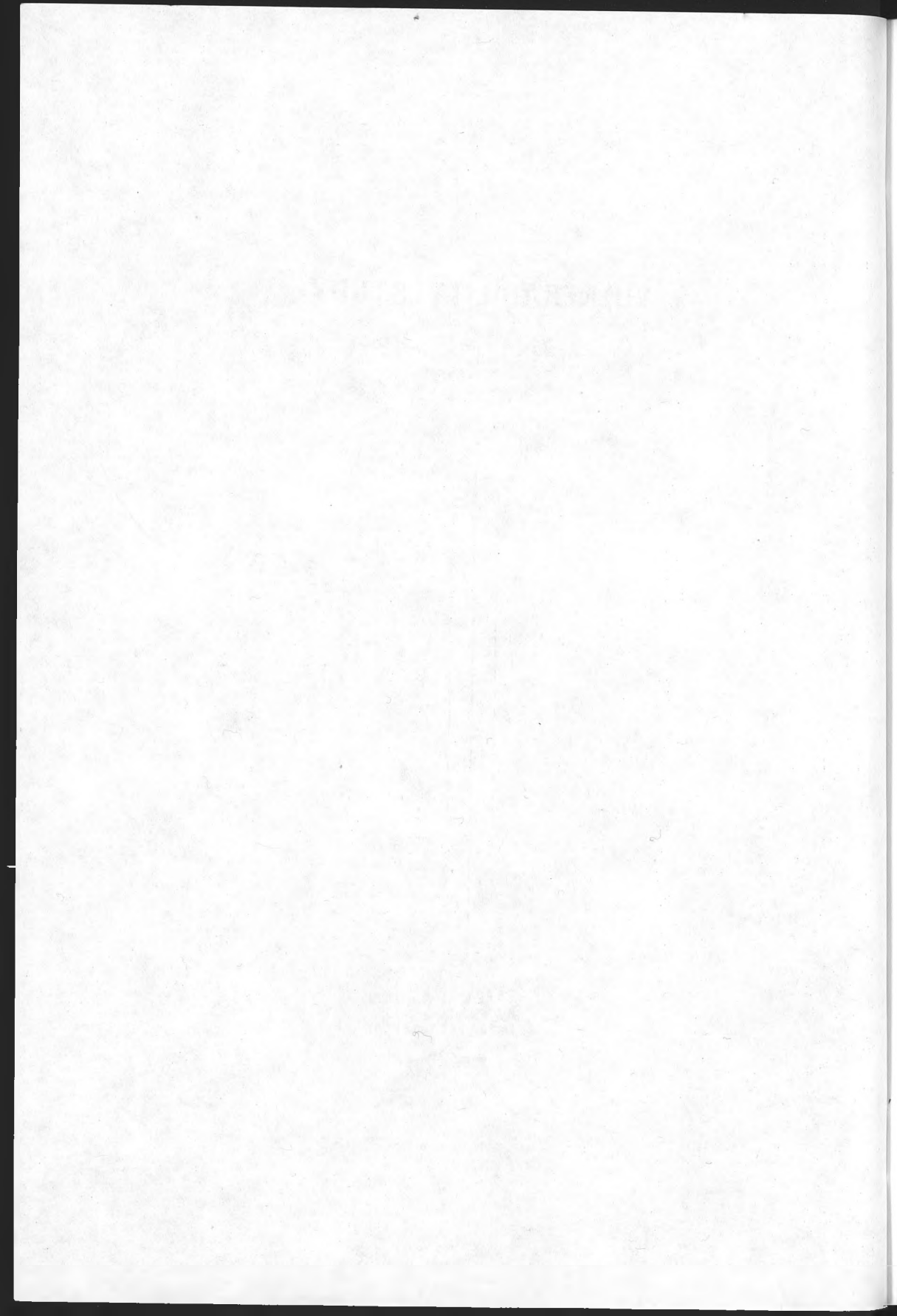


# VULNERABILITY STUDY



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## VULNERABILITY STUDY OF HOUSES.

### BACKGROUND

- MAJORITY OF PEOPLE IN THIRD WORLD COUNTRIES RESIDES IN HOUSES HIGHLY SUSCEPTIBLE TO EARTHQUAKES.
- MOST OF THE HOUSES DO NOT MEET THE STANDARDS OF EXISTING CODES.
- MAJORITY OF PEOPLE RESIDES IN NON ENGINEERED BUILDINGS.

### THE OBJECTIVES OF THE STUDY WERE :

- A. TO SURVEY THE VERNACULAR HOUSING OF A REGION/COUNTRY AND THE CONSTRUCTION TECHNIQUES/METHODOLOGIES USED IN ORDER TO :
  1. CLASSIFY THE VARIOUS BUILDINGS TYPES, AND
  2. ANALYZE THE RELATIVE VULNERABILITY OF EACH TYPE OF BUILDING TO EARTHQUAKES.
  
- B. - TO DETERMINE DESIGN CHANGES,
  - IMPROVEMENTS IN THE CONSTRUCTION PROCESS,
  - IMPROVEMENTS IN THE USE OF LOCAL BUILDING MATERIALS THAT CAN MAKE HOUSING MORE EARTHQUAKE RESISTANT, YET REMAIN AFFORDABLE TO THE MAJORITY OF PEOPLE RESIDING IN THESE BUILDINGS.

