UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANISATION

UNESCO

EDUCATIONAL ARCHITECTURE UNIT

CARIBBEAN SUB-REGION

Antigua & Barbuda
Barbados
Jamaica
St Christopher/Nevis
St Vincent & The Grenadines

The development of school design and hazard resistance, construction training and curriculum infusion

MISSION REPORT

James Lewis Architect RIBA
UNESCO Consultant
Datum International
1991
MISSION REPORT

Mission Reports were handwritten in full at the end of each country sector. They appear here with some modifications of style but with none of fact or of opinion as expressed at the time.

(References in brackets appear as ANNEX MR2 at the end of the Mission Report).

1. JAMAICA

Purpose

Briefing with UNESCO Representative and discussions with Jamaican Government officers for education, disaster preparedness, school design and construction, co-ordinated by the Ministry of Education.

Activities

A meeting of 15 architects, engineers and Ministry of Education officers had been arranged for the first day (Monday 14 October); a visit to six schools on the second day; a meeting at the Jamaica Institution of Engineers on the third day; and with the Office of Disaster Preparedness and the Earthquake Unit of the University of the West Indies on the fourth day. Additionally requested and implemented discussions with the Ministry of Education Planning Unit, the Caribbean School of Architecture and the Construction Resource and Development Centre. Arrangements for a meeting requested with the Jamaica Builders' Association did not materialise (see ANNEX J1 for discussions held and ANNEX J2 for schools visited).

Findings

a/ Of approximately 1000 public educational institutions (pre-primary, primary, secondary and tertiary), 98 were totally destroyed and 828 received extensive damage during Hurricane "Gilbert" in 1988. The total estimated cost of damage to school buildings was J$ 50 million (US$ 2.83 million) (see ANNEX MR 3 for disaster incidence).
b/ There is a very high technical awareness, concern and commitment amongst engineers and architects who would be well able to provide resource personnel for a sub-regional training project. The greatest concern and need is for the integration of existing technical information at and for various sectors and levels of application (technicians, draughtspersons, builders, self-builders, etc).

c/ For perhaps twenty years, there has been considerable awareness, activity, and application of construction techniques resistant to hurricane and earthquake. A Caribbean Uniform Building Code (CUBIC: Jamaica Institution of Engineers 1989) has been established but continues to require legislative adoption by the Government.

d/ Proposals exist for the infusion of hurricane and earthquake information and disaster preparedness material in schools curricula (Office of Disaster Preparedness/Ministry of Education/PCDPPP 1987; Office of Disaster Preparedness 1983; Media Research Associates 1991). Some information is currently included in some subjects eg geography and social studies.

e/ Schools have been "vandalised" during their use as shelters during hurricanes (Jamaica Record September 21 1988; ANNEX J 3) and from some officers of the Ministry of Education there is outright rejection of the use of schools as shelters in the future. Problems of vacating schools after their use as hurricane shelters exacerbates this issue. The suggestion that school design could be modified to ameliorate these issues was not acceptable to these officers.

f/ Many schools, perhaps most schools, do not have sufficient space and are therefore overcrowded. Actual role numbers are significantly higher (some near double) the design occupancy. Siting for a prototype (see Mission Report 5: Barbados (ANNEX B 3) recommendation for the discontinuation of the word "prototype") primary school building on an existing school campus would be an acceptable proposition.

g/ It should be accepted that school construction is a part of the construction industry generally and that therefore, construction for one building type could inform construction for another. Construction of prototype schools will demonstrate resistant techniques to the construction industry/activity at large.

Lessons experienced

The implication of the terms of reference that building construction information and techniques are of insufficient standard is not appreciated by engineers and architects. It is accepted however by professionals in private as well as in
Government employment, that training is required to be directed towards technicians and draughtspersons and the construction trades and general builders. Government has insufficient inspectors to ensure conformity of construction with drawings and contract documents.

It is difficult to separate demands for school construction from issues surrounding construction generally; but in attempting to do so, the view of the Chief Architect of the Ministry of Education was that hurricane resistant techniques for school buildings would not be the cause of higher construction cost - because those costs are already included. What is necessary is improved construction inspection to ensure the implementation of good building practice. This would increase costs per building by only a small percentage.

Although school construction and large scale reconstruction is undertaken by the Government, small scale reconstruction and repairs are let to local builders. Sugar Industry Housing Ltd and National Housing Corporation were given post-"Gilbert" school repair contracts in those cases where each was less than J$ 25,000 (US$ 1,415).

Recommendations

a/ Manuals and guidelines in resistant building construction should be prepared for use by technicians, draughtspersons, clerks-of-works, building inspectors, construction trades, general builders, self builders, materials suppliers, community groups, training institutions, etc. Contents should be arranged according to construction materials used and connections between them.

b/ More effort is required to achieve the legislative adoption in Jamaica of the Caribbean Uniform Building Code (CUBIC).

c/ Further work is required for the practical infusion into school curricula of hurricane and earthquake information, preparedness measures, and (at vocational levels) resistant construction principles and techniques. This is the commencement stage of a necessarily long term process of pervasive cultural acceptance of the importance of good construction, preparedness and other measures for disaster reduction. This could be arranged in association with the Jamaica Foundation for the Advancement of Literacy, the Caribbean Examinations Council, and the Jamaica Office of Disaster Preparedness.

d/ Adjustments are required in school management, as well as in design and construction, for the inevitable but successful community use of schools hurricane shelters.
Suggestions for this purpose are:

- regular use of schools for community activities
- presence of the school principal at the school during its use as a hurricane shelter
- storage provision for school documents, records, books, equipment and for some furniture secure against hurricane and vandalism

e/ Training should be given a broad interpretation, not only as training programmes in themselves but as also publications, posters, guidelines, and video material in easily understood graphic and popular images: "Strapless today - topless tomorrow".

f/ Prototype school construction should be a medium for training in the proposed project; and selected trained personnel from completed prototypes sent forward as trainers for subsequent similar buildings.

g/ A video should be prepared of the prototype school building to show design, management, construction operations and techniques.

h/ Resource personnel for training should be regionally selected and are available and willing amongst members of the engineering and architectural professions, the Construction Resource and Development Centre and the Caribbean School of Architecture and College of Arts, Science and Technology who are willing to participate as individuals and/or as training institutions and venues. Training should be arranged in conjunction with the National Training Agency.

