housing: SIDT and Hybrid Technologies.
6. Public awareness programs concerning disaster preparedness and safer housing, both governmental and non-governmental, have continued. The manager of the NDC is on the Solomon Islands Broadcasting System weekly to discuss disaster-related issues.

Conversely, it must be said that certain constraints have impeded progress towards improving vulnerability reduction. These constraints include:

1. A declining economic environment has led the government to be far more concerned with securing foreign aid and loans than with initiating efforts to protect resources.
2. The incorporation of mitigation into line ministries' planning has not occurred as envisioned. The NDC is neither staffed, financed nor empowered to see that preventive measures are in place throughout the government. The NDC's time at center stage is during disaster operations and then it is totally dependent on line ministries for staff. Once the emergency is over, the additional staff and the impetus for change are lost.
3. Although cyclones are the leading natural disaster threat, a worsening territorial conflict with Papua New Guinea over the island of Bougainville and a major malaria outbreak are the emergency matters that currently command the greatest attention. Funding emergency response efforts has taken precedence over long-range planning.

Building codes, home financing opportunities and building curriculum improvements primarily impact urban, employed, titled land owners who live in permanent housing. The vast majority of Solomon Islanders live in rural settlements in traditional housing. Rural building codes are not feasible and banks will not make loans in the rural areas. Nonetheless, improvements in housing safety in the rural areas can be seen and are being promoted by:

- the memory and continuing existence of NGO builder education programs which focus on village-level building traditions, trends and community-based initiatives.
- the return of urban builders to their rural villages with improved building skills gained from schools and urban work experiences.
- expanded government reliance on NGOs to provide services in this area, because the government is limited in its capability to directly impact rural building practices. This reliance is ongoing and likely to continue in the future.

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SOLOMON ISLANDS BUILDER EDUCATION PROGRAMS:

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INTRODUCTION

The history of builder education programs in the Solomon Islands begins with a 1983-84 housing vulnerability survey and builder education program conducted by the East-West Center's Pacific Islands Development Program (PIDP) in conjunction with INTERTECT and sponsored by the AID Office of U.S. Foreign Disaster Assistance (OFDA). These efforts were followed in 1986 by a builder education program included as part of a housing rehabilitation project following Cyclone Namu. In 1987-1988, another builder education program followed -- conducted by an NGO, the Solomon Islands Development Trust (SIDT) -- which was independent of a disaster rebuilding program. Over time, housing vulnerability efforts began to make their way into urban building codes and construction curricula.

All in all, the Solomon Islands, with their recurrent cyclones and a history of implementing builder education programs, affords an opportunity to look at a variety of programs to see what has and has not been sustained from them. From interviews with government officials involved in all aspects of housing and disaster response, there is an endorsement of the concept of builder education and mitigation as a means of protection. Unfortunately there has not always been the political will to see that endorsement through to real implementation, although some very tangible progress has been made. Other economic and political realities, such as a declining Gross Domestic Product (GDP), a worsening territorial conflict with Papua New Guinea and a very serious malaria outbreak, have taken precedence. Fortunately the NGO community has shown a willingness to take up the banner. Most promising are the efforts targeting improvements in traditional housing, the most prevalent and vulnerable housing in the Solomon Islands.

THE CONTEXT

1. Environment

The Solomon Islands is a South Pacific archipelago located between 6.5 and 13 degrees south latitude and 155 to 170 degrees east longitude. Part of Melanesia, it stretches nearly 900 miles across the Coral Sea between Bougainville (Papua New Guinea) in the northwest and Vanuatu in the Southeast. Australia is to the southwest and Fiji to the southeast, each about 1000 miles away.¹ The Solomon Islands fill the gap between Vanuatu and Papua New Guinea along the boundary of the Pacific and Indo-Australian Plates.

The country is made up of six main islands: Guadalcanal, Malaita, Choiseul, New Georgia, Santa Isabel, and San Cristobal. The land area exceeds 11,000 square miles, 80% of which comprises the six main islands. Additionally there are 30 smaller islands and over 900 islets, lagoons, atolls and cays.² The nation's capital, Honiara, is located on Guadalcanal. The other five island provinces have their own provincial capitals.

The main islands are rugged and mountainous with most interior ridges and valleys coming under dense tropical rain forests. Extensive tracts of grassland cover the fertile northern plains of Guadalcanal. Some smaller islands have active volcanoes and the whole archipelago is earthquake-prone. The climate is ocean-equatorial: warm and humid with a year-round mean temperature of 80°F and a rainy season from November to April. Annual rainfall averages 120 inches, with Honiara receiving 90 inches.³ The official cyclone season is from November to April.

2. Demographics

The last official census was taken in 1986. The current estimated population is 339,000 with a 3.5 percent annual growth rate. Forty seven percent (47%) of the population is under 15 years of age. Melanesians make up 94% of the population, Polynesians 4%, Micronesians 1% and Europeans, Chinese and others the remaining one percent. The Melanesians speak 40 languages and 50 dialects, but Pidgin English is spoken by 83% of the population. The official language of English is spoken by 26% of the population.⁴ According to the Foundation for the Peoples of the South Pacific (FSP), small rural villages comprise 85% of the total population. Current average per capita income is estimated to be under \$300⁵.

Most people reside in small, widely-dispersed settlements along the coast; only 11% of the population is urban. In the rural areas, a traditional Melanesian social structure is followed. That structure includes the practice of subsistence economy, the recognition of bonds of kinship with important obligations extending beyond the immediate family group, and a strong attachment of people to the land. Most Solomon Islanders maintain this traditional social structure and find their roots in village life.⁶

The Solomon Islands economy includes subsistence and market sectors. About 86% of the population engage to some extent in subsistence production, accounting for 25% to 30% of gross domestic product. Most people obtain food by root-crop gardening and fishing and have relatively little involvement in the cash economy. The market economy depends on primary commodity production for export, principally fish, timber, cocoa, copra and palm oil.⁷ The economy remains highly-dependent on changing world prices for these commodities.

3. Political and Economic Framework

The Solomon Islands gained their independence from Great Britain on July 7, 1978. They have a parliamentary democracy within the British Commonwealth with a unicameral Parliament and a ministerial system of government. Each ministry is headed by a policy-making cabinet member appointed by the Prime Minister. The ministry head is assisted by a permanent secretary who implements policy and directs ministry staff.

The current Solomon Islands Prime Minister is Solomon Mamaloni, head of the National Unity Party. He has been in office since March of 1989. Originally elected by the Alliance Party, in October 1990 he resigned from his party to form a government of "national unity". This move is said to have effectively weakened the opposition and broken up the five main political parties.⁸ Mamaloni is up for re-election this year and is expected to win.

Pacific Islands Monthly (May 1993) labeled the political problems facing the Solomons as including "... a deteriorating economy, a poor education system, the spill-over effect of the Bougainville conflict (with Papua New Guinea), a countrywide shortage of doctors, malaria (the Solomons have one of the highest rates in the world), government corruption, the goods tax and public service weakness. Many see the leaders themselves as creators of some, if not all, of these problems and the Mamaloni government making no major attempt to find solutions."⁹

The Mamaloni government has been marked by a trend towards privatization. This is very apparent in the housing sector. His government disbanded the Solomon Islands Housing Authority, which had been constructing low-income housing in the Honiara area, and reduced the Ministry of Transport's (MTWU) role in publicly-owned housing. Responsibility for government-owned housing was transferred to the Ministry of Housing (MOH). MTWU staff, trained as part of the 1984 PIDP/INTERTECT housing vulnerability reduction project, did not join the MOH when it was formed in 1989.

Politically, disaster affairs are administered by the Ministry of Home Affairs through the National Disaster Council (NDC). Each province has a Provincial Disaster Council. A National Disaster Management Office, under the Ministry of Home Affairs, looks after disaster preparedness year-round and is responsible for liaising with government ministries, offices and agencies to ensure that their preparedness measures are effective and up-to-date. Although tasked with seeing that preventive measures are in place throughout the government, the NDC is not equipped in terms of personnel, financial resources or empowerment to see that vulnerability reduction is incorporated into line ministries.

The political price for handling a disaster situation poorly should be remembered for a long time in Solomon Islands political circles. The Prime Minister in 1986 was forced to resign as a result of his handling of a French government offer of assistance to his home village after Cyclone Namu.¹⁰

The economic outlook in the Solomon Islands is not very good. In 1992 the Central Bank of the Solomon Islands reported that real GDP grew at a rate of 3.9 percent compared with the preceding year's growth of 1.8%. The GDP was estimated to be US\$168 million. Although some growth was noted, this is considered to be well below the economy's long-term growth potential of 7% and only slightly above the population growth rate of 3.5%. The inflation rate increased to an average of 15% from 8.7% the year before. In 1991, a record fiscal deficit of US\$25 million was double that budgeted for by the government. Overall fiscal indicators put the country in the "least developed" category.¹¹

The Solomon Islands resource endowment (fisheries, timber, croplands and minerals) largely determines its economic structure. The nation has a dual economy with 86% of the population living in "subsistence affluence" from the plentiful produce of the gardens, reefs and rivers surrounding 5,000 villages of an average of 60 inhabitants. The remaining 14 percent live in small monetized enclaves. This monetized economy has only 27,000 formal employees and perhaps 13,000 in informal employment. Despite this, the national accounts attribute 82% of the real GDP to the monetized economy.¹²

The subsistence economy is both a source of and a sink for labor, thanks to the "*wantok*" system which binds together all speakers of the same language on the same island. It acts as a built-in unemployment insurance and social security system -- those with money, shelter and food share it with needy *wantoks*, and those becoming unemployed in the monetized economy can always return to subsistence affluence in their home villages.¹³

Although it would seem prudent in view of the frequency of damaging cyclones, government expenditures do not target housing vulnerability reduction measures. The ongoing health problems of the nation, especially a malaria outbreak that is considered to be the highest incident rate in the world, are viewed as a particular impediment to economic and social development.¹⁴

The country is dependent on foreign aid, with net official development assistance rising from 16% of GDP in 1985 to 40% currently. With multilateral sources used to the limit, the desire for untied funds to create social and economic infrastructure in rural areas has led the government into dialogue with private loan organizers working on commission.¹⁵

We asked to see five-year development plans and were told they were no longer done. We were shown the national development plan for 1987. Although the plan included some ambitious development projects, the primary preparedness function of each civil servant assigned to the project was to seek out international funding.

4. Disaster Vulnerability

The Solomon Islands is exposed to a number of natural disaster agents that affect housing including earthquakes, tsunamis, volcanoes, tropical cyclones and wind storms, and floods.

A. Seismic Hazards

The Solomon Islands is located on the western side of the Pacific "Ring of Fire". The double chain of islands is situated along the boundary of the Indo-Australian and the Pacific plates. This boundary is an active subduction zone with one plate thrusting beneath another. In the case of the Solomon Islands, the northerly-moving Indo-Australian plate is being subducted under the southerly-moving Pacific plate at a rate estimated to be around 10 cm. per year. This rate of subduction is one of the highest in the world.¹⁶

Most of the earthquakes in the Solomon Islands occur in a zone about 200 km. wide which roughly parallels the trend of the island chain. The 350-km. area that lies adjacent to the islands of Guadalcanal and San Cristobal has been the site of 10 large shallow earthquakes since 1966.¹⁷ In the period from April 1977 to July 1987, 34 earthquakes registering more than 5.5 on the Richter Scale were recorded in the Solomon Islands.¹⁸ The local disaster history shows earthquakes occurring on 7 July 1977 (epicenter 160 km. south of Guadalcanal, 7.5); 8 July 1980 (near the Santa Cruz Islands, 7.3); and 9 July 1980 (in the Santa Cruz Islands, 6.8).¹⁹

Over a period of 56 years (1934-1990), 15 tsunamis were recorded. All but one were thought to be generated by earthquakes rather than volcanoes.²⁰ These tsunamis ranged from less than a meter to six meters high. The most powerful waves occurred in 1931 and 1939. The 1931 tsunami was caused by an earthquake which occurred between San Cristobal and South Guadalcanal. Fifty people were killed and 20 villages swept away on the coast of San Cristobal. In 1939 a tsunami in Guadalcanal destroyed the village of Maravovo. An earthquake off the coast of Chile in 1960 generated a tsunami felt throughout the Solomon Islands.²¹