- C. TO MAKE RECOMMENDATIONS FOR DISSEMINATION OF INFORMATION ON SAFER CONSTRUCTION FOR :
1. SHORT-NOTICE OR EMERGENCY SITUATIONS:
    - INCLUDING INSTRUCTIONS THAT CAN BE DISSEMINATED WHEN AN EARTHQUAKE STRUCK,
    - METHODS FOR IMPROVING SAFETY,
    - TECHNIQUES FOR REDUCING DAMAGE AND STRENGTHENING BUILDINGS TO BETTER WITHSTAND EARTHQUAKE FORCES.
  2. MEDIUM TERM:
    - SELF-HELP ACTIONS,
    - INCLUDING SUGGESTIONS ON HOW EXISTING BUILDINGS CAN BE IMPROVED AND MADE SAFER THROUGH MODIFICATION OR RETROFITTING MEASURES AS PART OF NORMAL UPGRADING AND MAINTENANCE.
  3. LONG-TERM:
    - COMPREHENSIVE ACTIONS,
    - INCLUDING RECOMMENDATIONS ON HOW TO INFLUENCE THE DESIGN AND CONSTRUCTION OF NEW NON-ENGINEERED HOUSES.
- D. - TO DEVELOP INFORMATION ON NON-ENGINEERED CONSTRUCTION AND THE VULNERABILITY OF VERNACULAR HOUSING.
- ASSIST THE LOCAL GOVERNMENT IN PREPARING THEIR INPUT INTO NATIONAL HOUSING POLICY AIMED TOWARD THE PROTECTION OF BUILDINGS AND SETTLEMENTS.



KEY ISSUES.

- THE IMPROVEMENT OF VERNACULAR HOUSING TO BETTER WITHSTAND EARTHQUAKES SHOULD BE VIEWED AS PART OF A COMPREHENSIVE RESPONSE TO THE OVERALL HOUSING PROBLEM IN THIRD WORLD COUNTRIES.
  
- RECENT REPORTS REVEAL;
  - EXISTING HOUSING SHORTAGE DUE TO NATIONAL ECONOMIC PROBLEMS.
  - HIGH NUMBER OF SUBSTANDARD HOUSING UNITS.
  
- DEMAND FOR HOUSING FAR EXCEEDS GOVERNMENT'S CAPABILITY TO BUILD;
  - HOUSING DEFICIT INCREASING RATHER THAN DECREASING.
  - IF MAJOR DISASTER WERE TO OCCUR, THE SUDDEN NEED FOR REPLACEMENT HOUSING COULD DOUBLE OR TRIPLE THE EXISTING SHORTFALL.
  
- LITTLE HOPE TO ELIMINATE THESE HOUSING PROBLEMS, DUE TO;
  - HIGH LEVEL OF UNEMPLOYMENT AND UNDEREMPLOYMENT.
  - SLOW RATE OF ECONOMIC GROWTH.
  
- WHAT CAN BE DONE;
  - INCREASE EMPHASIS ON UPGRADING EXISTING HOUSING.
  - INCREASE EMPHASIS ON ASSISTANCE TO FAMILIES ON AN INDIVIDUAL BASIS.

- ADVANTAGES OF UPGRADING;
  - SAFEGUARD AGAINST DISASTER.
  - CONTRIBUTION TO THE RESOLUTION OF EXISTING HOUSING PROBLEMS.
  - UPGRADING IS CHEAPER THAN REPLACEMENT.
  - UPGRADING PLACES THE MAJORITY OF THE BURDEN ON THE HOME-OWNER RATHER THAN ON THE GOVERNMENT.
  
- BY MODIFICATION AND UPGRADING;
  - THE NUMBER OF UNITS LOST TO A DISASTER WILL BE LOWERED.
  - THE RECONSTRUCTION BURDEN ON THE GOVERNMENT AND THE PEOPLE WILL BE REDUCED.
  
- A HOUSE THAT WITHSTANDS A DISASTER MEANS;
  - REPRESENTS A SAFE REFUGE FOR ITS OCCUPANTS.
  - ELIMINATES THE TREMENDOUS DISCONTINUITY AND ECONOMIC BURDEN.
  - SAVING OF BUILDING MATERIALS.
  - SAVING OF FINANCIAL RESOURCES.
  - FOR THE GOVERNMENT, IT REPRESENTS REDUCTION OF FURTHER STRAINS ON A RECONSTRUCTION ECONOMY, THEREBY ENABLING THE POLICY MAKERS TO SPREAD FINANCIAL RESOURCES.

## POLICY ISSUES.

- THE NEED FOR AN AGENCY WITHIN THE GOVERNMENT TO BE ASSIGNED RESPONSIBILITY FOR THIS SECTOR OF HOUSING.
- THE NEED TO RATIONALISE BUILDING ENFORCEMENT AND REGULATION PROCEDURES TO DEAL WITH UPGRADING OF THE VERNACULAR HOUSING STOCK.
- THE NEED FOR THE HOUSING SECTOR TO PREPARE FOR THE RAPID DELIVERY OF LARGE NUMBERS OF NEW HOUSING UNITS IN THE EVENT OF A MAJOR DISASTER THROUGH THE PREPARATION OF NATIONAL RECONSTRUCTION POLICIES AND PREDETERMINED MODES OF RESPONSE FOR THE REPAIR OF DAMAGED BUILDINGS.