Difficulties encountered

Given that Jamaica was the first stop of the Mission, the largest country, and the location of the office of the UNESCO Representative, more time at the commencement of the Mission would have been appropriate:

- to familiarise with the requirements of the Mission overall
- to spend more time with UNESCO staff with expertise in the region
- to experience more of the variety of school types and locations
- to take advantage of sources of Caribbean-wide sources of information and expertise located in Jamaica (Kingston) eg college of Arts, Science and Technology (CAST) and University of the West Indies.
- to take greater advantage of the variety of expertise and activities within the Ministry of Education eg video production, Caribbean Examinations Council.
- to allow "Caribbean time" for follow up of promised information, co-ordination of arrangements and activities.
- to allow for the contingencies of travel and shortage of sleep
- to make possible in Jamaica the writing of this Jamaica Mission Report.

b/ Co-ordination by the Ministry of Education amounted to the organisation of meetings, but not follow-up of requirements generated by those meetings (in which the Ministry participated). Suggestions from within the Ministry for a meeting with the Permanent Secretary were not implemented.

Support received

The enthusiastic, knowledgeable, efficient and courteous assistance of the UNESCO Representative, Associate Expert in Education, driver and administrative staff is acknowledged with gratitude.

The attention of the Chief Architect, Ministry of Education, as guide on the visit to schools during his vacation time is similarly and gratefully acknowledged.

Publication

"Cyclone resistant rural primary school construction - a design guide" was given to the Chief Architect, Ministry of Education

Arrival (at hotel): Monday 14 October at 00.30 hours after 22 hours door to door travel.

Departure (from hotel): 11.30 hours Friday 18 October

Working days: Four and a half.

ANNEX J1

Discussions held:

Mr Alfred D Adams, Smada Consultants Ltd, Engineers.
Mr Brian Ager, Architect.
Mr Earl Barrington Beckford, President, Jamaica Institute of Engineers.

(continued)
Mrs Caroline Beecher, Co-ordinator, World Bank Project. Ministry of Education.

Mrs Valerie Been, Assistant Chief Education Officer in Charge of Planning, Planning Unit, Ministry of Education.

Dr Barbara Carby, Research Officer, Office of Disaster Preparedness.

Dr Simon Clarke, Representative and Education Adviser, UNESCO Kingston

Mr Lucius Craigie, Chief Architect, Ministry of Education.

Mr E B Dixon, Beckford & Dixon Ltd, Consulting Engineers.

Mr Kirkland Douglas, Sugar Industry Housing Ltd.

Mr Astley Dove, Engineer, Estate Development Co Ltd.

Mrs E Ferguson, Principal, Port Morant All-Age, St Thomas.

Mr Errol Golding, Ministry of Education.

Miss Margaret Grandison, Earthquake Unit, University of the West Indies, Mona.

Mr David Harrison, Deputy Director (Acting Director), Caribbean School of Architecture, College of Arts, Science & Technology.

Mr Desmond Hayle, Desmond Hayle & Associates, Architects.

Mr W W Higgins, Principal, Morant Bay All-Age, St Thomas.

Mr Stephen Hodges, Executive Director, Construction Resource & Development Centre Ltd.

Mr Stephen Jameson, Repole Architects & Planners.

Mrs S Knight, Principal, White Horses All-Age, St Thomas.

Mr Beverley Lawrence, Ministry of Education.

Mr Oswald C Mattis, Mattis Demain Beckford Ltd, Consulting Engineers.

Mr Franklin McDonald, Director, Office of Disaster Preparedness.

Mr R M McDonald, Principal, Yallahs Primary, St Thomas.

Mr Brian McIntyre, Apec Consultants, Architects, Planners & Engineers.

Ms Annelies Merkx, Associate Expert in Education, UNESCO, Kingston.

Mrs Patricia Patterson, Director of Projects, Construction and Maintenance, Ministry of Education.

Mrs Delrose Roberts, Principal, Bath Primary & Vocational Training, St Thomas.

Mr Hugh Scott, National Housing Corporation.

Mrs Thomas, Bursar, Morant Bay High, St Thomas.

Mr Clarence D Wallace, Professional Engineering Consultants Ltd.

Mr Lloyd Williams, National Housing Corporation.

Mr Lauriston Wilson, Ministry of Education.
ANNEX J2

Schools visited

Bath Primary & Vocational Training, St Thomas.
Morant Bay All-Age, St Thomas.
Morant Bay High, St Thomas.
Port Morant All-Age, St Thomas.
White Horses All-Age, St Thomas.
Yallahs Primary, St Thomas.

ANNEX J3

THE JAMAICA RECORD, WEDNESDAY SEPTEMBER 21, 1988

Hurricane victims wreck school

By Pete Sankey.

Some 4,500 residents of Old Harbour Bay in St. Catherine, who sought refuge at the Old Harbour High School, have vandalized the school, leaving damages running to an estimated cost of $1/4M.

This estimate was given by the principal of the school, Mr. Guy Jobson, who told the JAMAICA RECORD that among the items stolen were nine sewing machines, nine microscopes from the science laboratory, and 30 chairs. Desks and benches were also broken and used to make fire for cooking in the staff and class rooms.

Blackboards that were nailed to the walls of classrooms were also torn off and used to make beds. Students records were scattered. It is also understood that the art and craft, storage, and reading rooms were also broken into. Faeces could also be seen on the floor and walls of several classrooms which now stink.