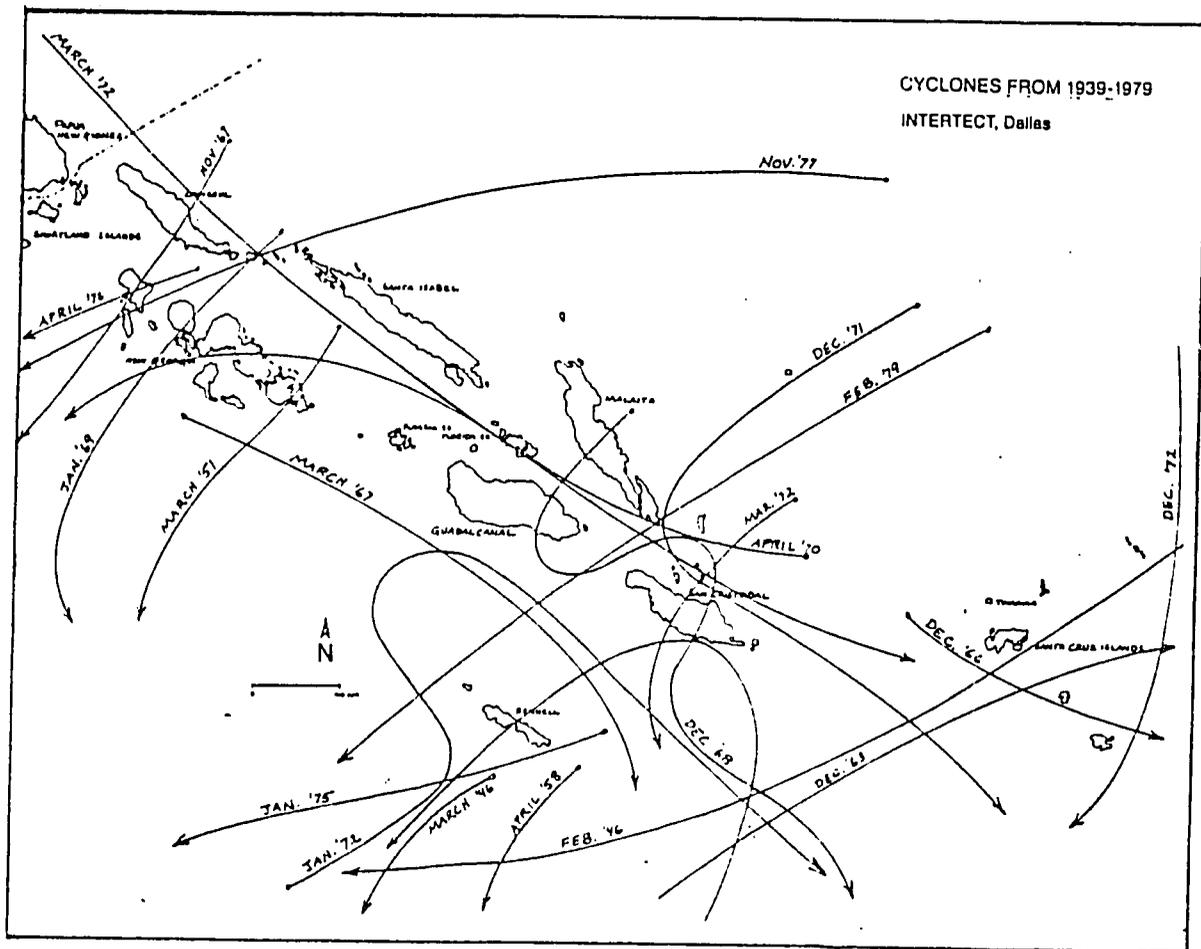
There are three volcanoes in the Solomon Islands which have erupted or shown signs of activity in last 160+ years. Savo, 12 miles off the coast of Honiara, erupted in the 1830s; it is presently inactive. Tinakula, in the Temotu province, has shown some activity in the last decade. Kavachi, a submarine volcano off the coast of Rendova in the Western Province, erupted for three days in 1988.

B. Cyclones

The Solomon Islands are located in what is known as a cyclone-genesis area, an area where cyclones form. Their presence in the Solomon Islands region is usually in the early stages of their life cycle; therefore, it is extremely difficult to forecast an accurate path that a cyclone will follow.²² The official cyclone season is from November to April, although other cyclones, most notably Cyclone Namu in May 1986, have occurred beyond the season. Cyclone Namu destroyed some 2,400 homes and killed possibly as many as 106 people in the provinces of Guadalcanal and Malaita.²³

On average, the Solomon Islands experience a cyclone of moderate severity every two years.²⁴ Cyclone Kerry in 1979 resulted in severe damage to traditional bush houses; it primarily affected the eastern islands with serious damage to buildings and agriculture, leaving 6,000 homeless, 2 dead and several people seriously injured. In April 1982, Cyclone Bernie zigzagged from Santa Isabel through Russell Island and across the west coast of Guadalcanal, with winds gusting up to 70-80 knots and 8-meter waves; heavy surf and falling trees caused most of the damage.²⁵ On January 1, 1993, Cyclone Nina caused extensive damage to homes and agriculture primarily on Rennell and Bellona islands, the islands of the Temotu province, south Guadalcanal and South Malaita.

FIGURE 1:
CYCLONE PATHS ACROSS THE SOLOMON ISLANDS 1939-1979



C. Floods and Landslides

Flooding is an on-going hazard affecting the Solomon Islands. Flooding can be caused by excessive rainfall any time of the year. The islands face cyclone-induced storm surge and flood hazards, especially in coastal village areas. Additionally, increased use of land for logging is adversely affecting run-off, causing landslides and flooding. The economic pressure of logging will greatly increase this area of vulnerability.

5. Disaster Response Framework

A. National Disaster Council, Government Ministries

The first Solomon Islands National Disaster Plan was approved in 1980. It called for formation of a National Disaster Council responsible for preparedness and response and for coordination of the national plan with provincial plans and Provincial Disaster Committees. In this first national plan, mitigation was not included. Reference was made in the plan to the future desirability of risk management studies aimed at reducing vulnerability.

A new national disaster plan was drawn up in 1987. The new plan expanded on roles and responsibilities of participating government agencies, Provincial Disaster Committees and Liaisons, NGOs and international donors. A post-disaster review was included in the new plan to ". . . ensure that lessons learned during operations are utilized in training and in the improvement of counter disaster measures generally". In 1989 the National Disaster Council Act was passed. It ensured the legal basis of the national disaster plan.

The National Disaster Council is chaired by the Permanent Secretary of the Ministry for Home Affairs, representing the Minister of Home Affairs. The role of the NDC is to coordinate all disaster-related measures concerned with planning, organization, preparedness, operations, relief and rehabilitation, training and public awareness, mitigation (when applicable) and other appropriate aspects. The council includes the Permanent Secretary of the Commissioner of Police, the ministries of Foreign Affairs, Transport, Works & Utilities, Finance, Communications, and Health & Medical Services. Other ministries and government agencies such as Industry, Electrical Authority, Solomon Islands Broadcasting Corporation, Education, and Agriculture can be co-opted as needed. The National Disaster Management Office (NDMO) has a full-time manager vested by the 1987 plan with "...keeping disaster related affairs under continuous review and of initiating necessary action".

The NDC Manager has a very small staff including two administrative assistants and one supply person. The Manager is responsible for liaising with government ministries, offices and agencies to ensure that their preparedness measures are effective and up-to-date. Additionally, the NDC Manager is to monitor the general area of counter-disaster planning to ensure that the planning system consistently meets current needs. The manager is, according

to the plan, ". . . to pay particular attention to the development of preparedness measures at local community level".

The current NDC Manager expressed his frustration at a lack of personnel with which to facilitate his planning and preventive responsibilities. He indicated that there have been a number of good ideas for mitigation that have come forward such as the 1984 PIDP/INTERTECT training, the builder education materials prepared following Cyclone Namu, and the disaster resistant construction resources for traditional housing prepared by Charles Boyle (a local architect involved in private sector and NGO vulnerability reduction initiatives) and published by the Australian Overseas Disaster Response Organization (AODRO). The NDC Manager concluded that, "Housing education programs have presented some good ideas to reduce vulnerability; however, a lack of personnel causes ideas to die out. You need people to put these ideas into practical realities. Outside support coming into the Solomon Islands is very good; however, unless there is an effective, existing infrastructure to receive this aid, outside aid is not effective."

B. Non-Government Organizations

In the 1980 disaster plan, NGOs were only briefly mentioned. The Solomon Islands Red Cross (SIRC) was identified as "...assisting in disaster relief and rehabilitation as agreed with the Chairman of the NDC". The Solomon Islands Christian Association (SICA) was also to assist as directed by the NDC. The Chamber of Commerce was charged with promoting and implementing mutual assistance within the private sector. Roles and lines of communication were not defined among the NGOs and the government. The NGOs were not communicating among themselves about disaster-related activities.

Cyclone Namu changed everything. The importance and need for NGO assistance (both local and international) became readily apparent. The 1987 disaster plan recognized the importance of the NGOs. The new plan placed the SIRC secretary as a "co-opted" member of the NDC. In addition to their disaster relief distribution, the SIRC was to coordinate with other NGOs regarding their relief activities. NGOs were recognized for their potential role in assessment, feeding, clothing, temporary shelter and other established NGO relief activities. However, the 1987 plan marked the first recognition that NGOs could play a part in "...public education and awareness assistance with preparedness measures at the community level".

After Cyclone Namu, the role of the NGOs was further clarified. Throughout the South Pacific development community there has been a movement to establish "Development Services Exchange(s)" (DSE). The DSE in the Solomon Islands serves as an umbrella group for development agencies -- religious, sectarian, international groups, etc. -- working there. The DSE meets monthly to discuss projects and needs, and to coordinate activities. Within the DSE there is a permanent disaster sub-committee. During times of disaster, the DSE Secretary, representing the disaster sub-committee and the DSE, serves as the liaison for the

NGOs to the National Disaster Council. AODRO has been very involved in NGO coordination and training.

C. Bilateral and Multi-lateral Aid

Because the Solomon Islands are so dependent on foreign aid for disaster relief and recovery, they have organized their request procedures. After disaster assessment, donor governments are brought together for a government briefing and aid request session. The practice of requesting cyclone-resistant rebuilding assistance in conjunction with a housing rehabilitation program appears to be established. The current Cyclone Nina rural housing reconstruction aid request for \$4,700,000 (Solomon dollars) seeks to rebuild homes and instill "awareness for rural people to construct cyclone resistance houses".²⁶

The Australians, because of their proximity and shared cyclonic threats, have offered support through the Australian Overseas Disaster Relief Organization (AODRO) and the Australian International Development Assistance Bureau (AIDAB) for training, planning, relief, recovery and mitigation efforts. Mitigation support is primarily in the sharing and promoting of building codes and cyclone resistant building techniques especially aimed at traditional housing vulnerability. New Zealand has offered similar types of support but not on so grand a scale as Australia.

The AID Office of U.S. Foreign Disaster Assistance (OFDA) assisted in the funding of the first major vulnerability analysis and builder education program in 1983-84. After Cyclone Namu, OFDA assisted with relief and assessment support and contributed to the post-cyclone housing rehabilitation and builder education programs.

There are 32 Peace Corps volunteers in the Solomon Islands; none are currently specifically assigned to disaster preparedness or builder education programs.

Japan has provided disaster aid, as has the Asian Development Bank and the European Economic Community. The U.N. Development Programme (UNDP), through the International Labour Organisation (ILO), was a major player in the Cyclone Namu builder education program.

FIGURE 2:
TYPICAL MALAITA VILLAGE



HOUSING PROCESS

1. Types of Housing

Housing in the Solomon Islands falls into three major categories: permanent, semi-permanent or transitional, and traditional housing. Permanent housing is usually limited to the urban areas of Honiara and the provincial capitals and is occasionally found on the village level. Village-level permanent houses are usually owned by more affluent villagers who reside in Honiara and maintain village homes for holidays and vacations. Semi-permanent housing is found predominantly in the urban areas around Honiara and other provincial capitals. Families reside in semi-permanent houses as they incrementally build permanent structures. Villages along the south coast of Guadalcanal have a large amount of semi-permanent housing. Some semi-permanent housing is found in rural areas, but the largest stock of housing in the rural areas is traditional housing.

Permanent housing is identified by the type of building materials used. Typically, these houses have reinforced concrete foundation piers and/or reinforced cement block foundation walls on a continuous footer. The framing is constructed using locally-sawn timber. Typically, 2" x 4"s are used for wall studs and roof truss members while 2" x 8" lumber is used for floor joists and beams. Wall cladding is either wood, plywood or a composition fiberboard. The roof covering is usually corrugated metal.

Semi-permanent housing is characterized by the combination of traditional building materials -- such as round "bush" poles, rope lashing and sago palm leaf cladding -- with permanent materials such as sawn timber, nails and, when available, metal roof sheets. Semi-permanent housing is often transitional; families reside in it as they incrementally save and build their permanent homes.

Traditional housing constitutes the vast majority of houses in the Solomon Islands. These houses are constructed using round bush poles and wooden posts for framing, typically with lashing to secure joints connections. These frames are then covered with palm leaf "shingles" in overlapping layers for roof and wall cladding. The life span of these structures varies. Usually cladding is replaced every 3-5 years, and posts and poles are replaced every 5-10 years. Traditional housing requires cyclic reconstruction.

2. Governmental Role in Housing

The Solomon Islands Government (SIG) has in the past played a significant role in the provision of housing. The current government, in office since 1989, has moved toward privatizing its housing role. While the Ministry of Transport, Works & Utilities (MTWU) and the Solomon Islands Housing Authority have traditionally been active in housing production, those roles have now been ended.

The MTWU has maintained an architectural and drafting division responsible for producing both single-family and multi-family house designs in addition to designs for public facilities such as schools and hospitals. The Ministry in the past has employed skilled tradesman and construction supervisors. In recent years the Ministry has eliminated many of these positions, shifting to a policy of using the contracting, engineering and design services of the private sector.

The Ministry of Housing, formed in 1989, maintains existing government-owned housing (primarily occupied by civil servants) and is administering a sites-and-services program for government-owned lands categorized as TOLs (Temporary Occupancy Lands). Families are permitted to occupy land for a yearly rental and construct housing without permits or regulations. Houses are typically initially constructed as traditional "leaf" houses and are gradually improved over time. Once the family constructs a house using "permanent materials", such as sawn timber framing with board siding and metal roof, the Land Commission will sell the parcel to the homeowner.

The MOH role in housing is almost exclusively limited to the nation's capital, Honiara, and a few government-owned houses in the provincial capitals. The Ministry does not construct any homes, nor does it play any role in promoting mitigation in home-building. According to its Permanent Secretary, the MOH plans to apply for international financing for home loans for people in the rural, primarily non-cash-economy villages who do not qualify for existing home loans. The Permanent Secretary indicated that these international loan applications may include disaster mitigation provisions.