## DEFINITION OF TERMS.

- DESIGN CHANGES: THE PROCESS OF ALTERING THE DESIGN OF A STRUCTURE BEFORE IT IS ERECTED TO MAKE IT MORE DISASTER RESISTANT.
- DISASTER RESISTANT CONSTRUCTION: A TERM USED TO DENOTE THE DEGREE TO WHICH A STRUCTURE CAN BE MADE MORE RESISTANT (OR SAFE) TO CERTAIN NATURAL PHENOMENA. THE TERM RECOGNIZES THAT NO BUILDING CAN BE CONSIDERED TOTALLY SAFE, BUT THAT CERTAIN STEPS CAN BE TAKEN TO IMPROVE PERFORMANCE OR SURVIVABILITY.

- HOUSING EDUCATION PROGRAM: A PROGRAM OFFERING INSTRUCTION TO HOMEOWNERS OR BUILDERS ON HOW TO BUILD A SAFER OR MORE DISASTER RESISTANT HOUSE.
  
- HOUSING MODIFICATION: CHANGES IN THE CONFIGURATION OF AN EXISTING BUILDING TO MAKE IT STRONGER. MODIFICATIONS MIGHT INCLUDE CHANGING THE PITCH OF THE ROOF, ADDING A ROOM, ETC.
  
- HOUSING SCHEMES: A TERM USED TO DENOTE CONVENTIONAL HOUSING PROJECTS WHERE A LARGE TRACT OF LAND IS ACQUIRED, SERVICES ARE INSTALLED, AND A GROUP OF HOUSES ARE CONSTRUCTED ON THE SITE.
  
- NOG: A TYPE OF CONSTRUCTION SYSTEM USING A WOOD STRUCTURAL FRAME TO SUPPORT MASONRY WORK USED AS INFILL.
  
- NON-ENGINEERED BUILDINGS: THOSE STRUCTURES BUILT EITHER BY HOMEOWNERS OR BY LOCAL BUILDING TRADESMEN SUCH AS CARPENTERS AND MASONS WITHOUT FORMAL ARCHITECTURAL OR ENGINEERING INPUTS INTO THE DESIGN OR CONSTRUCTION PROCESS.
  
- RETROFITTING: THE PROCESS OF INSTALLING ADDITIONAL SUPPORTS OR ALTERING COMPONENTS OF AN EXISTING BUILDING IN ORDER TO MAKE IT MORE DISASTER RESISTANT.
  
- RISK: THE RELATIVE DEGREE OF PROBABILITY THAT A HAZARDOUS EVENT WILL OCCUR. AN ACTIVE FAULT ZONE, FOR EXAMPLE, WOULD BE AN AREA OF HIGH RISK.

- VERNACULAR HOUSING: INDIGENOUS MODES AND STYLES OF HOUSING USING LOCAL TRADITIONS, SKILLS AND TECHNIQUES. NON-ENGINEERED BUILDINGS, AS WELL AS STRUCTURES FROM PAST ERAS WHEN ARCHITECTURAL AND ENGINEERING INPUTS WERE MINIMAL, ARE INCLUDED IN THE TERM. VERNACULAR HOUSING CAN BE IDENTIFIED BY A PARTICULAR STYLE OR DESIGN OF CONSTRUCTION, BY POPULAR FEATURES, AND/OR BY THE BUILDING METHODS USED.

- VULNERABILITY: A CONDITION WHEREIN HUMAN SETTLEMENTS OR BUILDINGS ARE EXPOSED TO A DISASTER BY VIRTUE OF THEIR CONSTRUCTION OR PROXIMITY TO HAZARDOUS TERRAIN. BUILDINGS ARE CONSIDERED VULNERABLE IF THEY CANNOT WITHSTAND THE FORCES OF HURRICANES OR EARTHQUAKES. COMMUNITIES IN UNPROTECTED, LOWLYING COASTAL AREAS EXPOSED TO HURRICANES, OR IN SEISMIC AREAS WHERE A LARGE PROPORTION OF THE STRUCTURES CANNOT WITHSTAND THE FORCES OF AN EARTHQUAKE, ARE CONSIDERED "VULNERABLE COMMUNITIES".

## II. RISK IN AN AREA ( COUNTRY ).

- HURRICANE RISK

- EARTHQUAKE RISK

- ESTABLISHING PRIORITY AREAS FOR VULNERABILITY REDUCTION

AS A GENERAL RULE, COMPREHENSIVE VULNERABILITY REDUCTION EFFORTS SHOULD BE INITIATED IN AREAS WHERE THERE ARE CERTAIN INDICATORS THAT SUCH EFFORTS WILL SUCCEED,

THE INDICATORS ARE AMONG OTHERS;

- AREAS WHERE NEW CONSTRUCTION IS OCCURRING ( SUCH AS THE GROWTH AREAS AROUND CITIES AND TOWNS ).
- AREAS WHERE AGRICULTURAL ACTIVITIES ARE STRONG.
- AREAS WHERE MIGRATION FROM RURAL TO URBAN AREAS IS MINIMAL.
- AREAS WHERE A THREAT FROM A DISASTER IS PERCEIVED AS BEING A MAJOR PROBLEM TO THE MAJORITY OF HOMEOWNERS WITHIN THE REGION.

FACTORS TO BE EXAMINED:

- DEMOGRAPHIC TRENDS AND DENSITY.
- AREAS OF ECONOMIC GROWTH.