"Not even beasts would behave like this," said the distressed principal.

Mr. Jobson said if the Ministry of Education could grant the funds to effect immediate repairs, the school could re-open within two weeks.

The Old Harbour High School was only recently upgraded to high school status and was one of the best kept schools in Jamaica, according to Mr. Jobson.
2. ST KITTS & NEVIS

Purpose

a/ To execute UNESCO Participation Programme Request No 5168.

b/ To undertake fact finding meetings and site visits so as to ascertain and/or confirm:

i/ the need for hurricane and resistant construction training and the form it could and should take for various construction sectors;

ii/ to further consider the functions of and facilities to be provided by a prototype building for the use of schools (especially primary schools) as community emergency shelters during and after hurricanes;

iii/ to discuss the need for and status of school curricula material on disaster preparedness and environmental hazards education.

Activities

Individual discussions were held on St Kitts with the Minister of Education, Youth and Community Affairs, Communications, Works and Public Utilities (on day of departure); Permanent Secretary to the Minister; the Chief Education Officer; the Director of Public Works; the Director of Youth and Community Affairs; the Chief Secretary to the Prime Minister's Office and Permanent Secretary, Ministry of Home Affairs; and Disaster Preparedness Co-ordinator; Deputy Disaster Preparedness Officer; Housing and Planning Officers; architects; teachers; trainers; builders; and building materials suppliers (see ANNEX STKN 1 for discussions held).

Visits, accompanied by a Public Works Department Assistant Engineer, were made to two recently completed primary schools, one multi-purpose centre under construction and (unaccompanied) to several and various rural school buildings and to numerous older buildings in conditions of destruction, collapse or disrepair (see ANNEX STKN 2 for schools visited).

Also on St Kitts, examinations were made of architectural technician's and engineer's drawings for the two completed schools, indicated as being the model of drawings to be used for a third primary school yet to be built at Dieppe Bay (see Report of Participation Programme Request No 5168).

On Nevis, visits were made accompanied by the Assistant Engineer, Nevis Public Works Department, to a recently completed secondary technical block, a recently completed day-care centre, a primary school, and another primary school under construction (commenced January 1991; due for completion December 1991; see ANNEX STKN 2).
Findings

Hurricane "Hugo" (September 1989) affected parts of St Kitts and especially Nevis. 14 schools were damaged including one 130 year old building totally demolished (see ANNEX STKN7 & MR3).

Findings relate to:

i/ recent new school construction;
ii/ school reconstruction and repair;
iii/ construction training;
iv/ school building maintenance;
v/ engineers and architects;
vii/ proposed prototype building
vii/ schools curricula
vii/ Nevis and St Kitts

Recent new school construction: Findings regarding earthquake and hurricane resistant school construction are contained in the Report addressed to the Hon Minister for Education and Works (etc) "Hurricane and Earthquake Resistant Construction of New School Buildings on St Kitts" Report of Participation Programme Request No 5168; November 1991.

It appears that some significant changes were made to school design and construction on St Kitts, between the preparation of drawings (as examined) and as built (as visited) and that these changes were the result of requests made by the funding agency (European Development Fund). It is understood that meetings were held between the Ministry of Education, Public Works Department, their architectural technologist and engineers, together with a reputed consultant engineer in hurricane resistant building construction.

Changes made involved increased roof pitch, decreased roof overhang, and hipped in place of gable roofs (on Nevis, the roofs of the technical block and primary school have not been hipped).

The discussions and changes took place after Hurricane "Hugo" of September 1989; construction of the two schools commenced (under commercial contracts let by the Public Works Department on behalf of the Ministry of Education) in September 1990 and were completed in September 1991. Drawings of the two schools had been prepared between April and October 1988.

Either as a result of these discussions, or in any case (as details appear on the drawings dated 1988), drawings and construction details conform closely with "Draft Guidelines for Building Regulations" (PCDPPP 1985) and the Structural Engineers Association of California (SEAC) Code is widely referred to.
Care has been exercised during this mission so far (particularly in relation to the Participation Project Request No 5168) in respect of the following:

- in view of professional involvement by engineers in recent new school building and the adoption and application of existing design and construction guidelines, there has appeared little need to prepare earthquake and hurricane resistant construction guidelines from first principles. There was little point in preparing guidelines for what is already being done in new school building construction.

- to offer recommendations for further consideration of adopted practice, or where additional modifications could improve resistance and/or comfort.

- to bring to the attention of the appropriate authorities on St Kitts and on Nevis, the UNESCO Educational Architecture Unit publications (and other sources where relevant).

ii/ 

School reconstruction and repair: reconstruction and repair of school buildings (and small new buildings) is usually undertaken under contract by commercial builders, not directly by Government departments who act as managers only. Whereas professionally managed new school building includes some limited on site construction inspection, there are no Government construction inspectors.

iii/ 

Construction training: standards of construction education, training and practice are variable and achieved, if at all, in an ad hoc manner. There is no Government policy to improve building construction, although it is generally agreed that it would be advantageous to do so. There is confirmed and widespread agreement to the need for certified training in good construction practice and in particular, for earthquake and hurricane resistant construction. There is therefore also the need for construction manuals and guidelines but, the construction industry caters for all building types and school building cannot realistically be separated. Manuals, guidelines and training should be addressed to and targeted at the industry at large.

The span of school building may be larger than some other building types, but their form is basic and simple. Materials used in school building construction are usually reinforced concrete and blockwork, timber and roof sheeting; construction trades and techniques of reinforcement, fixings and connections are therefore also basic and common 'Postscript: some early steel framed school buildings have been discredited in Antigua due to severe corrosion).
Building construction for schools is therefore, both practically and institutionally, an integral part and product of the construction industry at large. Therefore, what is good for general construction is good for schools - and vice versa.