The most active governmental role in housing-related disaster mitigation is through the Honiara Town Council plan review process. The Council requires construction standards that include disaster mitigation. These standards are at best only in force in the Honiara urban area and where home financing -- i.e., either government-sanctioned or bank loans -- is involved. In the provinces there are town and country planning offices. These councils are only concerned with "titled lands", ensuring that boundaries and setbacks are not violated. The proportion of titled land in the provinces is minuscule, with custom land tenure arrangements controlling 87% of the land.²⁷ There is no building code review in the provinces.

Formal building plans are required for privately-owned and platted lots in and around Honiara. The Honiara Municipal Authority reviews all building plans for site development compliance, environmental impact and construction standards. Cyclone-resistant strapping and bracing are required for plan approval.

Outside of Honiara in the rural areas and provincial centers, houses that are constructed on privately-owned or government-owned and platted lands must submit plans for a site development review to the Provincial Town & Country Planning Board. Construction standards are not reviewed and there are no building codes in force. Houses constructed on

communal or family-owned lands are not regulated by the government at all. This is the largest block of housing stock in the Solomon Islands.

The MOH hopes to receive international financing to fund the acquisition of building materials for rural villages. They have indicated an interest in including vulnerability reduction in these funding requests. There are no other SIG funds available to address the housing needs of the rural populations. The SIG primarily becomes involved in rural housing programs after major disasters and with international funding.

3. Home Financing and Insurance

Home financing opportunities are primarily limited to titled land in Honiara and the provincial capitals. The **Home Finance Corporation**, started in 1991 and funded by the European Economic Community, is under the portfolio of the Ministry of Housing. It provides home loans with the requirement that homes must be constructed from locally-approved building plans and be insured. Currently the HFC only has loans in Honiara. The program hopes to extend into the rural areas with additional funding in the future. Because there are no building code regulations in the rural areas, any vulnerability reduction requirements would have to be mandated by the HFC.

The **National Provident Fund** is the Solomon Islands social security plan and is also very active in making home loans. Workers or self-employed people join the fund and pay regular dues. Most NPF loans are in the Honiara area, with a few made in the provincial capitals. Home construction loans go directly to the building contractor; house plans must be approved by the Honiara Town Council or Provincial Planning Offices. Insurance is required for urban loans. The NPF has 58 loans in rural areas for materials and labor only. Because these loans do not involve titled lands, the NPF does not require any building code compliance. Insurance is not available for these loans.

Private banks make home loans to qualified borrowers. Loans are almost exclusively made in the urban areas (Honiara and provincial capitals) because lands there are titled and the loans can be "secured". Approved building plans must be used. Insurance is required. Loans could conceivably be made in rural areas for materials and labor but generally are not because families do not have the resources to qualify or secure a loan. Similar loan requirements are mandated by the **National Bank of the Solomon Islands**. A public employee's **Credit Union** does not offer housing loans.

Insurance coverage is provided through two underwriters operating in the Solomon Islands. The standard home "Fire and Perils" covers losses from cyclones, but only to permanent structures. No coverage is available for loans or homes in the rural areas. Insurance companies do not inspect covered properties unless the owner's stated value seems to be unreasonably high.

4. Land and Building Materials Acquisition

Land ownership is reserved for Solomon Islanders. Urban land not in private hands is controlled by the government's Land Commission. Large tracts of Honiara-area lands are being developed through the Ministry of Housing TOL sites-and-services schemes. These sites can be purchased and titled. In rural areas, land is communally-owned and subject to very sensitive access issues. Land held on a family or village level may be handed down from mother or father according to local custom. Logging is putting a great deal of additional pressure on rural lands.

Building materials for formal-sector permanent homes are generally acquired using construction loans. A number of building material suppliers located around Honiara serve the formal-sector market. Building materials for semi-permanent homes are usually acquired incrementally as funds are available while a family resides in a traditional home. Materials for traditional homes are acquired from the bush. Villagers report that logging and other environmental influences have made the acquisition of bush materials difficult. This problem is accentuated after cyclones. The trend among the residents of traditional and semi-permanent homes is clearly towards permanent building materials; however, vulnerability is increased when permanent materials are fused with traditional materials inappropriately.

5. Role of the Private Sector in Formal and Non-formal Housing

The private-sector housing process can be divided into two primary categories: the formal sector, in and around Honiara, which builds permanent housing; and the non-formal sector which builds permanent, semi-permanent and traditional housing in rural villages and provincial capitals.

A. Formal Sector

Within the formal sector, houses are usually built by contractors hired by the owner. Most of these houses are financed by public or private sector loans. These loans require municipally- or provincially-approved house plans as well as homeowner's insurance. The insurance industry (which has access to only two underwriters) does not require any building safety features beyond those called for in local building plans. Insurance in the villages is non-existent as insurance companies will not cover any "untitled" properties.

The formal sector builds "permanent housing". In general, there is a high degree of cyclone mitigation incorporated into urban permanent housing since 1986. Elements include consistent use of cyclone strapping (particularly at the rafter-to-wall connections), diagonal bracing in the corners, good truss construction, reinforced concrete/cement block foundations, and the use of metal connectors with lateral nailing. Urban, formal-sector permanent housing enjoys the benefits of building code enforcement.

B. Non-formal Sector

The non-formal sector also constructs permanent housing; however, the effective use of mitigation techniques is less consistent. Permanent housing within this sector is usually constructed in an incremental way over a long period of time, often by several tradesmen with a higher degree of participation by less-skilled builders such as homeowners and extended families. Permanent housing usually begins as a house that has mixed materials and construction types -- traditional materials such as round "bush" poles, rope lashing and palm leaf cladding, as well as some sawn timber and nails.

Houses that are constructed incrementally have less mitigation incorporated into the finished house than do the more recent permanent houses built from the ground up to replace a semi-permanent or traditional house. Typically, a family will purchase materials bit by bit over a period of years until enough has been purchased to build the house. Institutional financing is limited to the urban and formally-employed; individuals outside of that limited group must finance over time by personal and family savings.

Semi-permanent housing constructed by the non-formal sector using both sawn timber and traditional "bush" materials tends to be highly vulnerable to cyclones and earthquakes. Usually these houses have unstable foundations with minimal connections to the wall framing. Inadequate nailing and connections, poor joints between bush materials and sawn timber are some of the most prevalent points of vulnerability. These houses are perceived to be transitional.

Generally, these houses are constructed by each family and, as available, "bush" carpenters who live in the village. Materials are for the most part collected by the family from the mountain or bush areas and carried to the site. Usually when traditional materials are used, no financial resources are required. Houses take about 2 months to construct from start to finish. Construction in recent years has utilized some nailing instead of traditional bush lashing. Nailing is not always properly installed.

Vulnerability to cyclones is very high given the lightweight materials and minimal anchoring into the ground. The use of nails has increased the vulnerability dramatically; traditional lashing is much stronger.

CYCLONE NAMU

1. Extent of Disaster

Cyclone Namu first struck the Island of Sikaiana, northeast of the province of Malaita, on May 18, 1986. This very strong and slow-moving cyclone then moved into the southern and eastern portions of Malaita and her smaller sister island, South Malaita. When the cyclone reached Malaita and South Malaita, winds were estimated to be gusting at 100

knots. In its path, houses were destroyed, roofs ripped off, trees knocked down, crops destroyed, and vast tracts of forest and plantations ruined. Aside from severe wind damage to homes and nature, river valleys were flooded causing additional extensive damages. By May 19th, the cyclone was affecting eastern Guadalcanal and to a lesser extent the island of Makira. By May 20th, Namu was leaving the Solomon Islands but not before damaging the islands of Bellona and Rennell.²⁸

Damage assessment reports were compiled by the National Disaster Council and two subcommittees: the Technical Assistance Team and the Operations Subcommittee. Additional assistance came from teachers, agricultural extensionists and NGO staff trained to complete village surveys and familiar with the remote areas of Sikaiana, Malaita and Guadalcanal. Radio and logistical support was provided by the U.S. Marines and British military. The results of the survey were radioed in to field officers on a daily basis, and data was forwarded to the computer center at the Ministry of Home Affairs. NDC staff, using an Olivetti micro-computer and R-BASE database software, provided an increasingly accurate picture of damage concentration which was used for the provision of emergency food and shelter supplies.²⁹

The urban areas of Guadalcanal and Malaita escaped cyclone damage. Destruction in all sectors was confined to rural areas. The assessment showed that high-wind damage to housing was concentrated on the southern half of Malaita and Small Malaita and, to a lesser extent, on the southern-most tip of Guadalcanal.

Most of the deaths occurred on the Guadalcanal plains and were caused by an unusual type of flooding. Logging companies operating in the bush had prepared hundreds of tree timbers for eventual shipment. Heavy rains swept the pre-cut logs and many other standing trees into the river beds where they piled up at various points to create dams which then burst, generating even more destruction and flash-flooding as the flow worked its way towards the plains.³⁰

Solomon Islands Government damage reports estimated that 47% of the homes in Malaita and South Malaita were destroyed while 23% of the homes in the Guadalcanal province were destroyed. The SIG estimated that 2,400 homes were destroyed and 1,650 were severely damaged.

2. Housing Assistance Programs

A. OFDA Assessment

In June 1986, OFDA contracted INTERTECT to do a post-cyclone housing needs assessment. That assessment came at a time when an estimated 80% of the villages in Guadalcanal and Malaita had already been rebuilt in a temporary fashion using materials salvaged from their destroyed homes, supplemented with new materials from the surrounding

forest.³¹ Sago palm leaves (for roofs and walls), betel nut timber (for flooring), and loya cane vines (for lashing/binding) were the traditional building materials most requested.

On Malaita the assessment team recommended development and implementation of a village-based housing education and public awareness program in the most severely-affected areas of Guadalcanal and Malaita, and organization of a materials supply and distribution program utilizing materials available from adjacent islands.

At the time of the assessment, two portable sawmills had already been provided for World Vision housing reconstruction activities in Malaita and six more were on the way for Guadalcanal. These sawmills were working independently of any other reconstruction efforts. With regard to the issue of sawn timber, the assessment team believed that, given the 98% damage to traditionally-constructed housing versus the 2% damage to other forms of housing, introducing sawn timber materials as a focus of housing rehabilitation was inappropriate.³²

The damage from Cyclone Namu was in the rural areas of Malaita and Guadalcanal where the housing stock is overwhelmingly traditional. It did not make sense to the team to potentially undermine the considerable rebuilding that had already taken place by introducing materials not normally used in traditional building and coupling all of this with a builder education program featuring new materials.

The assessment team stated that, given the nature of the damage, the infrequent use of sawn timber in traditional housing and the difficulty of establishing ownership of fallen and displaced timber, they did not recommend that the portable sawmill project be directly linked with the Housing Education Program, nor that demonstration housing be constructed using this timber.³³

The assessment team reviewed the housing vulnerability reduction materials prepared for the Solomon Islands in 1984 by PIDP and INTERTECT, deciding that they were more appropriate to permanent and semi-permanent housing and not directly applicable to the methods and materials used in traditional housing.³⁴ The team recommended use of an educational curriculum designed specifically for the rural villages of the Solomon Islands.

Their overall recommendation was to bring in sago palm from local resources and have the Solomon Islands Development Trust, which had already established a village-based disaster preparedness program, conduct a builder education program that would stress vulnerability reduction and traditional building methods. It was recommended that the FSP and World Vision sawmill program be functionally and operationally independent of the housing education/training program so that the schedule and goals of those programs did not conflict.

B. Rural Housing Rehabilitation Program (RHRP)³⁵

In response to Cyclone Namu, the RHRP was implemented by the National Disaster Council under the Ministry of Home Affairs and three NGOs: IHAP (International Human Assistance Programs), FSP (Foundation for the Peoples of the South Pacific) and SOLTRUST, an off-shoot of the Solomon Islands Development Trust. The RHRP received its major funding from OFDA, EEC and UNDP.

Collectively these five groups -- IHAP, FSP, SOLTRUST, UNDP and the RHRP management -- made up the core of the management committee. Additional input into the management committee was provided by World Vision which was conducting an independent sawmill program and the Seventh Day Adventists who were distributing relief supplies, such as food, tents and some building materials, to church members.

The RHRP manager, under the direction of the Ministry of Home Affairs, coordinated the overall program which had five major components:

- **Sago palm distribution.** The palms were used for roof and wall cladding for traditional houses. The government arranged for boats to deliver shipments of sago palms to Malaita from other islands unaffected by the cyclone. Three shipments were delivered.
- **Walk-About Timber Sawmill.** FSP implemented a program to provide portable sawmills to affected areas so that fallen timber could be sawn and used for housing reconstruction. Training was also provided for sawmill operators.
- **Roof Sheet Distribution.** The NDC received funding from the EEC to purchase galvanized metal roof sheets for distribution. RHRP records indicate that a total of 77,000 metal roof sheets were purchased for distribution to families targeted for assistance. Each family was to receive 22 sheets and nails.
- **Public Awareness Campaigns.** SOLTRUST and FSP worked with the Builder Education Program to promote disaster preparedness and explain the RHRP to affected villagers. The Solomon Islands Broadcasting Corporation (SIBC) broadcast information on the rebuilding program. Fact sheets related to the program were distributed.
- **Housing Education/Builder Education Program.** IHAP was responsible for Builder Education Program coordination. An ILO technical training advisor was funded by UNDP to prepare and conduct builder training. Fourteen two-person demonstration teams were trained to conduct workshop sessions and lead discussions with the general public about cyclone resistant rebuilding. Training eventually focused on both traditional housing and construction using sawn timber and metal

roof sheets (semi-permanent construction). Demonstration houses were constructed in a number of villages, primarily on Malaita.