### III. HISTORY OF VERNACULAR HOUSING IN AN AREA (COUNTRY).

#### EVOLUTION OF VERNACULAR HOUSING.

- THE FORM OF BUILDING EXPRESSION AND THE SIGNIFICANT LINK TO VARIOUS ERAS IN THE HISTORY OF AN AREA/COUNTRY MUST BE STUDIED.
- USUALLY, MANY OF THE BUILDING FORMS AND FEATURES STILL FOUND TODAY IN TRADITIONAL AND VERNACULAR ARCHITECTURE DATE BACK TO SPECIFIC PERIODS IN THE HISTORY OF AN AREA (COUNTRY).

#### HURRICANE AND EARTHQUAKE ARCHITECTURE.

- THE PRINCIPLES OF DISASTER RESISTANT CONSTRUCTION TODAY WERE NOT THOROUGHLY UNDERSTOOD BY OUR ANCESTORS.
- HOWEVER, THROUGH TRIAL AND ERROR AND COMMON SENSE, MANY TECHNIQUES AND FEATURES WERE DEVELOPED TO REDUCE DAMAGE FROM HURRICANES AND EARTHQUAKES THAT STRUCK PERIODICALLY.
- THE TECHNIQUES AND FEATURES INCORPORATED INTO THESE DESIGNS TO IMPROVE THE RESISTANCE OF THEIR HOMES MUST BE STUDIED.

#### CONTEMPORARY NON-ENGINEERED HOUSING.

IN GENERAL, CONTEMPORARY NON-ENGINEERED HOUSING CAN BE DEVIDED INTO TWO CLASSIFICATIONS:

- RURAL HOUSING
- URBAN HOUSING

THE CHARACTERISTICS OF RURAL AND URBAN HOUSING MUST BE NOTED AMONG OTHERS:

- WHETHER TRADITIONAL CONSTRUCTION METHODS IS STILL BEING USED.
- THE SIZE.
- WHETHER OWNER-CONTRACTOR RELATIONSHIP IS EXISTING.
- WHAT ARE THE PRIMARY STRUCTURAL COMPONENTS, TIMBER, BRICK, R.C., STEEL, ETC.
- WHAT ARE THE MOST PREVALENT STYLES FOUND.
- WHAT ARE THE MOST POPULAR ROOFING MATERIALS.

#### CONTEMPORARY SEMI-ENGINEERED HOUSING.

- THE GOVERNMENT, AS WELL AS A NUMBER OF LOW COST HOUSING CORPORATIONS, HAS CHOSEN THE APPROACH OF USING CONVENTIONAL HOUSING PROJECTS OR SCHEMES AS THE METHOD OF PROVIDING HOUSING FOR LOW INCOME FAMILIES.
- THE PRIMARY OBJECTIVE;
  - DELIVER BASIC HOUSING.
  - DELIVER DURABLE HOUSING.
  - DELIVER LOW COST HOUSING.
- KEY POINTS USUALLY NEGLECTED;
  - SITE CHOSEN ARE MARGINAL LANDS THAT ARE EASY TO ACQUIRE AT A LOW COST.
  - SITES ARE VULNERABLE TO HURRICANES AND EARTHQUAKES.
  - SITES ARE VULNERABLE TO FLOODING.
  - MATERIALS USED ARE OF INTERIOR QUALITY.
  - POOR WORKMANSHIP.
  - IT IS IMPORTANT TO UNDERTAKE A THOROUGH REVIEW OF THE VULNERABILITY OF THESE HOUSES.



#### IV. VULNERABILITY ANALYSIS OF VERNACULAR CONSTRUCTION.

##### THE PURPOSE OF THE ANALYSIS.

- TO IDENTIFY THE MOST COMMON TYPES OF NON-ENGINEERED HOUSES.
- TO IDENTIFY THE STRUCTURAL PROBLEMS OF EACH TYPE.
- TO DETERMINE THEIR RELATIVE VULNERABILITY TO BOTH HURRICANES AND EARTHQUAKES.
- OPTIONS FOR IMPROVING THE STRUCTURAL PERFORMANCE OF EACH BUILDING TYPE ARE THEN CONSIDERED.

##### POPULAR HOUSING DESIGNS.

- POPULAR DESIGNS OF VERNACULAR HOUSING THROUGHOUT THE AREA (COUNTRY) MUST BE IDENTIFIED AND ANALYSIS MUST BE MADE.

##### DETERMINANTS OF VULNERABILITY.

- VULNERABILITY TO DISASTER IN GENERAL IS A FUNCTION OF THE FOLLOWING FACTORS;
  - THE DESIGN AND CONFIGURATION OF THE HOUSE.
  - THE QUALITY OF WORKMANSHIP.
  - THE STRENGTH OF MATERIALS USED.
  - THE RELATIVE SAFETY OF THE SITE.