Training in the construction industry is required not only on account of hurricanes and earthquakes. Although this economic and social need is significant in itself, there are additional reasons of economics in the construction industry. Because construction skills and construction quality are so variable, and therefore unreliable, a larger "factor of safety" has to be applied than would otherwise be the case. Component and material sizes are sometimes increased (consciously or unconsciously) "to be on the safe side"; whereas with a closer and more accurate understanding of design and construction principles (and preferably with inspection of construction as it proceeds), construction can be more precisely designed and specified, and construction overall thus made to be more cost effective.

For specificity, guidelines and manuals must be relevant, not general. School building construction requirements, norms and materials must be known before training materials can be prepared. It may not be the case that what is relevant for Jamaica and St Kitts will be relevant for Antigua, St Vincent and Barbados (Postscript: with regard to the building materials listed above, relevance is common to all, but design standards for new schools are most advanced in Barbados).

Details, notes and diagrams have been prepared in St Kitts, for reinforced concrete foundations and ringbeam, timber roof construction, connections and fixings, sheet roofing and nailing, and for roof design and earthquake resistant design principles (see Mission Report: Antigua ANNEX AB5).

iv/ School building maintenance: maintenance is a crucial aspect of earthquake and hurricane resistance; earthquakes and hurricanes are a cause of the need for maintenance.

School buildings (and most other Government buildings) are in severe need of maintenance. This is not a matter if disregard by Government but of lack of resources; annual allocations only partially cover annual recurrent maintenance requirements. Consequently and additionally, is a massive "backlog maintenance", exacerbated but not caused by Hurricane "Hugo", for which assistance is required for school buildings in particular.

A Caribbean Development Bank/USAID funded Basic Needs Trust Fund (BNTF) Report (January 1990) has made detailed
building surveys of schools (and health centres) in St Kitts and Nevis. Undertaken by Consulting Engineers Partnership, the Report concludes that although hurricane ("Huco") damage to some schools may have contributed to the general condition of disrepair, most maintenance requirements were due to an almost complete lack of repair due to a lack of adequate funding "or proper allocation of funding available". School buildings were found to be in a worse condition than health buildings.

Cost estimates for recommended building maintenance for the 16 selected schools (exclusive of secondary schools) were:

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<tr>
<th></th>
<th>ECS</th>
<th>USS equiv</th>
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<tbody>
<tr>
<td>St Kitts</td>
<td>1,050,550</td>
<td>404,058</td>
</tr>
<tr>
<td>Nevis</td>
<td>925,360</td>
<td>355,907</td>
</tr>
<tr>
<td>Totals</td>
<td>1,975,910</td>
<td>759,965</td>
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</table>

For comparison, the estimated costs of damage caused by Hurricane "Huco" to all 21 schools on St Kitts was ECS 986,250 (US$ 379,330) and on Nevis ECS 400,000 (US$ 153,846), a total of ECS 1,386,250 (US$ 533,176). These figures are from a different source.

Some work has been undertaken in response to the BNTF Report, the cost of materials (only) being reimbursed from BNTF sources (see ANNEX STKN 3). The 1991 maintenance allocation for all government buildings (* below) was ECS 750,000 (US$ 288,462) plus ECS 250,000 (US$ 96,154) reimbursed from the BNTF Project (via Treasury: see ANNEX STKN 5). This allocation was less than the maintenance request, the amount requested for schools alone being ECS 465,655 (US$ 172,469) (see ANNEX STKN 5). These amounts (except for the BNTF Project, itself exclusive of secondary schools) are for St Kitts only and not inclusive of Nevis schools. [* Government buildings include medical facilities (hospitals, health centres, old persons' homes); police stations; government offices; post offices; sports facilities; community centres; official residences; as well as schools].

v/ Engineers and architects: For the past twenty years in the Caribbean Region, engineers have been the most articulate and influential profession concerning earthquake and hurricane resistance. By comparison, architects may recognize their need to depend upon engineers for expertise in resistant structures. Engineers have the opportunity for training within the Region at the University of the West Indies (Trinidad); but architects will inevitably have been trained outside of the Region, often to curricula exclusive of hurricane and earthquake information.
Meanwhile, a serious need has prevailed amongst architects (and architectural technicians and draughtsmen) in the Caribbean for training in improved methods of building design and construction to take account of hurricane and earthquake resistance.

Where architects conventionally retain their position as "lead profession", engineers are able to apply their specialist expertise only within the limits of conceptual design by the architect. Matters such as roof pitch, hips or cables, and overhang, for example, may be regarded simply as matters of personal aesthetic preference, unless architects come to a better understanding of their crucial role and responsibility in this respect. There are cases where recommendations by an engineer have been rejected by an architect for secondary reasons in a lack of understanding of principles for resistant design.

This situation should begin to slowly change with the formation of the Caribbean School of Architecture at the College of Arts, Science and Technology (CAST) at Kingston, Jamaica, but in the meantime there continues to be a need for the training of architects already in practice. The best way to achieve this would be for the preparation of (video) modules under a heading of Continued Professional Development (CPD).

vii Proposed prototype building: (see recommendation under Mission Report 5 [Barbados] ANNEX B3 for discontinuation of the word "prototype"). Annex STKN 4 describes in detail the approach and recommendations regarding the function of the prototype building. Conclusions are that:

a/ the provision of more shelter space itself in schools is not justified;

b/ for the buildings that exist, improved services and utilities are required for larger numbers of adults, as well as children, for significant periods of time. These especially in primary schools where toilet accommodation is of smaller physical size and where home economics cooking facilities are often not available. (Primary schools are more commonly in or near most communities, whereas secondary schools are more often considerable distance away and shared by several communities).

Services and facilities required are:
- secure potable water supply and storage
- additional toilet facilities
- secure school storage
- storage space for emergency shelter use
- hurricane shutters
- communications equipment
- cooking facilities
- standby power
All of these facilities should be provided in an additional separate school building (or community centre etc) designed for the purpose (see ANNEX STKN 5 & 6).