Exact details of the financing of the RHRP were not available to the consultants. A Local Materials Building Council (LMBC) was reportedly formed by the government to make recommendations about materials to be used in reconstruction. No records were available about their work and no evidence of their current existence was found during this study. The choice of building materials used appears to have been highly influenced by donor contributions. The EEC financed metal roof sheets; U.S. assistance was directed towards the Builder Education Program and the activities of IHAP and FSP.

By June 1988, a director's management report from the RHRP files revealed that the program was beset with a number of problems, such as:

1. There was an inaccurate village expectation that sawmills would produce enough timber to rebuild every house.
2. People were unwilling to use a combination of bush materials, sawn timber and metal roof sheets on their homes.
3. The RHRP needed to effectively communicate that people should rebuild together and not wait for someone else to organize the community.
4. The government and donors expected people to rebuild quickly. Delays would affect future cyclone rehabilitation projects in those areas, and this needed to be communicated to the affected areas.
5. Builder education workshops were too dependent on the availability of donated materials. Delays in the distribution of materials were creating problems for the implementation of workshops.

Once these problems were recognized, some changes were made in the Builder Education Program to reflect village rebuilding needs. Villagers were encouraged to begin rebuilding with the materials available to them rather than waiting for additional materials.

The RHRP ended when funding was exhausted in February 1989. Although a great deal of effort was expended and expectations had been raised, very few houses had been reconstructed in the manner envisioned by the RHRP. We were told by the NDC Manager that only 17% of the houses targeted for rebuilding were completed.

The reasons cited repeatedly in interviews⁵ for a lack of program success concentrated on the following points:

1. Insufficient attention was paid to the extensive rebuilding (using existing traditional materials) that had taken place prior to the RHRP start-up. The problems associated with introducing new building techniques and materials -- specifically sawn timber framing and metal roof sheets -- were not anticipated. Not only were the materials and techniques unfamiliar, but villagers also resisted using these new materials for a portion of their homes.

If new materials and techniques were to be used, the village preference was for houses constructed completely out of new materials. This local preference was in complete variance with the RHRP plan to provide new building materials and techniques to be used in conjunction with traditional building materials. Towards the end of the program, the BEP offered training either for traditional or semi-permanent housing.

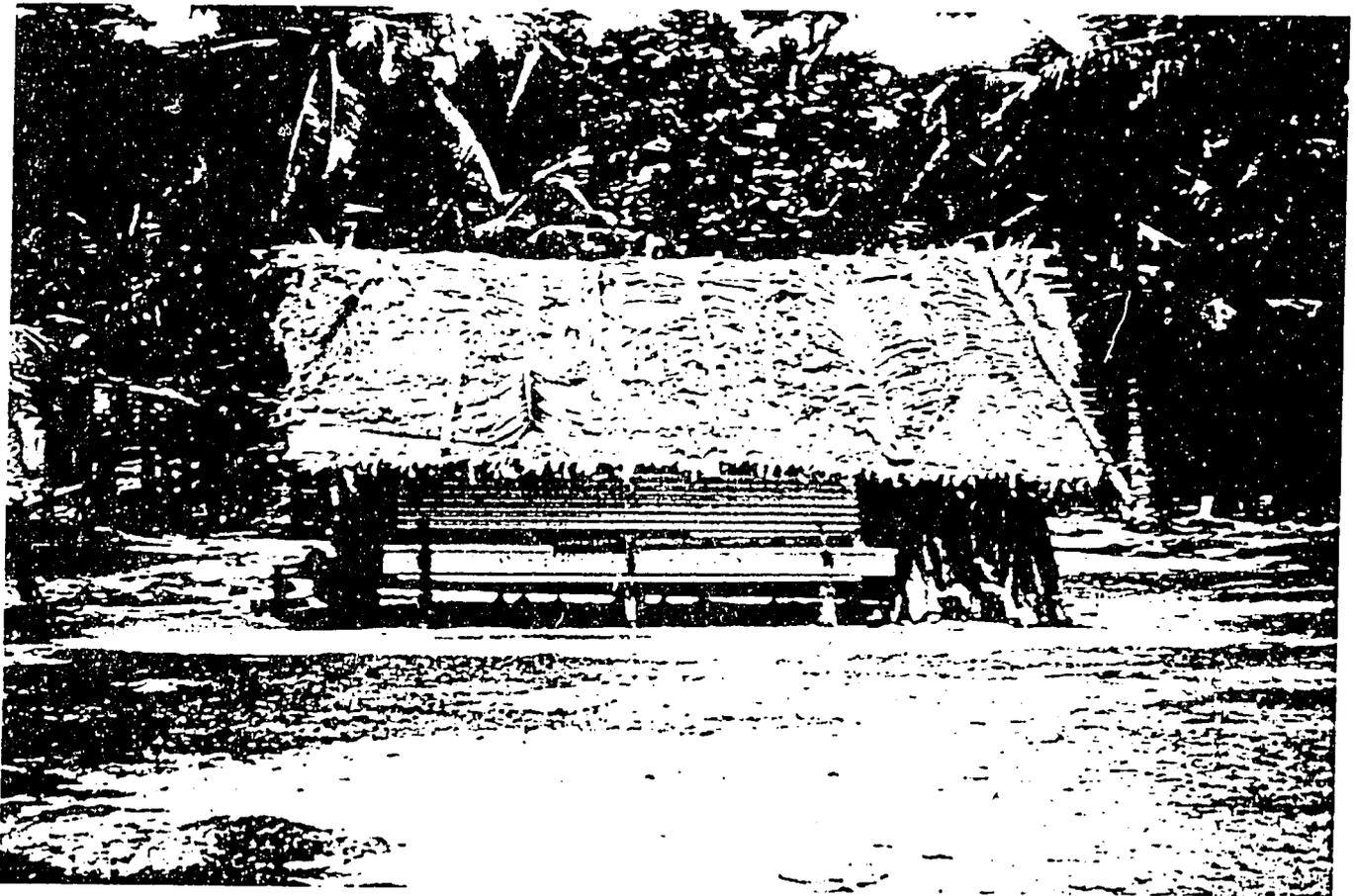
2. The use of fallen timber and portable sawmills was not well thought-out. Not only was the issue of introducing a new material (sawn timber for framing) not adequately planned for, but the very sensitive issue of land and timber ownership was not foreseen. The "right" to use or access fallen timber was not assured and there were some local village problems when efforts were made to access the timber. The placement and building of demonstration houses was also a contentious land ownership matter. Village chiefs sometimes expected to receive replacement houses whether they needed them or not.
3. In this type of rehabilitation program where a number of component projects -- sawn timber production, public awareness, delivery of building materials, builder education -- must operate in a very coordinated fashion to maximize desired goals, timing becomes unforgiving. A major problem for the RHRP was related to timing: metal roof sheet delivery did not always coincide with village builder education programs. Sometimes training would take place with insufficient building materials. Sawn timber production was beset with its own production and delivery problems. When related and dependent sub-projects get off schedule, the whole project and its components can suffer.
4. The Manager of the National Disaster Council summed up some of the RHRP problems -- such as timber and land ownership issues, the problems with materials delivery, misread village expectations and the value of a builder education program targeting semi-permanent (a combination of traditional and new building materials and techniques) structures -- as being a result of not having taken into consideration "... a whole lot of complicated issues". He concluded, "only 17% of houses targeted after Namu were rebuilt. Political influence hampered the overall effectiveness of the program. The right issues must be targeted."

Although the RHRP was not viewed in retrospect as a particularly successful reconstruction program, the Builder Education Program does continue to have some positive

impact on rural village building. Discussion of these results is included in the following sections on Builder Education Programs and Sustained Mitigation Practice.

FIGURE 3:

TRADITIONAL HOUSE WITH METAL ROOF SHEETS
FROM THE CYCLONE NAMU PROGRAM -- FIVE YEARS LATER



BUILDER EDUCATION PROGRAMS

1. PIDP/INTERTECT

In 1983-1984, AID/OFDA and the U.N. Centre for Human Settlements (UNCHS), with the Solomon Islands Government, funded a housing vulnerability analysis followed by a series of cyclone-resistant construction workshops. The vulnerability analysis report was entitled "Improvement of Low-Cost Housing in the Solomon Islands to Withstand Natural Hazards". The workshops were conducted jointly by INTERTECT, PIDP and a consultant funded by UNCHS.

The initial 1984 workshop brought together government and non-government representatives involved in housing issues. The consultants and workshop participants made a number of recommendations for overall vulnerability reduction. The major points made were that the NDC should have a leadership role in promoting mitigation within and outside the government, that there was a need for developing improved training curricula, and that public awareness programs should be fully utilized to promote safety issues.

The workshop included the construction of a demonstration house in Guadalcanal as a training exercise for government agencies involved in housing construction and reconstruction. Additionally, several illustrated manuals were designed by INTERTECT for use in builder education workshops. A series of rural workshops were held to increase public awareness of cyclone-resistant building techniques. SIDT mobile team members were also trained during this time.

In terms of **sustainability**, the PIDP/INTERTECT effort was the initial vulnerability reduction study and training conducted in the Solomon Islands and its impact continues today. Government officials participating in the training included individuals from the Ministry of Transport, Works & Utilities (MTWU). Although this ministry is not actively involved in producing housing, they do impact housing design by producing architectural designs which incorporate disaster resistant building techniques. These designs are frequently used in urban housing and especially with homes that have public or private sector loans. On the other hand, the Ministry of Housing (MOH) was not in existence in 1984 and the Permanent Secretary indicated that no one who took the training was assigned to the MOH when it was formed. The MOH does not construct homes but does require approved building plans when MOH/HFC home loans are used.

The vulnerability study and its findings are remembered, although no one we saw was able to produce a copy of the document. However, more importantly, incorporation of disaster resistant building techniques into urban building codes has taken place. A great deal of support in this direction has come from AIDAB and AODRO and from the lobbying of the local NGO, Hybrid Technology. The PIDP/INTERTECT initiatives marked the first movement in this direction, but follow-up by other groups led to this achievement.

The most vulnerable housing in the Solomon Islands is rural and outside the realm of urban building codes; the benefits of building codes will more than likely never extend to these homes. The 1984 training, especially the training manuals featuring local materials, techniques and language, has surfaced in other builder education projects, most notably the RHRP post-Cyclone Namu rebuilding/builder education activities.

During this field study, we saw rural housing that had been and was being constructed with disaster resistant building techniques. Village carpenters, trained by the RHRP/BEP, recalled the training, showed us their improved homes, and in some cases were able to produce the training documents. They believed in the practices and remained in the villages to continue and promote disaster resistant building techniques. Although Malaita has not suffered from a major cyclone since Namu, very strong windstorms have impacted the islands and improved houses fared well in these storms. In this regard, the 1984 training has been sustained because it was localized and it dealt with the building materials and practices in place at that time and today.

2. Solomon Islands Development Trust

The SIDT conducts rural educational programs. SIDT was established in 1982 by FSP as a way of lessening reliance on expatriate development organizations. SIDT maintains "mobile teams" in the rural areas. A field officer will train and manage from 4 to 20 two- and three- person mobile teams. Nationwide SIDT maintains a network of 300 mobile team members.

In the aftermath of Cyclone Namu, SIDT focused on disaster awareness and preparedness. From 1987 to 1989, cyclone resistant construction education was one component of their village disaster preparedness education. These efforts targeted mitigation measures for traditional houses in Malaita, the province primarily impacted by Cyclone Namu. SIDT had participated in the 1984 PIDP/INTERTECT training and used the INTERTECT illustrated cyclone resistant construction manuals as a basis for their village education program. Several follow-up village workshops were conducted by SIDT after the initial PIDP/INTERTECT workshops. There is some memory on the village level of that training.

Particularly crucial for **sustainability**, as a well-established, respected and effective local NGO/development agency, SIDT has taken the message of disaster preparedness and disaster resistant building techniques to the most vulnerable areas: the rural villages. They focused on the most vulnerable types of housing and targeted individuals who had and would be involved in village building. The training made use of locally-adapted resources (i.e., the 1984 training manuals) and was conducted by a group already accepted on the village level.

The SIDT training, unlike the RHRP/BEP training, did not have the burdens of introducing new building materials and being associated with a problem-beset housing rehabilitation program. What has been sustained from the SIDT training is the memory and

implementation of improved building techniques, primarily because the message was valid and the messenger well-known. Disaster preparedness training continues to be a part of SIDT village education programming.

3. Rural Housing Rehabilitation Program/Builder Education Program 1987-1989

A post-Cyclone Namu Builder Education Program was conducted as a major part of the Rural Housing Rehabilitation Program. The program was designed to reach builders in the rural villages of Malaita and Guadalcanal that had experienced significant housing damage during Cyclone Namu. Given the extent of damage, Malaita was the principal focus. Two-person housing education teams were formed to implement the program. Local carpenters were hired to be Housing Extension Officers (HEOs).

Technical assistance was solicited from the private sector (architects and contractors) as well as the public sector to develop a two-week training course for tradesmen hired to demonstrate cyclone resistant construction techniques. The education program was organized to take place in the form of workshops in rural villages. Initial information meetings were held with village representatives to discuss the RHRP program goals, the workshop location content and requirements.

Workshops were designed to have two components. The first was a general public awareness discussion that used the PIDP/INTERTECT illustrated manuals as a public awareness resource and curriculum guide. The second component was hands-on construction of a demonstration house. Originally a demonstration house was to have been built in each targeted village using sawn timber provided by the portable sawmills and metal roof sheets that were part of the housing rehabilitation program. Difficulties with the availability of these materials often prohibited the housing education teams from building demonstration houses. Instead repairs were made to traditional houses as a method of demonstrating cyclone resistant techniques.