- VULNERABILITY TO HURRICANES IS A FUNCTION OF;
  - CONFIGURATION OF THE BUILDING.
  - CONFIGURATION OF THE ROOF.
  - HOW WELL THE BUILDING IS TIED TOGETHER.
  - HOW SECURELY THE ROOF IS TIED TO THE WALLS.
  - HOW WELL THE BUILDING IS ANCHORED TO THE GROUND.
- VULNERABILITY OF HOUSING TO EARTHQUAKES IS DETERMINED BY MANY OF THESE SAME FACTORS PLUS SEVERAL OTHERS, SUCH AS
  - SITE (SHOULD BE FLAT WITH STABLE SOILS).
  - FOUNDATION (SHOULD BE STRONG AND LEVEL).
  - BALANCE (PARALLEL WALLS SHOULD BE OF EQUAL SIZE AND WEIGHT).
  - CENTER OF GRAVITY (WALLS SHOULD BE LOW, ROOF SHOULD BE LIGHTWEIGHT)
  - REINFORCEMENT IN THE WALLS (ADEQUATE VERTICAL, HORIZONTAL AND DIAGONAL REINFORCING SHOULD BE PLACED IN EACH WALL)

#### VULNERABILITY ANALYSIS OF THE BASIC CONSTRUCTION TYPE.

- AN ANALYSIS OF THE PRINCIPAL HOUSING TYPES FOUND IN A CERTAIN AREA (COUNTRY).
- PRIMARY EMPHASIS IS ON HURRICANES AND EARTHQUAKE RESISTANCE POTENTIAL.
- RECOMMENDATIONS ARE DIVIDED INTO THE CATEGORIES;
  - SIMPLE LOW-COST CHANGES WHICH COULD BE CARRIED OUT IN AN EMERGENCY (EMERGENCY MEASURES).
  - MORE SOPHISTICATED ACTIONS THAT CAN BE CARRIED OUT OVER A LONGER PERIOD OF TIME (PROGRESSIVE UPGRADING MEASURES)

- MAIN POINTS TO BE COVERED BY ANALYSIS,
  - CONSTRUCTION TYPE.
  - ROOF TYPE.
  - SIZE.
  - VULNERABILITY.
  - OTHER WEAK POINTS.
  - MODIFICATIONS FOR HURRICANE RESISTANCE:
    - EMERGENCY MEASURES
    - PROGRESSIVE UPGRADING MEASURES
  - MODIFICATIONS FOR EARTHQUAKE RESISTANCE:
    - EMERGENCY MEASURES
    - PROGRESSIVE UPGRADING MEASURES

### VULNERABILITY ANALYSIS OF HOUSES BUILT OF MIXED MATERIALS.

- VARIATIONS OF HOUSING TYPES WHICH DISPLAY A MIX OF THE BASIC BUILDING TYPES REPRESENTS AN EVOLUTIONARY CHANGE IN THE BUILDINGS.
- THIS STYLE OF BUILDING MAY REPRESENT AN ATTEMPT BY THE HOMEOWNER TO DEMONSTRATE ECONOMIC ACHIEVEMENT BY USING A MORE PRESTIGIOUS BUILDING MATERIAL.
- IN MOST CASES THESE MIXED TYPES STRUCTURES ARE VULNERABLE TO HURRICANES AND EARTHQUAKES.
- IT IS NOT THE MATERIALS THAT ARE USED, BUT RATHER HOW THEY ARE USED.

### POPULAR BUILDING FEATURES.

- FEATURES AND PRACTICES WHICH REDUCE VULNERABILITY.
- FEATURES AND PRACTICES CONTRIBUTING TO VULNERABILITY.

## PROBLEMS COMMON TO ALL BUILDING TYPES.

SOME OF THE MORE POPULAR STYLES AND DETAILS THAT HAVE BEEN IDENTIFIED AS BEING DANGEROUS IN EITHER HURRICANES OR EARTHQUAKES.

- PROBLEMS IN BASIC CONFIGURATION,
- ROOF CONFIGURATION,
- VERANDAS,
- OPEN SPACES BETWEEN ROOF AND WALL,
- POOR FASTENINGS OF THE ROOF TO THE WALLS,
- POOR CONNECTIONS BETWEEN WALLS AND GROUND,

## SPECIAL PROBLEMS.

POINTS TO BE ADDRESSED IN HOUSING IMPROVEMENT ACTIVITIES;

### 1. SITING.

- POOR SIZE SELECTION,
- POOR SITE PREPARATION,
- POOR ADAPTATION OF THE BUILDING TO THE SITE,
- IMPROPER MATCHING OF BUILDING TYPE TO SITE.

### 2. DETERIORATION OF OLDER BUILDINGS.

- ALMOST 75% OF LOW INCOME FAMILY HOUSES IN THIRD WORLD COUNTRIES ARE IN THE STATE OF DETERIORATION AND NO MEASURES ARE CURRENTLY BEING TAKEN TO PREVENT DETERIORATION OF THESE BUILDINGS.
- THEY ARE BECOMING UNLIVABLE,
- THEY ARE INCREASING IN VULNERABILITY TO DISASTER EVENT,

3. USE OF UNTREATED WOOD.

- UNTREATED WOODS DETERIORATE RAPIDLY ESPECIALLY IN TROPICAL COUNTRIES AND ARE SUBJECT TO TERMITES.

4. DISAPPEARANCE OF BUILDING SKILLS.

- WITH RAPID URBANIZATION AND THE CHANGES IN BUILDING STYLES, MANY CONSTRUCTION SKILLS WHICH WERE ONCE EVIDENT IN VERNACULAR BUILDINGS ARE UNUSED AND FORGOTTEN.
- THE EXCELLENT STONEMASONRY, CARPENTRY AND MASONRY SKILLS EXHIBITED IN MANY OLDER BUILDINGS ARE HARD TO FIND IN PRESENT DAY CONSTRUCTIONS.