It would be an opportunity lost not to use the construction of the additional prototype building as a training medium and as the location for the production of a construction training video film (see ANNEX STKN 5 & 6).

vii/ Schools curricula: Until there are national, sub-national, community and shelter plans for implementation at the onset, during and in the aftermath of hurricanes, the implementation of curricula materials in schools is either a/ premature or b/ a means to achieving such plans in the long term future. Education and government policy inform each other; currently, education appears to have the lead over other sectors of Government.

Some work has been commenced at the St Kitts Teacher Training College, for the inclusion at various grades of "disaster preparedness" material. It is included as ANNEX STKN 3.

viii/ Nevis and St Kitts: Even some St Kitts and Nevis Government officers seem to find difficulty in understanding the institutional distinctions between St Kitts and Nevis. The St Kitts and Nevis Federal Government clearly attends to all United Nations affairs; but Nevis Government has to work hard to keep itself informed of United Nations activities as they do (or should) apply to Nevis, and to follow up on subsequent action or share of benefits that there may be. It is suspected for example, that materials, equipment and/or information intended for both, do not always get sent on to Nevis from St Kitts.

In Nevis, postace is separate; and Ministries of Education and of Communications, Works and Public Utilities, are separate from those on St Kitts. Nevis has it's own Premier. Some funding from some sources goes directly to Nevis. "In a sense, we (Nevis) are more independent than they (St Kitts) are".

Achievements

The pre-prepared project itinerary provides half the total project time in Jamaica and St Kitts & Nevis together (with three quarters of this total in St Kitts & Nevis). This suggests that, in addition to the execution of PP 5168 and bearing in mind the forthcoming execution of PP 5000 in Antigua, draft contents for the prototype building development, training programme, project document (and mission report) should be completed before departure from St Kitts. This has been achieved.
The Report to the Minister (PP 5169) has also been written, illustrated, typed and bound in St Kitts and personally presented before departure (together with a copy of UNESCO's "Cyclone Resistant Rural Primary School Construction") and a copy sent to the Premier of Nevis (see ANNEX STKN 9 for accompanying letters).

The visit to Nevis was essential (not only useful) for closer understanding of the constitutional and institutional differences and distinctions that exist between the two islands of the Federation.

Recommendations

UNESCO should assist the funding of "backlog maintenance" for school buildings, as identified in the Basic Needs Trust Fund Report (Postscript: Similar conditions prevail and BNTF Reports have been produced in other countries of this mission and this recommendation therefore repeats and accrues under other sections).

Difficulties encountered

The need to complete draft project document contents for the proposed additional prototype building and the training programme on the basis of findings from Jamaica and in St Kitts and Nevis has made it necessary to make assumptions on behalf of Antigua and Barbuda, St Vincent and the Grenadines and Barbados. These assumptions have been entered into before accurate costing has been possible.

Minister Morris (Education and Works etc) was in UNESCO Paris until the end of my St Kitts mission.

The originals of the engineer's schools drawings were not available in St Kitts (having been prepared in Dominica).

Small places have time consuming walking distances: 30 minutes each way from hotel to PWD: good for exercise but time consuming. Occasional transport (Assistant Engineer's private car) was provided for some meetings.

Nevis should have been a separately specified item of the terms of reference and of the itinerary, with time and cost allocated to it. Disrupted and locally changed ferry times (due to sub-regional football matches as well as to engine trouble) caused mission time to be wasted where the Nevis visit had to be fitted between St Kitts appointments.
Support received

Prompt and efficient appointments and information finding by Assistant Engineer PWD and courteous and interested attention by Chief and Assistant Engineers, PWD, Nevis. Patient and diligent but time consuming word-processing assistance from PWD secretarial staff.

Arrival: Late evening Friday 18 October 1991.
Departure: Afternoon Tuesday 12 December 1991
Nevis visit: 09.30 hrs 3 November - 14.00 hrs 9 November.
Working days: 16 (excluding arrival and departure days and four weekends during which appointments for meetings and discussion are not possible).

ANNEX STKN 1

Discussions held

Mr George Archibald, Clerk-of-Works, Department of Public Works, Ministry of Communications, Works and Public Utilities, and Building Board, Nevis.
Mr G A Belle, Managing Director, Vincent Morton & Associates Ltd., Building & Civil Works Contractors, and President, St Kitts Nevis Contractors Association.
Mr Lester Blacket, Chief Engineer, Department of Public Works, Ministry of Communications, Works and Public Utilities, Nevis.
Mr Fitzgerald Bon Camper, Assistant Engineer, Department of Public Works, Ministry of Communications, Works and Public Utilities, St Kitts.
Mr Alphonso E Bridgewater, Director, Department of Youth and Community Affairs, Ministry of Education, Youth and Community Affairs, St Kitts.
Mrs Vapel Burt, Education Officer, Ministry of Education, Youth and Community Affairs, St Kitts.
Mr Rudolph Byron, Head of Construction, St Kitts & Nevis Technical College.
Mr Calvin Farier, The Chief Secretary, Prime Minister and Permanent Secretary, Home Affairs, St Kitts.
Mr Douglas L Gillanders, Cooper Kauffman Ltd, Quantity Surveyors, St Kitts.
Mr Joseph J Hallidav, Chief Education Officer, St Kitts Nevis.
Mr Philip Hanny, Assistant Engineer, Department of Public Works, Ministry of Communications, Works and Public Utilities, St Kitts.
Mrs Daphne Hobson, Daphne Hobson and Associates, Architects, Nevis (Extended telephone conversation).