A second round of workshops was conducted in late 1987-88, after materials had been received in many villages. The focus of the workshops was to demonstrate how to build safely using a mixture of traditional bush materials and permanent materials such as metal roof sheathing. At the end of the program, the HEOs were conducting workshops aimed specifically at village carpenters. These workshops involved a number of local carpenters from different villages who were trained collectively at central locations. A technical advisor, financed by UNDP and ILO, was hired in 1987 for the duration of the program to manage and train the HEOs.

In July 1988, the training was revised to reflect the realities that the HEOs were facing in the field. Families targeted to receive assistance were given twenty-two 8' x 3' corrugated iron roof sheets. It was apparent that the HEOs needed home designs to match that roof size. Additionally the designs needed to accommodate the different types of floor

and wall framing used, including traditional materials. The ILO Technical Advisor devised three separate house designs, each incorporating cyclone resistant construction techniques.

One design was based on a home framed totally from sawn timber. A second design was a "semi-permanent or transitional" design in that it used a combination of bush and sawn timber framing. The third design was based on total use of bush materials for floor and wall framing. All designs would be topped with the 22 sheets of donated C.I. roofing. In this way the HEOs could make progress towards the goal of rebuilding with whatever combination of wall and framing materials the family had accumulated. Approximately 600 workshops were conducted over the two-year period.

FIGURE 4:

DEMONSTRATION HOUSE IN S. MALAITA, BUILT IN RHRP PROGRAM



FIGURE 5:
DEMONSTRATION HOUSE, S. MALAITA -- FRAMING DETAIL

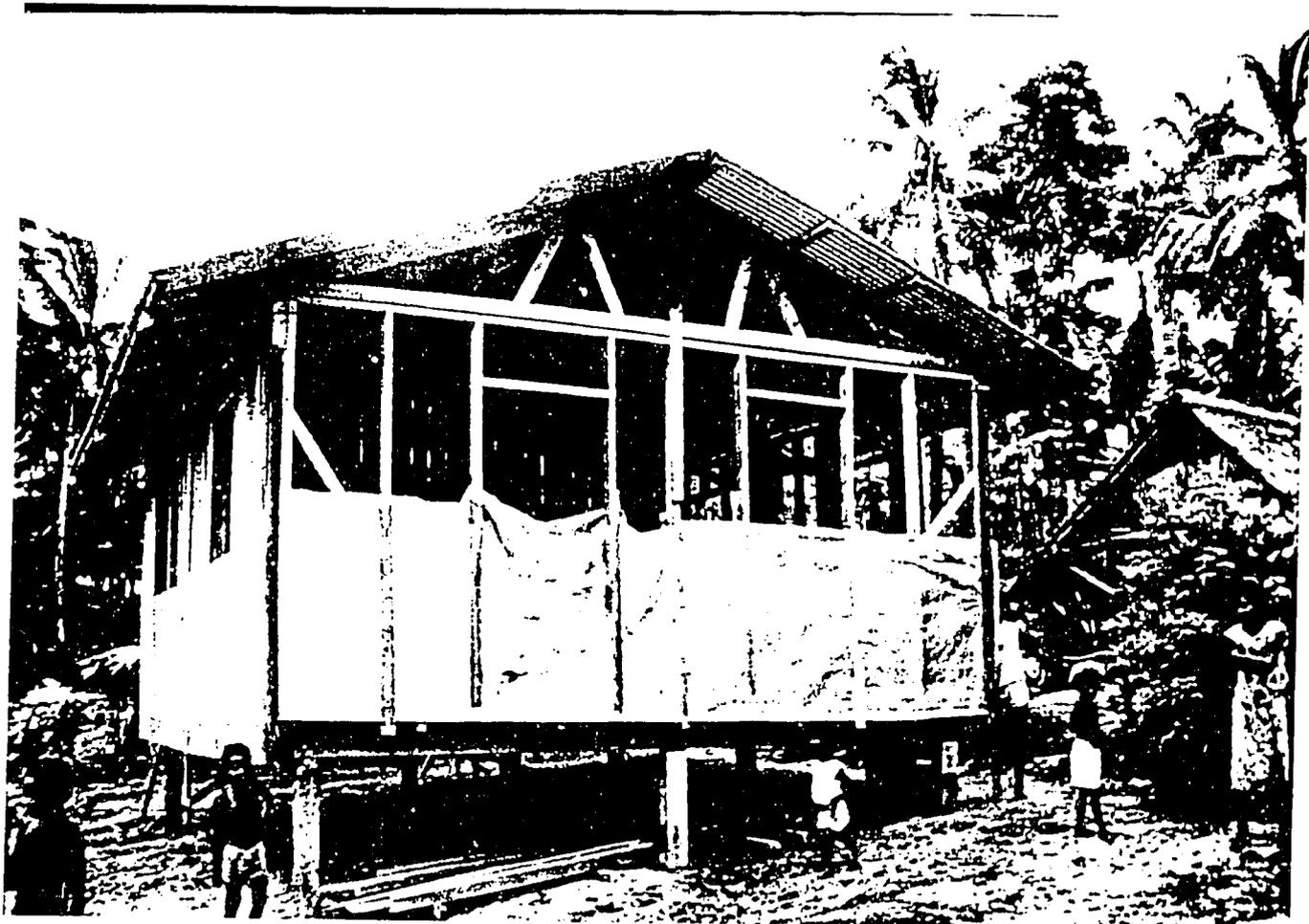
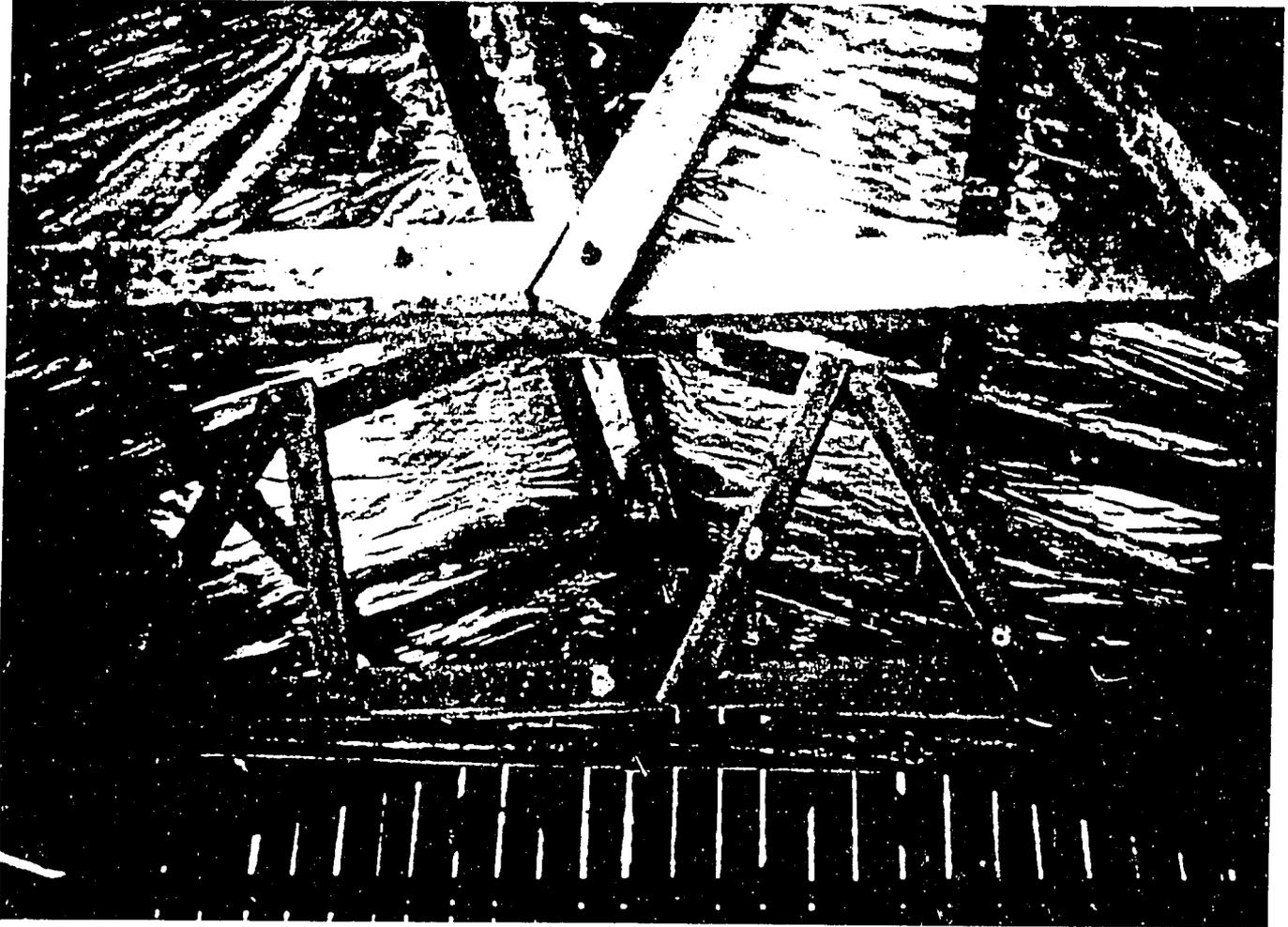


FIGURE 6:

DEMONSTRATION HOUSE, S. MALAITA -- ROOF DETAIL



With regard to **sustainability**, within government and NGO circles, the Builder Education Program component of the RHRP is remembered more favorably than the RHRP. The training materials used are still available and the BEP management personnel are still in the Solomon Islands involved in other development activities. The overall experience and lessons learned should inform future rehabilitation activities.

The NDC in its Cyclone Nina (January 1993) aid requests wants to implement a housing rehabilitation program in conjunction with a builder education program. The choice of building materials remains unknown and will more than likely be determined by the international aid available.

In field observations, we saw evidence of homes constructed with cyclone resistance in villages where RHRP/BEP training had taken place. The memory of the training exists and some of the HEOs remain in the villages and are still actively involved in building homes. One villager proudly displayed his training manual. The training in this respect has been sustained; however, we saw a good bit of stored sawn timber and metal roof sheets. Some village leaders commented that some houses built during the RHRP were not built well because they were only temporary homes as villagers awaited donated permanent building materials which never arrived. In this regard, the training suffered from "guilt by association" with a flawed housing rehabilitation program.

4. Hybrid Technologies

Hybrid Technologies is a non-profit construction and design research organization in Honiara. Hybrid Technologies has developed a prototype house that utilizes traditional construction materials built with both cyclone and earthquake resistant techniques. Innovations in framing and joint construction, referred to as "basketweave" construction, increase the strength of traditional houses.³⁷ Construction of the prototype house was funded by AODRO.

Rural classroom buildings were designed by the Ministry of Education using this technique with sawn timber. Classrooms were constructed in Bellona and withstood the recent Cyclone Nina which destroyed 90% of the housing stock in January 1993.

Hybrid Technologies pursues funding from various sources to continue research, provide training and sponsor the construction of cyclone/earthquake resistant buildings. In 1988, Charles Boyle was funded by AODRO to produce a handbook of guidelines entitled "Disaster-Resistant Construction for Traditional Bush Houses", a publication that references the 1984 PIDP/INTERTECT materials among others. Within the Solomon Islands development community, and most especially the DSE, Hybrid Technology is recognized as the leading NGO voice for disaster resistant building practices.

In terms of **sustainability**, Hybrid Technology has become recognized as the NGO committed to disaster resistant building in part because they are local and a permanent entity.

The information they offer is on-going and very specific rather than being solely associated with a disaster housing rehabilitation project. Hybrid Technology draws from professional expertise (Pacific Architects, Ltd.) coupled with the grassroots focus of an NGO development agency. The distinction between Pacific Architects and Hybrid Technology does sometimes become blurred; when asked if the NDC made use of the Hybrid Technology resources, the NDC Manager responded that they had to be purchased.

What is clear is recognition on the part of both the government disaster response community and the NGO community that a local group exists and is very committed to the promotion and provision of disaster resistant construction technology, especially focusing on vulnerable traditional housing construction. Hybrid Technology gives a home to resources promoting disaster resistant building techniques that is permanent, non-political and close to the most vulnerable housing sector.

5. College of Higher Education, Industrial Trades Development

Formal college-level construction training for carpenters and masons is provided through the College of Higher Education, Industrial Trades Development. The College of Higher Education was consolidated with the former Honiara Technical Institute in 1992 to provide industrial training of the highest level available in the Solomon Islands. The four-year construction course includes one year of college training in preparatory subjects such as materials, blueprint reading, drafting, carpentry and masonry skills. The second year comprises 6 months of job placement in the construction industry and 6 months at the college. The third year involves full-time employment in the field. The fourth year includes 6 months in college and 6 months in construction employment.

While in college, students build structures on campus as models and buildings used by the college. Cyclone resistance is stressed and demonstrated in the models and buildings constructed. An AIDAB-funded design manual is the primary reference document used. When asked why that document was preferred, an instructor informed us, "...that's where the money comes from". Particular emphasis is placed on grading and drying lumber as this has caused problems in semi-permanent and permanent home construction. The instructor we spoke with stressed that, as more and more Solomon Islanders moved towards semi-permanent and permanent housing, the desire for cyclone resistance would be increased. Course completion is dependent on passing tests which do require knowledge of disaster resistant building techniques.

Formal construction training plays an important role in **sustainability**. The CHE/ITD program provides the highest technical training for construction in the Solomon Islands. Students come from all over the country to take the course. Living in Honiara gives them the best opportunity to access higher-paying private sector employment. While working in Honiara, they build disaster resistant homes because of financing and code requirements. Many return to the provinces to build homes that reflect the advanced building skills they have learned. Graduates of the school who do build in the villages can transfer

knowledge to the village level and sometimes provide employment in the process. The Australian model is the primary source of their information about cyclone resistance.