5. DISCONTINUANCE OF HURRICANE/EARTHQUAKE RESISTANT FEATURES.

- IN RECENT YEARS, PRESENT GENERATION DESIGNERS AND BUILDERS ARE NOT AWARE OF MANY OF THE ONCE POPULAR AND TIME PROVEN HURRICANE/EARTHQUAKE RESISTANT CONSTRUCTION TECHNIQUES.
- IT IS IMPORTANT THAT THESE TECHNIQUES BE IDENTIFIED AND RECOGNIZED FOR THE CONTRIBUTION THEY CAN MAKE TO REDUCING OVERALL VULNERABILITY.
- THESE TECHNIQUES SHOULD BE USED IN NEW CONSTRUCTION.

V. LOCAL BUILDING PROCESSES AND PRACTICES.

CONSTRUCTION IN THE RURAL AREAS.

HOUSES ARE MOSTLY BUILT THROUGH OVERALL HELP AND COOPERATION UTILIZING LOCALLY AVAILABLE MATERIALS.

CONSTRUCTION IN THE URBAN AREAS.

DEPENDS ON MANY FACTORS:

- LAND TENURE.
- FINANCIAL STATUS OF THE FAMILY.
- AVAILABILITY OF MATERIALS.
- BUILDER'S CONSTRUCTION SKILLS.

ANALYSIS OF LOCAL BUILDING SKILLS.

STRUCTURAL INTEGRITY OF A BUILDING DURING HURRICANES AND EARTHQUAKES CAN BE IMPROVED SIMPLY BY IMPROVING THE QUALITY OF WORKMANSHIP AND DETAILING WHEN THE BUILDING IS ERECTED.

SKILLS AFFECTING THE VULNERABILITY OF A STRUCTURE:

1. CARPENTRY SKILLS.

- JOINTS,
- SPLICING,
- IMPROPER USE OF BRACING.

2. PROBLEMS IN MASONRY CONSTRUCTION.

- POOR MORTAR,
- POOR CONCRETE MIX,
- POOR CONNECTIONS BETWEEN WALLS,
- INSUFICIENT MORTAR BETWEEN BLOCKS,
- UNLEVEL MASONRY ON EACH COURSE,
- POOR DETAILING AROUND DOORS AND WINDOWS,
- IMPROPER/INSUFFICIENT FOUNDATIONS.

CONSTRUCTION COSTS.

- BUILDING COSTS ARE UNLIKELY TO REMAIN FIXED FOR ANY LENGTH OF TIME.

- THE RELATIVE COST OF BUILDINGS IN RELATION TO DIFFERENT BUILDING SYSTEMS AND THE MATERIALS USED;

- 1. BLOCK AND CONCRETE - (MOST EXPENSIVE)

2. WOOD FRAME

3. CONCRETE NOG

4. ETC.



- (LEAST EXPENSIVE)

- THE ANNUAL COST OF BUILDING MAINTENANCE IS ANOTHER IMPORTANT CONSIDERATION IN EXAMINING OVERALL HOUSING COSTS.

- 1. WOOD FRAME, - (MOST ANNUAL MAINTENANCE)

2. STONE NOG.

3. BRICK NOG.

4. BLOCK AND STEEL.

5. ETC.



- (LEAST ANNUAL MAINTENANCE)



### MATERIAL PREFERENCES.

- PREFERRED MATERIAL FOR BUILDING WALLS AND ROOFS VARIES WITH EACH REGION ACCORDING TO:
  - AVAILABILITY OF SPECIFIC MATERIALS.
  - COST.
  - SETTING.
- STRATEGIES AND APPROACHES MUST BE DEVELOPED FOR DELIVERING PREFERRED MATERIALS AND COST-REDUCTION APPROACHES PRIOR TO THE OCCURENCE OF A DISASTER.

### REPLACEMENT VERSUS REPAIR.

- MANY PEOPLE LIVING IN DETERIORATED BUILDINGS IN RURAL AREAS PLANNED TO BUILD NEW REPLACEMENT HOUSES OF MASONRY RATHER THAN TO REPAIR EXISTING STRUCTURES. THIS IS ASSOCIATED WITH MEASURE OF STATUS.
- STRATEGIES AND APPROACHES MUST BE DEVELOPED TO BROADEN THE PROGRAMS TO FACILITATE;
  - REPAIR AND MAINTENANCE OF EXISTING STRUCTURES.
  - REPLACEMENT OF DETERIORATED BUILDINGS.
  - ENCOURAGE THE USE OF SAFER TECHNIQUES DURING REPAIR AND REPLACEMENT.

## VI. KEY ISSUES.

### HOUSING FINANCE.

- ONE OF THE MAJOR PROBLEMS CONFRONTING VULNERABILITY REDUCTION EFFORTS IS THAT OF HOUSING FINANCE.
- LOW INCOME FAMILIES HAVE DIFFICULTY IN OBTAINING FUNDS FOR HOUSING AND HOME IMPROVEMENTS DUE TO LACK OF CREDIT WORTHINESS.
- ANOTHER MORE CRITICAL PROBLEM IN TERMS OF VULNERABILITY REDUCTION IS THE INABILITY OF LOW-INCOME FAMILIES TO OBTAIN FUNDS FOR MAINTENANCE AND REPAIR OF DETERIORATED BUILDINGS.
- MAJORITY OF LOW-INCOME FAMILIES ARE THUS EXCLUDED FROM PARTICIPATING IN FORMAL CREDIT SYSTEM.