Mrs Patricia Hobson, Permanent Secretary, Ministry of Education, Youth and Community Affairs, St Kitts.
Mr E Innes, Principal, St Kitts & Nevis Technical College.
Mr Juan Isaac, Department of Youth and Community Affairs, Ministry of Education, Youth and Community Affairs, St Kitts.
Mr Ray John, Department of Civil Aviation, Air Traffic Controller, Meteorologist, Deputy Disaster Co-ordinator, St Kitts.
Mr James A E Kelly, Architectural Technologist, St Kitts.
Mr Joseph R Lancaster, Onions, Bouchard & McCulloch, Architects, Engineers & Interior Designers, St Kitts.
Mr Steve Laplace, Manager/Buyer, St Kitts-Nevis-Antigua Trading & Development Co Ltd.
Mr Ashton G Leader, Assistant Housing & Planning Officer, Central Housing Authority, St Kitts.
Mrs Patsy Matthews, Senior Physical Planning Officer, Ministry of Agriculture, Lands, Housing and Development, St Kitts.
Mr Theodore Mills, Senior Health Inspector, Ministry of Health and Womens' Affairs, St Kitts.
Mr Stephen Mitchell, Consulting Engineers Partnership Ltd., St Kitts.
The Hon Sidney Morris, Minister of Education, Youth and Community Affairs, Communications, Works and Public Utilities, St Kitts.
Mrs Morton, Headmistress, Basseterre Primary, St Kitts.
Mr Michael Perkins, Assistant Engineer, Public Works Department, Ministry of Communications, Works and Public Utilities, Nevis.
Mrs Christine A Springette, Senior Education Officer, Ministry of Education, Youth and Community Affairs, Nevis.
ANNEX STKN 2

Schools visited

St Kitts (accompanied by Assistant Engineer, St Kitts)

Basseterre Primary
Basseterre Multi-purpose Centre
Basseterre Junior High
Dieppe Bay Primary
Trinity Primary
Trinity Primary Old Building
(demolished by Hurricane "Hugo")

St Kitts (independently)

Conaree Primary
Cavon Primary
Cavon Secondary
Kays Primary
Molinieux Primary
Ottley's Primary
Trinity Primary Old Building
(demolished by Hurricane "Hugo")

Nevis (accompanied by Assistant Engineer, Nevis)

Charlestown Secondary (new technical block)
Charlestown Primary (under construction)
Lowlands Day-care Centre
Lowlands Primary
Introduction

Jamaica is threatened annually by natural disasters, particularly hurricanes. A prepared public is more likely to cope appropriately with these problems, thus saving lives and property. Therefore, disaster preparedness objectives, materials, and activities suggested by the Office of Disaster Preparedness have been included where they are most appropriate in the elementary curriculum. Additional teacher aids, such as slides, filmstrips and films may be loaned teachers by ODP. A teacher's resource booklet of teaching materials, as well as other pamphlets for primary and secondary age levels are in the planning stages.

The goal of Disaster Preparedness Education is to save lives and property by helping students understand how natural forces work and teaching them to plan ahead so they can be confident in their ability to respond to emergency situations. In grades 1 - 3 emphasis is on the everyday observations and activities of children which can help them understand hurricanes and what they can do to help themselves.

In grades 4 - 6, more scientific explanations are introduced with greater attention to the social and physical consequences of natural disasters and methods of preventing injury and damage.

Grade 1

Topic/General Aim: We can do things to help ourselves in an emergency.

Concepts/Generalisation: Preparedness for Hurricanes and other natural disasters

Objectives: Pupils will be able to

1) describe what strong winds, a lot of water, or ground shaking can do to the earth, people, and buildings.

2) list at least three self-help actions they can perform at school or at home before, during or after hurricanes and earthquakes.

3) talk about their fears and know they can receive reassurance from parents, teachers, and friends.

Skills: listening, problem-solving, planning

Attitudes: Confidence in their ability to help themselves, appreciation of the powers of nature, willingness to discuss fears and overcome them.

Class Activities: (The suggestions that follow are for interpretation of preparedness material at relevant points in the existing curricula.)
Objectives: Pupils can identify which foods are best to have on hand for times when there is no kerosene or coal, gas or electricity for cooking, or water for washing foods.

Activities: When teacher is asking students to classify foods, include questions about which foods can be used when it is not possible to cook or wash foods -- e.g., canned foods, dried foods, fruits and vegetables with peels we remove before eating, etc.

(It is not necessary to discuss what might cause lack of water or power, unless pupils raise the question. Try to avoid frightening description of natural disasters with young children.)

Objective 6. Realize that they can use a map to know exit routes in case of a fire alarm, or to use after the ground stops shaking in an earthquake, or in any school emergency when it is important to leave the building quickly.

Activities: When locating the school on the map of the district, also locate the safest way to homes and/or high ground.

7. and 8 are appropriate for preparedness education --- include a discussion of emergency exits, safest open areas --- away from power lines and buildings.

13. Include a discussion of safe areas in the classroom in a hurricane or earthquake. Ask which side of the house is safest in strong winds. Practice getting under desks or tables on a signal from the teacher. (earthquake)

Objective C. Land can be level or hilly, on the same level as the sea or above the sea.

Activity 2 Discussion while students work on the map could include questions about what happens to rivers when they have too much water, how high waves can be in a storm, etc. Introduce concepts of high, higher than.

Objective: Pupils will discover what happens to earth (and) when a little water is added, when a lot of water is added.

Activity: Have pupils make cones, hills, or towers of earth. Sprinkle with water, observe what happens. Pour a lot of water, observe what happens. Ask what happens to hills, rocks, roads, plants, etc. in heavy rains.
Objective: 

a) Pupils will be able to identify what they could do at home if there was no adult to help them meet their needs.

(This is already a preparedness/self-confidence objective).

Activity: Discussion with the teacher about what to do if they are home alone and the earthquakes, or there is a storm: e.g. where to take shelter, to stay indoors, etc.

Objective: 

b) Pupils able to recognize their own emotions and distinguish between the different kinds.

Add: Pupils able to express and cope with their fears of natural disasters such as hurricane, storm, flood and earthquake.

Activity: In the pretending activity, pretend you are a boy or girl waking from a frightening dream about a hurricane, earthquake or flood. Another student pretends to be a parent or older sister.