6. Ministry of Commerce, Trades & Testing Division

The Ministry of Commerce offers short courses in construction through the Trades & Testing Division. Students are recruited from local Honiara industries, Honiara-based "school leavers", and the provinces. The construction course is taught by Francis Sene who participated in the 1984 PIDP/INTERTECT training; he also assisted in the building of the demonstration house. He was asked by the ILO Technical Training Advisor of the Cyclone Namu RHRP/BEP to recommend suitable carpenters and help train them as Housing Extension Officers.

Training for carpenters is either for 2 weeks, 3 weeks (intermediate) or 5-6 weeks (an advanced supervisory course). The 2-week course is very basic and does give students some exposure to cyclone resistant building techniques. The intermediate course is for students who are already employed and they and their employers want their skills improved. The advanced course deals with technical and supervisory issues. Both the intermediate and advanced courses have final tests which require knowledge of disaster resistant (primarily cyclone resistant) building techniques. Intermediate and advanced courses are taught in Honiara and occasionally in the provinces.

Regarding sustainability issues, this training, and its instructor, have benefitted directly from previous builder education programs, specifically the 1984 PIDP/INTERTECT training, the RHRP/BEP training, and information provided by AIDAB through its Solomon Islands construction design manual. Mr. Sene's experience with builder education programs should be of value for future programs. He is an example of the type of individual who should be identified for vulnerability reduction training; his influence in the housing process is long-term.

With one of the TTD courses targeted for the unemployed, there is an opportunity to influence the non-formal housing sector. Students trained in Honiara have the opportunity to improve their skill level with private sector employment and to transfer their knowledge to the provincial villages when they return home.

7. Rural Training Centers

There are 20 Rural Training Centers throughout the Solomon Islands. These are NGO training centers which emphasize locally-needed skills such as agriculture, fishing and carpentry. The Peace Corps has placed three volunteers in Rural Training Centers, none of whom is currently involved in building skills development. The RTCs have worked with SIDT in the past, providing disaster preparedness and building information training.

From the perspective of **sustainability** issues, the Rural Training Centers are most valuable to vulnerability reduction training in their proximity to the most vulnerable housing type: traditional housing. Because they are already in place and are rurally-based, they offer a good "home" for community-based initiatives. These centers are well suited for use in future rehabilitative or preventive building training programs.

SUSTAINED MITIGATION PRACTICE

1. **Field Survey: Permanent Housing**

An impressive amount of permanent housing has plans drawn by registered architects or experienced draftsmen which include provisions for good foundation, wall and roof construction. Collectively, this is a result of local experience with cyclones, most recently and significantly with Cyclone Namu. Prior to Cyclone Namu, disaster resistant construction was not in wide use in either the private or the public sector.

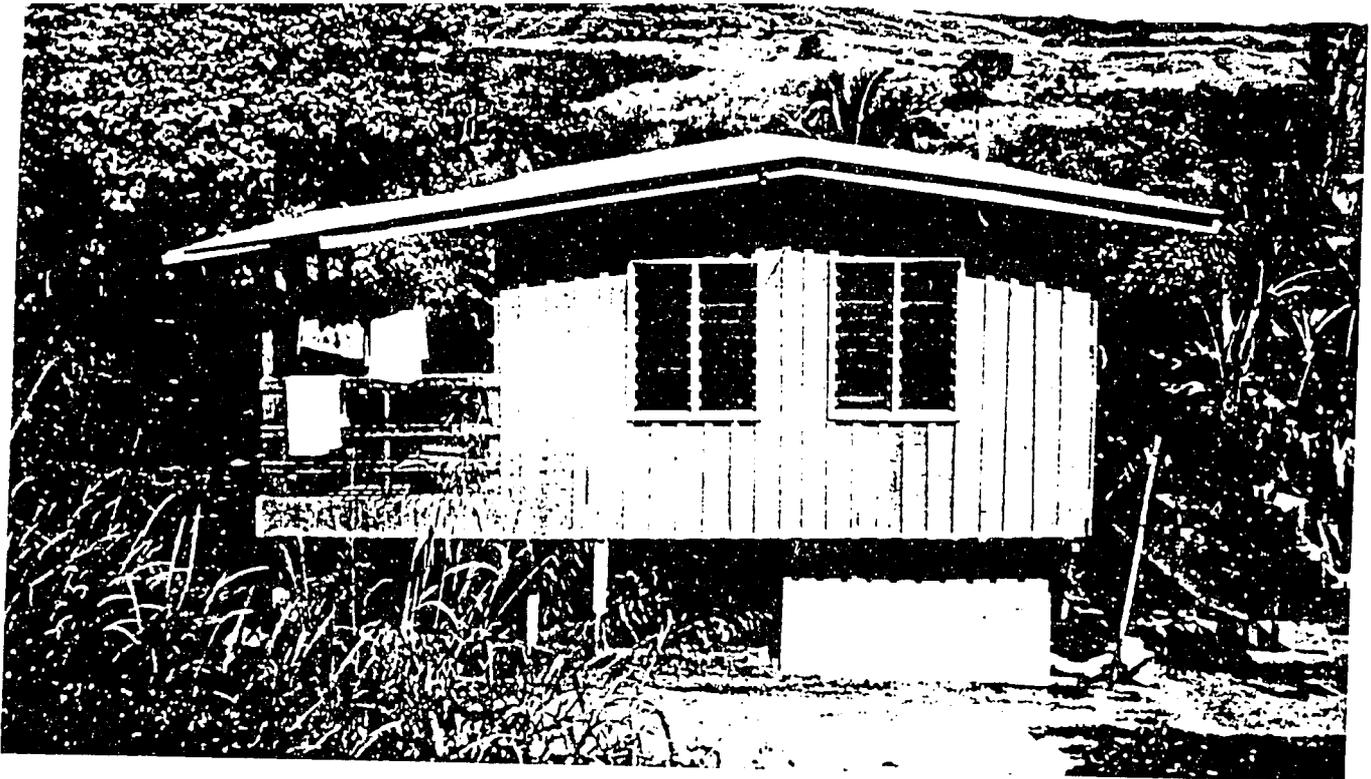
In the aftermath of Cyclone Namu, the Australian International Development Assistance Bureau (AIDAB), in conjunction with the Solomon Islands Government, sponsored a joint project to develop a national building code and housing design standards specifically for cyclone and earthquake resistance. Although the code has not been adopted as a national standard, the design manual is used as a practical reference for private and public sector architects and draftsmen.³⁸

Local architectural firms have become sensitized to the need for incorporating mitigation into all building design projects. One local firm, Pacific Architects, Ltd., specializes in disaster resistant architectural design. This firm is also used as a resource for government housing initiatives during disaster response. They are recognized locally as the principal private sector advocate of cyclone resistant design. Pacific Architects has developed several low-cost house designs incorporating cyclone resistant construction techniques. These standard plans are available to the general public.

In the public sector, the Ministry of Transport, Works & Utilities (MTWU) has been responsible for developing the majority of both public facilities and public housing designs. The architectural division within the Ministry routinely incorporates cyclone resistant construction details in their plans and specifications. The Ministry also inspects construction projects to ensure conformity to the plans.

The overwhelming proportion of permanent housing is built in and around Honiara by contractors who are experienced in building with plans that include cyclone resistance. Cyclone clips, braces and connector plates are readily available at local building supply houses.

FIGURE 7:
PERMANENT HOUSING



The Honiara Municipal Authority, through its Town Council, regulates housing construction and site development on privately-owned lots within Honiara. The national building code and the home construction manual are used as references in the plan approval process. Cyclone strapping and bracing are specific elements for review. In addition to government requirements, the major lending institutions require municipally-approved house plans.

Permanent housing outside Honiara does not receive the same review process. There are no construction standards related to cyclone or earthquake resistance in force in the provinces.

The construction industry in Honiara is generally highly formalized and accustomed to working with engineered structures. A growing number of carpenters and contractors in the Honiara area have received formal training from the Industrial Trades Program of the College of Higher Education. The four-year carpentry curriculum includes cyclone resistant construction methodology, primarily focused on strapping, bracing, reinforcing, framing and site preparation.

The houses that have this level of mitigation are those that were constructed after Cyclone Namu, were financed either by the public or private sector, and were constructed with a municipally-approved plan. There is other permanent housing in and around the Honiara area which may not include so much improvement, but any new permanent housing in Honiara dependent on a loan is exposed to this level of mitigation.

A prime example is areas falling within the sites and services program of the Ministry of Housing and the Land Commission, designated as "Temporary Occupancy Lands". In TOL schemes, families are permitted to build temporary, traditional leaf houses and gradually improve to permanent housing. The temporary housing is not subject to any approval process or permitting. However, in order to convert from temporary (rental) land tenure to titled (purchased) tenure, a permanent house must be constructed. Houses in these schemes may be built without any drawn plans. If a public or private loan is involved, a municipally-approved house plan must be used and construction inspected. Other urban lands that are communally-owned outside of the municipal authority do not have plan approval requirements.

In the course of this study, permanent housing construction sites in both the public and private sectors were inspected. The team found consistent use of cyclone resistant construction methods. Typical examples included cyclone resistant strapping and bracing as well as steel reinforcement in masonry walls.

2. Field Survey: Semi-Permanent Housing

Semi-permanent or "transitional" housing is constructed outside the formal sector. Although many of the same carpenters and tradesmen who work in the formal sector also build semi-permanent houses, the level of craftsmanship, quality, use of materials and supervision are all issues that affect the overall structural integrity of the house. Semi-permanent housing construction represents a significant proportion of the total home construction industry, particularly in Guadalcanal province. In addition to skilled labor resources, a large proportion of the houses may be constructed by family members or *wantoks*. This labor is largely unsupervised and is inconsistent in quality. Since semi-permanent construction represents a transitional form that mixes traditional building materials gathered from the forest (such as bush poles and sago palm leaf for wall and roof cladding) with more permanent materials (such as sawn timber for the roof and wall framing), there are no set standards for combining the two. There are many variations in both design and construction methodology.

Construction practice in this sector incorporates, to a limited degree, a number of cyclone resistant construction techniques. The most prevalent is the use of cyclone strapping or wire ties securing the rafters to the top wall plate. Additionally, some diagonal bracing is used in the wall corners. In villages where Cyclone Namu damaged housing and where housing rehabilitation workshops taught cyclone resistant construction techniques, there was a high degree of mitigation. Field observations in the rural villages that received builder education in cyclone resistant construction as part of the Rural Housing Rehabilitation Program revealed very little semi-permanent housing construction. Of the semi-permanent construction observed, the majority was constructed with materials donated or produced in conjunction with Cyclone Namu reconstruction programs.

The frequency and consistency of cyclone resistant construction techniques in other villages that were not affected by the cyclone is difficult to project. There are two main training programs that offer some limited exposure to cyclone resistant construction techniques for builders in the non-formal sector: the Ministry of Commerce TTD courses and training for village carpenters at the Rural Training Centers.

There are two primary issues associated with sustaining mitigation in the semi-permanent housing construction process. The first issue has to do with the relatively long time-span of construction and improvement of materials. A house is generally not perceived to be a "permanent" structure until late in the process. Cyclone vulnerability may not be thought about until the very end. The second issue is reaching a larger proportion of the non-formal sector builders with skills-upgrading training on a consistent basis. Many "bush" carpenters who are improving their housing have never had any formal training at all. Sawn timber construction requires another type of construction knowledge to build proper joints and framing.

FIGURE 8:

SEMI-PERMANENT/TRANSITIONAL HOUSE



FIGURE 9:
TRANSITIONAL HOUSE, MALAITA
(MIXTURE OF SAWN TIMBER AND BUSH MATERIALS)