### LAND TENURE.

- PROBLEM OF LAND OWNERSHIP AND TENURE IS ONE OF THE MAJOR FACTORS CONTROLLING THE HOUSING SECTOR IN THE THIRD WORLD COUNTRIES, SINCE LOANS ARE RELATED TO THE ISSUES OF LAND TENURE AND OWNERSHIP.

## IMPLICATIONS OF WIDESPREAD HOUSING DETERIORATION.

- RANDOM SURVEYS INDICATE THE ESTIMATED PERCENTAGE OF REPAIR OF THE VERNACULAR HOUSING ARE;
  - 20% NEED MINOR REPAIRS,
  - 30% NEED MAJOR STRUCTURAL REPAIRS.
  - 15% IS DETERIORATED BEYOND REPAIR.
- IN TERMS OF DISASTER PREPAREDNESS, THIS MEANS THAT APPROXIMATELY 45% OF VERNACULAR HOUSING IS VULNERABLE TO EARTHQUAKES AND/OR HURRICANES.
- THIS WOULD INCREASE THE CURRENT ESTIMATED HOUSING DEFICIT SUBSTANTIALLY.
- THE PRIORITY SHOULD BE FOR THE SYSTEMATIC UPGRADING AND MAINTENANCE OF THE EXISTING HOUSING, SO THAT RESOURCES (BOTH FINANCIAL AND TECHNICAL) CAN BE FOR OTHER DEVELOPMENTS IN OTHER SECTORS.

## LACK OF A DESIGNATED AGENCY.

- AT THE PRESENT TIME, NO AGENCY OR MINISTRY IS ASSIGNED RESPONSIBILITY FOR PROVIDING ASSISTANCE IN UPGRADING OF EXISTING BUILDINGS.
- HOUSING AND CONSTRUCTION MINISTRY ONLY DEALS WITH;
  - THE DEVELOPMENT OF NEW HOUSING SCHEMES.
  - THE DEVELOPMENT OF NEW COMMUNITIES.
- IN ORDER FOR HOUSING IMPROVEMENT AND VULNERABILITY REDUCTION EFFORTS TO BE EFFECTIVE, A MINISTRY MOST BE TASKED WITH THIS RESPONSIBILITY.

## VII. VULNERABILITY REDUCTION STRATEGIES.

THREE CLASSIFICATIONS ACCORDING TO TIME PERIOD OF ACTIVITIES;

- SHORT TERM ACTIVITIES (EMERGENCY ACTIVITIES).
- INTERMEDIATE ACTIVITIES.
- LONG TERM ACTIVITIES.

### - SHORT TERM ACTIVITIES.

OBJECTIVE; - TO PROVIDE COMPREHENSIVE PROTECTION FROM AN IMMEDIATE DANGER SUCH AS HURRICANES AND EARTHQUAKES.

- PROVIDE IMMEDIATE ACTION TO ENSURE THE SAFETY OF PERSONS WITHIN A HOUSE.

REQUIREMENTS FOR COMPREHENSIVE EMERGENCY ACTIVITIES ARE;

#### 1. THOROUGH PREPAREDNESS PLANNING.

- ACTIONS REQUIRED.
- ORGANIZATIONS THAT WILL PARTICIPATE.
- TOOLS AND EQUIPMENTS NECESSARY.
- FORMULATION OF A COMPREHENSIVE PLAN TO STRUCTURE RESPONSE.

2. IDENTIFICATION OF PUBLIC INFORMATION REQUIREMENTS.

- MEDIA REQUIRED TO DISSEMINATE INFORMATION THOROUGHLY;
  - LEAFLETS.
  - POSTERS.
  - PRE-RECORDED ANNOUNCEMENTS.
  - NEWSPAPER INSERTS.
  - SUPPLEMENTS.
- INFORMATION MUST SHOW HOW TO PROTECT A HOUSE, REDUCE INJURY.

3. TRAINING AND TECHNICAL ASSISTANCE FOR LOCAL EMERGENCY RELIEF OFFICIALS AND ORGANIZATIONS.

- A SUFFICIENT NUMBER OF PEOPLE ACQUAINTED WITH HOW TO USE THE TECHNIQUES SHOULD BE TRAINED AND AVAILABLE TO HELP THE PUBLIC IN EACH AREA.

4. INFORMATION DISSEMINATION MECHANISMS.

- MOST EFFECTIVE MEANS; VISUAL MEDIA.
- TO A LIMITED EXTENT; NEWSPAPER AND T.V.
- FOR MORE COMPREHENSIVE INFORMATION; HIGHLY ILLUSTRATED BOOKLETS AND LEAFLETS.
- MECHANISM OF DISTRIBUTING THIS INFORMATION MUST BE DEVELOPED IN ADVANCE.

- INTERMEDIATE ACTIVITIES.

- OBJECTIVE; - TO STRENGTHEN EXISTING HOUSING.
  - TO UPGRADE THE MAJORITY OF STRUCTURES.
- ACTIVITIES MUST BE ABLE TO BE CARRIED OUT;
  - WITH MINIMAL FINANCIAL AND TECHNICAL ASSISTANCE.
  - DO NOT REQUIRE EXTENSIVE RECONSTRUCTION OR MODIFICATION OF EXISTING BUILDING.