Discuss which responses were comforting, how they helped the frightened person.

Objective: 

c) recognize the problems/dangers of too much water, including floods and rainfall.

Activity:

Item 5: Include questions such as: Can dirty water make you sick? Do you know how to purify (clean) water so we can drink and cook with it.

Item 7: what should we do when there is a hurricane? Discuss safety measures, especially providing a supply of clean water for emergencies.

Objective: 

d) Identify safety rules at home and at school, including hurricane and earthquake safety.

Activity:

4. Safety at Home review: 1. how to make water safe to drink 2. rules for hurricanes - stay inside, bring loose things in from outside, shut the storm shutters if you have them, listen to the radio for information about what to do. 3. rules for earthquakes - stay inside, near a strong wall or doorway or under a table or bed, away from things that might fall on you or break. Stay near other family members, comfort younger brothers and sisters.
Grade 1 Social Studies  
Term III, Week 3, p.7

Objectives: Add: pupils will realize that it is important to protect/ provide for food, water, clothing, shelter in emergencies such as hurricanes, earthquakes, and floods.

Activity: Show pictures of people readying homes for a hurricane. Have class list what should be included in a home or classroom emergency kit. Students bring things from home or the school provides items for a classroom kit:
- flashlight and batteries
- small battery operated radio
- matches, candles
- first aid supplies
- other items suggested by the class

Grade 1 Religious Education  
Term III, week 3

Objective: People can all overcome their fears and show courage even in times of emergency such as hurricanes and earthquakes.

Activity: Ask if students have experienced hurricanes or storms. Did they show courage or bravery? Did they comfort younger family members?

Grade 1 Social Studies  
Term III, week 4, p.10

Objective: C Pupils will realize that climate influences the kind of food, clothing, and shelter the family requires.

Activity: Display pictures of tropical storms. Ask students what problems weather (climate) causes in Jamaica. What kinds of shelters are best for this climate and these problems?

Grade 1 Science  
Term III, week 4, p.12

Objective: Pupils will discover what happens to various objects when put in water.


Grade 1 Science  
Term III, week 9

Objectives: Pupils will discover that large objects displace more water than small objects.

Activity: Blow gently on the water in a large container. How does the "wind" move the water? Blow harder. Does the water move higher on the sides of the container? Do storms sometimes make the waves come up higher on the land?
GRADE 2 TERM 1 WEEK 3

SOCIAL STUDIES

TOPIC/GENERAL AIM

How the family satisfies needs - shelter

CONCEPT/GENERALISATIONS

(e) Our homes should be safe from hurricanes.

OBJECTIVES

(f) List the damage that can be done to a house by hurricanes.

(g) Identify building sites that are (i) unsafe (ii) fairly safe during a hurricane.

(h) List ways in which a house can be made safe against hurricanes.

SKILLS........DISCUSSING, COLOURING

ACTIVITIES

(3) Discuss how to make

(a) the foundations

(b) the walls

(c) the roof

of a house safe from damage by hurricanes.

(4) Discuss the safe location of windows.

(5) Discuss how the wind can be prevented from blowing in through windows.

TERM II WEEK 2

TOPIC Investigate weather.

ACTIVITIES

1 ......... cool, windy, etc.

2. Observe the effects of

(a) light breeze

(b) stronger winds on loose objects, leaves and branches of trees, flags

smoke.

3. Discuss the effect of hurricane winds on the trees, fruits on trees, things

that are not bolted down like garbage tins, roofs of houses.

TERM II WEEK 3

SOCIAL STUDIES

TOPIC/GENERAL AIM

People in our community who protect us.

CONCEPTS Safety protection
OBJECTIVES

(e) Describe the work of the Parish Disaster Committee relating this to the work of the National Disaster Committee before, during and after a disaster, like a hurricane.

(f) Describe the precautions we should take before, during and after a hurricane.

ACTIVITIES

(5) Discuss the meaning of "disaster" and why a hurricane is referred to as a disaster.

(6) Discuss the composition of the Parish Disaster Committee, briefly discussing the roles of some of the members of the committee.

Grade 3

Topic: How natural disasters occur and how to be ready for them

Concept: Natural disasters: community/individual responsibilities

Objectives: Pupils will

--- be able to explain the causes of hurricanes and earthquakes
--- be able to list three self-help activities they could perform before, during, or after a hurricane or earthquake
--- express confidence in their ability to take care of themselves in emergencies, express their fears and overcome them, seek appropriate assistance from parents and other adults, identify emergency services in their community.

Grade 3 Science

Term I week 2, p. 6

Topic: How does water in motion behave?

Objective: be able to describe the movement of water in the sea, in storms, in rainfall.

Activities presently listed are appropriate for disaster awareness.
In discussions, the teacher leads students to list ways people protect themselves from high seas and winds.

Grade 3 Religious Education

Term I week 7, p. 19

The story of Noah used here offers an opportunity to discuss how Noah took action to protect his family from the flood. Ask what actions families in Jamaica can take to protect themselves and their neighbours in time of flood or hurricane.

Grade 3 Science

Term I week 10, p. 30

Concept/Generalization: Water is useful and water is harmful

Objective: (appropriate as written)
Activity: Discuss with pupils other effect of water: Hurricanes, floods, heavy rainfall. How can we prevent some of the damage caused by hurricanes and floods? Have students draw pictures of measures we can take to protect ourselves from hurricanes.

Grade 3 Science Term II week 5, p. 15

Topic: Strength of winds
Are they helpful or harmful?

Objectives: Pupils will be able to define what wind strength is required to damage buildings, plants.

Activities: Study the weather reports and weather maps published in the CLEANNER by the Meteorological Office. What information do these maps give? Why is it important? How can we use this information? (To prepare for the weather predicted)
What is the windspeed of a hurricane? More than 120 kilometers per hour. A tropical storm has winds anywhere from 64 kph to 120 kph.