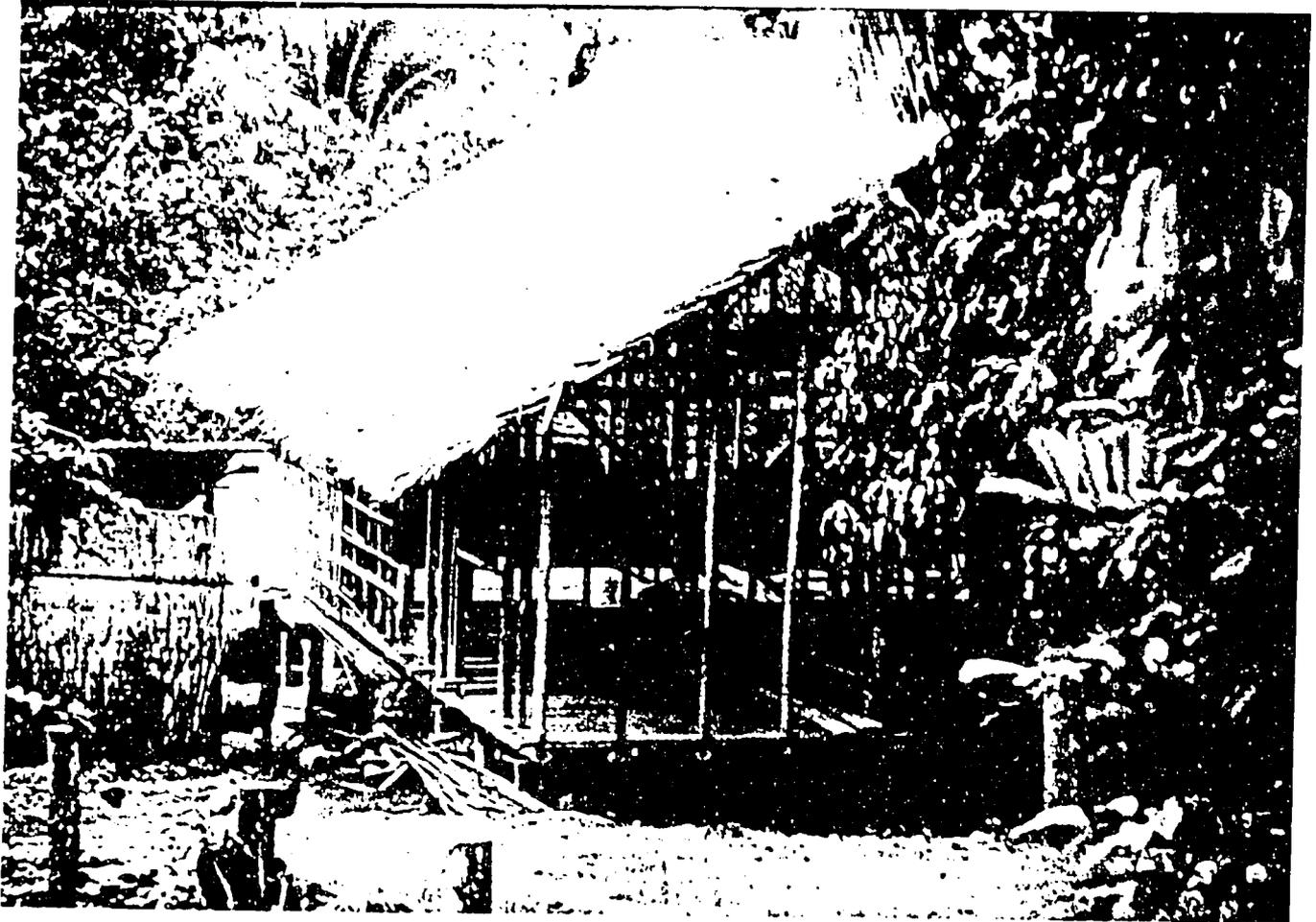
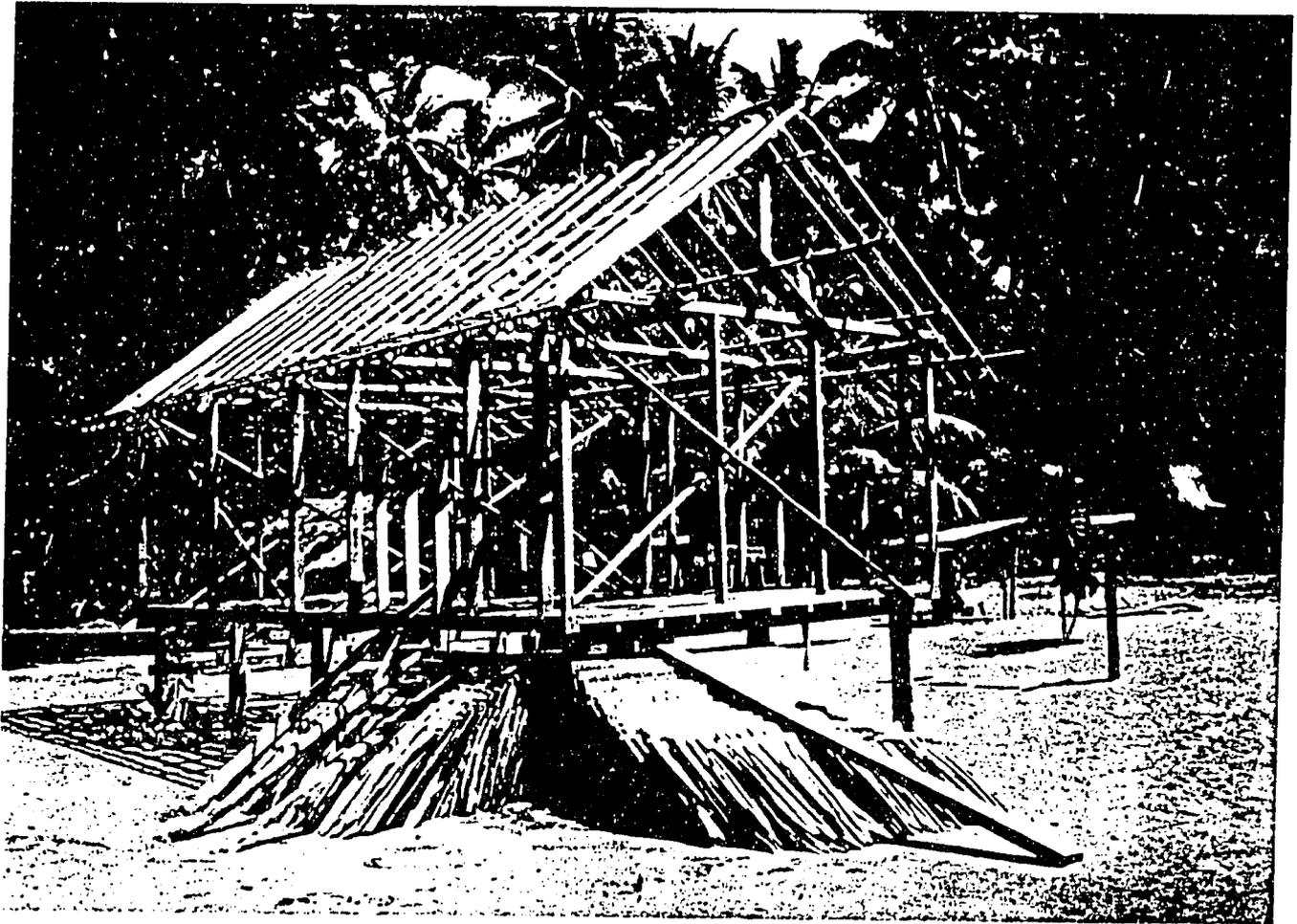


FIGURE 10:

TRANSITIONAL HOUSE FRAME -- SAWN TIMBER WALL FRAME,
BUSH POLE ROOF FRAME, LEAF SIDING



3. Field Survey: Traditional Construction

Traditional housing represents the largest and most vulnerable portion of housing stock in the Solomon Islands. Eighty-five to 90% of all land in the Solomon is communally-owned and, of that communal property, the overwhelming percentage is constructed using traditional materials. There is no appreciable difference in style in urban versus rural traditional housing stock.

In field observations of villages affected by Cyclone Namu and provided with building education programs, there appears to be a high degree of awareness of cyclone resistance issues and implementation of some of the associated techniques. Builders who participated in the training programs (1987-1988) actively promote and utilize some of the methodology learned.

The most visible cyclone resistant construction practice is the use of handmade metal cyclone straps between the posts and the top beam. Another technique seen is improved lashing of roof rafters to the main structure. This technique was traditionally very strong but had been replaced in recent years by the use of nails. Typically the nailed joints are much weaker and were observed to be a primary cause of failure in the wake of Cyclone Namu.

An additional issue is the current availability of traditional lashing and suitably-aged bush poles and leaves. This relates both to the destruction that occurred from Cyclone Namu and the current logging practice of clear-cutting lands adjacent to the villages, making traditional materials harder to access. Field observations indicate that the donation of metal roof sheets and, to a limited degree, sawn timber has raised the expectations of villagers. The predominant view in these villages is that some day families will construct houses using "permanent materials". This expectation has affected the quality of construction using traditional materials. These structures are now viewed as temporary houses until the permanent houses can be built.

The reality of village economics (in general, not cash-oriented) prevents the vast majority of villagers from obtaining permanent building materials. Furthermore any permanent housing requires maintenance and material replacement, such as metal roof sheets, that is once again beyond the capabilities of most village families.

In the villages visited during this study, it was abundantly clear that donated metal roof sheets had not been installed as envisioned. The families are unable to purchase additional permanent building materials, such as sawn lumber, to rebuild their houses. Additionally, villagers will not use what is perceived to be a permanent roof cladding on traditional bush framing. Therefore the issue of sustainability for cyclone resistant construction in the traditional building sector depends upon the commitment of villagers to traditional housing. There is strong sentiment among the villagers interviewed to move towards permanent building materials.

It should be noted, however, that as villagers begin to construct using permanent materials, other issues related to traditional relationships between village chiefs and village residents emerge. For example, land tenure appeared to be a frequent issue associated with the improvement of housing using permanent materials, but it was not as serious an issue so long as the house was constructed using traditional materials.

Given the impressive number of villagers aware of cyclone resistant construction from past builder education and public awareness programs, and the frequency of cyclone resistant construction techniques now in use within those affected villages, continued training and public awareness programs should achieve a high degree of success.

FIGURE 11:
TRADITIONAL HOUSE



FIGURE 12:
TRADITIONAL ROOF/WALL FRAMING DETAIL



FIGURE 13:
TRADITIONAL LASHING



FIGURE 14:
TRADITIONAL LASHING WITH SOME NAILING

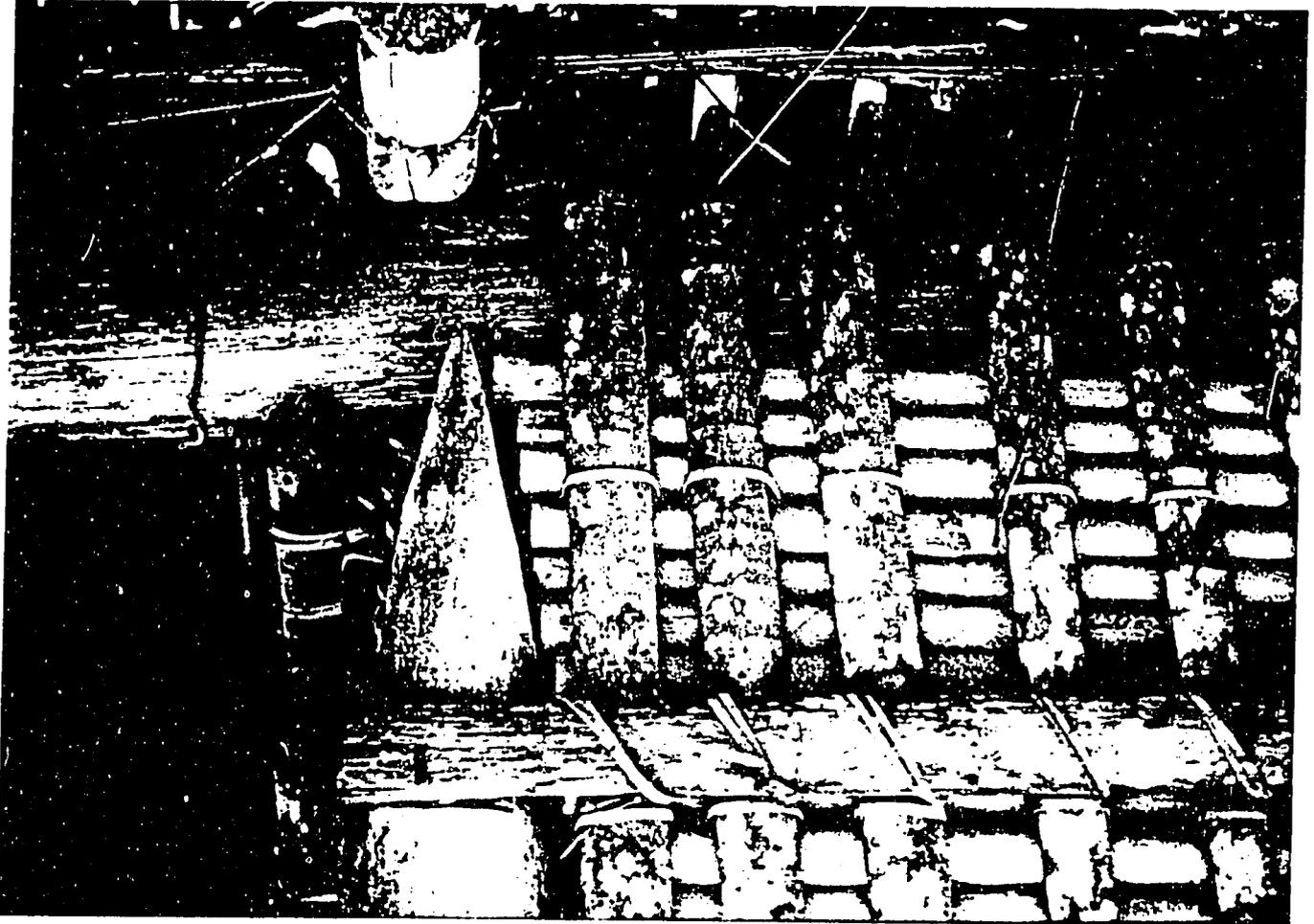


FIGURE 15:

CYCLONE STRAPPING ON TRADITIONAL HOUSE



INSTITUTIONAL SUSTAINABILITY

1. Government

The Solomon Islands Government has shown progress towards improving vulnerability reduction initiatives. Improvements have taken place in urban building codes and financing requirements which require and enforce code compliance. Insurance must be carried on loan-financed homes.

A construction design manual, produced with bilateral Australian assistance, has been fully incorporated into college and trades-level curricula. The design manual is touted as the future nation's code, although currently unadopted. A National Disaster Plan is in place which refers to preventive measures. The NDC Manager is on the Solomon Islands Broadcasting Station schedule weekly discussing disaster preparedness.

Considerable progress has been made in the ten years since the 1983 vulnerability reduction analysis. Unfortunately this institutional progress is limited to permanent housing in the urban areas of Honiara and, to a much lesser extent, in the provincial capitals.

Urban building codes, financing requirements and curriculum improvements are in place. Memory of vulnerability reduction training remains and is renewed from time to time when input is needed for disaster housing programs. Unfortunately, the ability of the National Disaster Council to facilitate the integration of vulnerability reduction measures into line ministry planning is not measurable. Severe economic stress has caused the government to be far more concerned with receiving outside aid and loans than with planning and protecting its own resources.