1. REQUIREMENTS.

1.1. BUILDING PERFORMANCE STANDARDS.

- MINIMUM BUILDING STANDARDS MUST BE DEVELOPED;
  - BASED ON BUILDING PERFORMANCE.
  - EMPHASIZING THE SAFETY OF OCCUPANTS.

1.2. FINANCIAL ASSISTANCE OR OTHER INCENTIVES.

- SPECIAL PLANS WILL BE REQUIRED TO HANDLE REQUESTS FROM FAMILIES WITHOUT CLEAR REGISTERED TITLE TO THEIR LANDS.

1.3. INFORMATIONS.

- TO ENCOURAGE AND GUIDE HOUSING IMPROVEMENT ACTIVITIES.
- INFORMATIONS NEEDED;
  - A. HOW TO DECIDE WHAT MODIFICATIONS ARE REQUIRED AND PRACTICAL.
  - B. WHERE TO OBTAIN ASSISTANCE.
  - C. HIGHLY ILLUSTRATED BOOKLETS, FILMS WHICH PROVIDE "HOW TO DO IT" INFORMATION.

1.4. TECHNICAL ASSISTANCE.

- TECHNICAL ASSISTANCE IN THE FORM OF ADVICE AND DEMONSTRATIONS SHOULD BE READILY AVAILABLE IN ALL AREAS.

1.5. DEVELOPMENT OF LOCAL SKILLS.

- PROVIDE TRAINING TO EXISTING BUILDING CONTRACTORS IN ORDER TO ENABLE THEM TO PARTICIPATE IN HOUSING IMPROVEMENTS ACTIVITIES.

2. COORDINATION AND IMPLEMENTATION.

- A MINISTRY SHOULD BE ASSIGNED FOR THE OVERALL RESPONSIBILITY FOR THE IMPLEMENTATION OF THE UPGRADING OF THEIR HOUSES.

3. FINANCIAL ASSISTANCE.

- NEW APPROACHES SHOULD BE DEVELOPED FOR THE PROVISION OF FINANCIAL ASSISTANCE TO HOMEOWNERS FOR THE UPGRADING OF THEIR HOUSES.

4. TECHNICAL ASSISTANCE IN THE AREAS.

- FOCAL POINT FOR TECHNICAL ASSISTANCE; OFFICE OF BUILDING INSPECTOR;
  - PROVIDE ADVICE TO THOSE UPGRADING THEIR HOMES.
  - WORK WITH LOCAL CONTRACTORS TO TRAIN AND ENCOURAGE THEM TO PARTICIPATE.

5. TECHNICAL INFORMATION RESOURCES.

- AT PRESENT: THERE IS NO SINGLE REPOSITORY FOR INFORMATION REGARDING VERNACULAR HOUSING OR THE TECHNIQUES AND SKILLS REQUIRED TO MAINTAIN AND UPGRADE THESE HOUSES.
  
- THEREFORE THE GOVERNMENT SHOULD ESTABLISH "A NATIONAL CENTER FOR BUILDING AND CONSTRUCTION", WHICH WOULD INCLUDE;
  - 5.1. A HOUSING INFORMATION CENTER WITH LIBRARY AND PUBLIC INFORMATION MATERIALS;
    - ON ALL TYPES OF BUILDING CONSTRUCTION FOUND IN THE AREA/COUNTRY.
    - INCLUDING ENGINEERED AND NON-ENGINEERED STRUCTURES.
    - BUILDING TECHNIQUES.
  
  - 5.2. A NATIONAL HOUSING REFERENCE LIBRARY FOR;
    - ARCHITECTS, ENGINEERS, BUILDERS, PUBLIC OFFICIALS, MATERIAL SUPPLIERS.
    - DEVELOPING DATA CONCERNING HISTORIC AND VERNACULAR CONSTRUCTION.
  
  - 5.3. A BUILDING AND MATERIAL RESEARCH COMPONENT, STRUCTURED TO ENABLE IT TO CARRY OUT A VARIETY OF RESEARCH ACTIVITIES, SUCH AS;



- SOCIO-ECONOMIC RESEARCH,
- ARCHITECTURAL RESEARCH,
- ENGINEERING RESEARCH,
- DEVELOPMENT OF A PROGRAM TO INVESTIGATE INDI-  
GENOUS MATERIALS AND NON-ENGINEERED STRUCTURES.

- LONG TERM ACTIVITIES.

- OBJECTIVE; TO ENSURE THE SAFETY OF NEW HOUSING BY ENCOU-  
RAGING BUILDERS TO INCORPORATE DISASTER RESIS-  
TANT FEATURES IN BUILDINGS AS THEY ARE ERECTED.
- REQUIREMENTS; - A VARIETY OF COMMITMENTS AND ADJUSTMENTS  
ON THE PART OF THE GOVERNMENT.
  - A NATIONAL HOUSING POLICY WHICH RECOGNI-  
ZES THE ROLE OF NON-ENGINEERED BUILDINGS.
  - A NEW DIRECTION IN LAND DEVELOPMENT AND  
URBANIZATION POLICIES/APPROACHES.
  - TOOLS REQUIRED SAME AS FOR INTERMEDIATE  
TERM, EMPHASIS IS ON NEW CONSTRUCTION  
RATHER THAN EXISTING BUILDINGS.

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MEMORANDUM

TO: [Illegible]

FROM: [Illegible]

SUBJECT: [Illegible]

[Illegible text follows, appearing to be a memorandum body with several paragraphs of text that is too faint to transcribe accurately.]