In the rural (majority) areas of the Solomon Islands, the benefits of the government's commitment to vulnerability reduction can be seen in improved building techniques and training that have been transferred back to the villages; individuals who are trained in disaster resistant building techniques in Honiara, either in a school or at a work site, may take that knowledge with them to use in the villages. It is unlikely that any type of formalized building code will ever impact rural, non-formal building practices.

2. Non-Governmental Organizations

The NGO community in the Solomon Islands has sustained and increased over a period of time their involvement and commitment to disaster preparedness and builder education initiatives. This improvement reflects the growth and maturing of the NGO community as a far more Solomon Islands-based group rather than one solely dependent on expatriate personnel and support. The growth is also based on their continuing emphasis on education and community-based initiatives. The Development Services Exchange (DSE) has strengthened the NGO community and increased their ability to coordinate services and planning.

NGOs such as SIDT, SOLTRUST and Hybrid Technologies have used available builder education resources, such as those provided by PIDP/INTERTECT and AODRO, and adapted them for their specific needs. Because these NGOs were so involved in the post-Namu rebuilding programs, their experiences can, if accessed, provide valuable guidance for future post-disaster housing programs. Because the Solomon Islands Government relies so much on NGOs for development and relief activities, continued involvement of NGOs in builder education programs is assured.

3. Private Sector

The private sector contribution to increased housing safety has primarily impacted formal, urban, permanent housing construction. Homes constructed by the private sector in the Honiara area are highly dependent on loan resources. Private and public lending institutions require professionally-produced building plans which must by municipal regulation include disaster resistant construction techniques. As long as private sector, permanent housing construction is fueled by home loans, new housing should be safer.

The private sector role in safer housing can reach the non-formal housing sector through improved building skills that employees transfer to their individual building efforts. To ensure that a long-term and very viable component of the housing industry is actively involved, the private sector should be included in any housing vulnerability reduction initiatives where long-term participants in the housing process are sought.

FINDINGS

1. General

- Formal-sector mitigation progress can over time transfer to the non-formal sector. Mitigation initiatives, especially training, should not focus primarily on governmental intervention but rather seek to identify members of the housing community likely to be involved in housing over the long run.
- The success of a post-disaster building training program is often determined by the success of the overall disaster housing assistance program. If the overall housing program is flawed -- for example, regarding the choice of materials or unforeseen local issues such as land tenure and timber ownership -- the builder training program can suffer.
- The most vulnerable housing is in the rural villages. Builder education should focus on how to improve traditional homes and how to build semi-permanent homes. If permanent building materials are available, villagers prefer to move towards semi-permanent housing. Semi-permanent houses require specific guidance in ways to

AID	Agency for International Development
BHM	Basic Health Management
NEIC	National Earthquake Information Center
OFDA	Office of U.S. Foreign Disaster Assistance
OIG	Office of International Geology
PMP	Prevention, Mitigation, and Preparedness Division
UN	United Nations
USGS	United States Geological Survey
WWERM	Worldwide Earthquake Risk Management Program

combine traditional and permanent building materials in order to increase disaster resistance.

- It has been suggested by individuals involved with the RHRP that village participation in the post-disaster rebuilding program would have been better if residents had been required to have more input into the program. Villagers could have been required to have all traditional materials gathered before metal roof sheets were delivered, for example. Villagers only received assistance rather than having specific rebuilding responsibilities or goals.

2. Institutional

- The movement of the government away from constructing homes may have improved housing safety by increasing the importance of financing requirements. When borrowed funds are involved, the demands for safer housing increase from the lending sector. Enforceable building codes must be present to protect investments. This improvement affects the permanent housing stock in the formal sector among urban, employed and titled landowners.
- To task the National Disaster Council with ensuring that preparedness and preventive measures are implemented among line ministries is unrealistic in view of the staff, resources and empowerment available to the NDC. The NDC is very committed to promoting vulnerability reduction but feels powerless to do so.
- Requests for development or disaster aid with mitigation assistance may be due to the combination of a desire for vulnerability reduction and a belief that funding applications may be more salable with their inclusion. Because the Solomon Islands is so dependent on foreign aid and so cyclone-prone, requests for post-disaster housing rehabilitation assistance that include builder education programs will likely continue.
- The institutional memory of vulnerability reduction initiatives is reasonably alive. Shifts in institutional roles have, however, reduced the potential for that knowledge being transferred to the public sector currently involved in housing policy. For example, because MTWU officials involved in the 1983-84 vulnerability study and training did not move to the MOH when it was formed, some of the awareness and knowledge gained during that period did not carry over to the ministry now concerned with housing issues.
- Two local NGOs -- SIDT and Hybrid Technologies -- offer ongoing support of disaster resistant building techniques and training, especially for traditional housing.

3. TECHNICAL

- Traditional builders in the non-formal sector respond to skills upgrading and training in improved techniques. Appropriate builder training has resulted in improved construction methods sustained over a longer period of time.
- With three major housing types -- permanent, semi-permanent and traditional -- housing education in the Solomon Islands must be designed to meet the needs of each housing type and the groups involved in providing that housing.
- Introduction of improved building methods must be based on local traditions and materials. Access to materials and familiarity with methods and design are important issues when conceptualizing builder education strategies.
- In the Solomon Islands, input from Australian organizations on building codes and design manuals has come from a long-term development relationship between the two countries, their reasonably close physical relationship and a very shared cyclonic threat.
- The disaster resistance now evident in the building curricula of the College of Higher Education and the Trades & Testing Division initially benefits formal-sector housing; in the long term, benefits may transfer to the non-formal building sector.

ACRONYMS

AID	U.S. Agency for International Development (also USAID)
AIDAB	Australian International Development Assistance Bureau
AODRO	Australian Overseas Disaster Relief Organization
BEP	Builder Education Program
CHE	College of Higher Education
DSE	Development Services Exchange
EEC	European Economic Community
FSP	Foundation for the Peoples of the South Pacific
HEO	Housing Extension Officer
HFC	Home Finance Corporation
GDP	Gross domestic product
IHAP	International Human Assistance Program
ILO	International Labour Organisation
ITD	Industrial Trades Development
LMBC	Local Materials Building Council
MOH	Ministry of Housing
MTWU	Ministry of Transport, Works and Utilities
MHA	Ministry of Home Affairs
MOC	Ministry of Commerce
NDC	National Disaster Council
NDMO	National Disaster Management Office
NGO	Non-governmental organization
NPF	National Provident Fund
OFDA	AID Office of U.S. Foreign Disaster Assistance
PIDP	Pacific Islands Development Program of the East-West Center, Honolulu
RHRP	Rural Housing Rehabilitation Program
RTC	Rural Training Center
SIBC	Solomon Islands Broadcasting Corp.
SICA	Solomon Islands Christian Association
SIET	Solomon Islands Development Trust
SIG	Solomon Islands Government
SIRC	Solomon Islands Red Cross
TOL	Temporary Occupancy Lands
TTD	Trades & Testing Division
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
WV	World Vision

ENDNOTES

1. U.S. Embassy 1992: 3.
2. U.S. Embassy 1992: 3.
3. U.S. Embassy 1992: 3.
4. U.S. Embassy 1992: 3.
5. Parker 1992: 1.
6. Countries of the World 1992: 1111.
7. Countries of the World 1992: 1112-1113.
8. Tiffany 1993: 18.
9. Tiffany 1993: 18.
10. Countries of the World 1992: 1112.
11. U.S. Embassy 1992: 5.
12. U.S. Embassy 1992: 5.
13. U.S. Embassy 1992: 5.
14. U.S. Embassy 1992: 12.
15. U.S. Embassy 1992: 12.
16. AODRO 1989: 11.
17. AODRO 1989: 12.
18. "Report on the National Disaster Preparedness Workshop" 1990: 16.
19. Parker 1992: 1.
20. "Report on the National Disaster Preparedness Workshop" 1990: 16.
21. AODRO 1989: 14.
22. "Report on the National Disaster Preparedness Workshop" 1990: 10.
23. AODRO 1989: 3.

24. Boyle 1988: 16.
25. Parker 1992: 1.
26. At the time of this study, specifics such as what type of building materials to request and use were still under discussion.
27. U.S. Embassy 1992: 13.
28. Robinson and Parker 1986: Appendix 1, p. 1.
29. Robinson and Parker 1986: 3.
30. Robinson and Parker 1986: 3-4.
31. Robinson and Parker 1986: 6.
32. Robinson and Parker 1986: 31.
33. Robinson and Parker 1986: 31.
34. Parker 1992: 6.
35. The RHRP is alternately referred to as the Rural Housing Reconstruction Program and the Rural Housing Rehabilitation Program. They are the same.
36. From interviews with the NDC Manager, the Director of the National Museum who did a study on rural housing rehabilitation after Cyclone Namu in Malaita, the ILO Technical Training Advisor, and a former IHAP official.
37. See Boyle 1989 article on basketweave construction.
38. Solomon Islands National Building Code and Design Manual 1989.

REFERENCES

- AODRO, "Report on the Second Disaster Preparedness Workshop for Non-Governmental Organizations", Honiara, Solomon Islands, 1989.
- Barrau, Jacques and Emile Massal, Food Plants of the South Seas Islands, South Pacific Commission, Noumea, New Caledonia, 1956.
- Bola, Joe, "Draft - UNDP/ILO Rural Housing Reconstruction Project SOI/87/006 (Solomon Islands) - Terminal Report", Honiara, Solomon Islands, November 1988.
- Bola, Joe, "Rural Housing Rehabilitation Program, Housing Extension Officers Upgrading Training Programme", prepared for RHRP, funded by UNDP/ILO, Honiara, Solomon Islands, September 1987.
- Boyle, Charles, "Case Study: Hybrid Technology/Pacific Architects", 1992 (draft for ODA Project).
- Boyle, Charles, Disaster-Resistant Construction for Traditional Bush Houses: A Handbook of Guidelines, AODRO, Australia, 1988.
- Boyle, Charles, "The Development of 'Basket-Weave' Construction", AODRO Newsletter, Vol. 7, No. 4, December 1989.
- Burhill, I.H., Dictionary of the Economic Products of the Malay Peninsula, Crown Agents for the Colonies, London, England, 1935.
- Countries of the World and Their Leaders Yearbook 1992, Gale Research Inc., Detroit, 1992.
- "Course Outline, Disaster Resistant Building Techniques", prepared by RHRP for training, Honiara, Solomon Islands, August 1987.
- Dodge, Charles, Descriptive Catalogue of Useful Fiber Plants of the World, U.S. Dept. of Agriculture, Office of Fiber Investigations, Washington, D.C., 1987.
- Dransfield, John and Natalie W. Uhl, General Lamarum: A Classification of Palms, Allen Press, Lawrence, Kansas.
- Goodwin, Bill, Frommer's Dollarwise Guide to the South Pacific, Prentiss Hall Press, 1988.

- Hamnett, Michael P. and Soane Hurrell et al, Reducing the Vulnerability of Housing to Natural Disasters: A Proto-type Program Developed in the Solomon Islands, Pacific Islands Development Program, East-West Center, Honolulu, Hawaii, June 1984.
- Hamnett, Michael P. et al, Regional Overview of Disaster Preparedness and Disaster Experience in the South Pacific, PIDP, East-West Center, Honolulu, Hawaii, September 1982.
- Honiara Municipal Building Codes, Honiara Town Council, Honiara, Solomon Islands.
- "How to Make Your House Strong", illustrated training manual prepared during RHRP Program, Honiara, Solomon Islands, no date.
- INTERTECT, "How to Strengthen a Solomon Islands House", PIDP, East-West Center, Honolulu, Hawaii, 1984.
- INTERTECT, "Mekem Haos Blong Iu Hemi Strong Fitim Sten Ap Insaet Saekloni", public awareness poster, PIDP, East-West Center, Honolulu, Hawaii, 1984.
- Margolis, Susanna, Adventuring in the Pacific, Sierra Club Books, San Francisco, California, 1988.
- National Disaster Council, "Report of the Technical Advisory Team on Cyclone Nina Damage and Proposed Rehabilitation Programme", Solomon Islands Government, Honiara, Solomon Islands, March 1993.
- National Disaster Plan, Solomon Islands Government, Honiara, 1980.
- National Disaster Plan, Solomon Islands Government, Honiara, 1987.
- Parker, Jean W., "Desk Study: Solomon Islands", J. Parker & Associates, Dallas, Texas, 1992.
- Reid, Robert K., "The Cost of War - Trouble on the Western Solomon Front, Islands Business Pacific, April 1993.
- "Report on the National Disaster Preparedness Workshop", Solomon Islands Government, Honiara, Solomon Islands, May 1990.
- Robinson, E.H. and Ronald S. Parker, "Post-Cyclone Shelter and Housing Rehabilitation Needs Assessment: Solomon Islands", INTERTECT for AID/OFDA, August 1986.
- Rural Housing Rehabilitation Program Files, MHA's storage files chronicling program from 1986-1989, Honiara, Solomon Islands.

Solomon Islands Development Trust, "Project Summary - Disaster Preparation/Village Development Program", proposal prepared for AID/OFDA, 1987.

Solomon Islands Government, "Cyclone Nina Proposed Rehabilitation Programme", Honiara, Solomon Islands, March 1993.

Solomon Islands Government, Solomon Islands National Development Plan: 1987, Solomon Islands Government, Honiara, Solomon Islands, 1987.

Solomon Islands National Building Code and Design Manual (unadopted), AIDAB, 1989.

Tiffany, Martin, "The Solomon Call For Change", Pacific Islands Monthly, May 1993.

U.S. Embassy, "Solomon Islands Economic Profile", Honiara, Solomon Islands, 1992.