Activity: Write to or visit a meteorological office for more information. Keep a booklet of weather maps cut from the newspaper during the hurricane season. When was the period of greatest storms?

Grade 3 Science Term II week 6, p. 18

Objectives: Pupils will be able to perform the procedure for putting out a fire on personal clothing or hair.

Activities: Discuss with the students how a person's clothing or hair might catch fire. (Standing too near an open flame, leaning over a stove, explosion of a gas stove, etc.) Tell students how to stop, drop, and roll, to put out the fire on themselves. Have students discuss this procedure and practice it.

STOP: Why shouldn't you run if your clothes are on fire?

DROP: Why get down on the ground, or wrap in a blanket if one is handy?

ROLL: Why does rolling on the ground help put out the fire?

If you see someone running (i.e., a smaller child) What could you do?

Have class members pretend they are on fire and show how they would Stop, Drop, and Roll. (Put a sheet, cloth or cardboard on the floor or ground to protect students clothing they they roll.)

Activity 2. Have students list other things they could use to put out fires in an emergency. (Dirt, baking soda, banana leaves, etc.) Emphasize that they can stay calm in an emergency if they think how about what to do.
Grade 3 Social Studios

Objective: Students will be able to realize that different climates have different safety problems.

Activity: List the problems each of the two communities might face because of the difference in location and climate — e.g., greater danger of flood, hurricane, landslide, damage from waves, etc.

Grade 4 Social Studies

Topic: Where do we live?

Objectives:
(d) Interview members, and interpret and record the relevant information. Include information on Natural Disasters or Emergencies that their families have experienced.

Learning Activities:

Teacher:
1. Disaster Questionnaire
   Using the sample questionnaire for Community Preparedness. Discuss with students what questions they would ask of older members of their community or find out what disasters affect their community and how they were affected by it.
2. Ask pupils to bring results to schools and discuss the results with them.

Pupils: Participate in Discussion

Develop relevant background questions: age, sex, district, how long lived there. Develop questions on past disasters; how they affected the area, why they occurred, how people reacted, how did it change the community. Interview a senior member of the family. Report results of interviews to class.

Determine and list Emergencies and disasters that have struck your district.

Grade 4 Social Studies

Topic: Where is our Parish?

Objectives:

Learning Activities:

Teacher:
1. After explaining the use of the "key" in reading maps, using the map of Jamaica's flood prone areas discuss with students the areas most likely to flood. Ask students to postulate reasons for this. Ask students to read the map and determine if their Parish is prone to flooding and where.

Pupils:
Participate in discussion. On reading maps, using flood prone area map of Jamaica. Determine if a flood could happen in their district.
Grade 4 Social Studies

Topic: What do farmers do in your parish

Objectives: Explain how types of crops grown or animals reared influence nature of the farmers activities.

Learning Activities:

Teacher:

5. After discussion of what farming activities take place in your district, discuss how the natural surroundings affect these activities. Using types of weather experienced in different areas, discuss how living in an area where hurricanes threaten every year would affect farming habits.

Pupil:

After a discussion on farming activities and how a hurricane could affect them, will think of a skit showing one aspect of how a hurricane would affect a farmer, a teacher or a truck driver and banker.

Add to Learning Activity:

2. Pupils: Find out: (c) How these crops could be affected by natural disasters

4. Teacher: Ask students to relate stories of farmers preparing for a hurricane, i.e., men up animals, pick coconuts, and ripe fruits that could fly around dangerously in strong winds, clear area of loose objects (zinc sheets, lumber, toys, verandah furniture, board up house etc.).

5. Pupils: Ask farmers if there is a certain way in which they can know hurricane is coming.

Grade 4 Music

Topic: Rhythm

Objectives: 2 skills a) respond to steady beat
b) create rhythm accompanying a song

Learning activity

Teacher:

1. a) Ask children to think of a terrible storm, with lots of winds and rain. Ask them to think of and imitate what predominant beat they would hear, e.g., crashing of ocean waves, wind flapping a piece of loose zinc or window shutter.

b) Ask pupils to imaging the rhythm pattern the rain on the roofs or wind at the walls might make.

Pupils

a) Create the beat of a storm
b) Create the rhythm of a storm
c) Class divided in two, have students do rhythm and beat in tandem.
Grade 4 Physical Education

Topic: Music and Movements

Objectives: a) Move in good timing using rhythm
b) Change directions more precisely.

Skills Practice:

3. a) Ask students to turn in a circle, with arms open, in an anti-clockwise direction (from right to left). Explain that a hurricane rotates in an anti-clockwise direction. Ask them to rotate like a hurricane - slow at first, encourage them to slowly pick up speed, but stop them soon and frequently to prevent dizziness.

b) After pupils can make easy rotation ask them to start at one point and rotate anti-clockwise to get to another point. Tell them this is the same way a hurricane moves, rotating slowly sometimes, fast at other times and moving forward.

Limbering Down: Students will move in a forward direction slowly rotating... slowing down to barely moving then rest and with deep breathing, stretching, with hands over head, then relaxing.

Grade 4 Art and Craft

Topics: 1. Making Posters, banners and post cards
2. Creating designs for transfer on lino or wood blocks.

Objectives: (a) - (e)

Supplemental Learning Activity:

Teacher:

1. Ask students to design a poster with a slogan for preparing for a Hurricane. Discuss what some preparations are.

Pupils

1. Think of hurricane readiness slogan
2. Letter
3. Illustrate the idea of the slogan

* See attached Resource Material
1. Sample questionnaire
2. Flood map of Jamaica
3. ODP Hurricane Pamphlet.
Grade 4 Mathematics

Topic: Measuring Time

Example

Math Problem: The Meteorological Office has issued a hurricane warning. The path of Hurricane Barry is headed for the south coast of Jamaica. Hurricane Barry is now located 160 kilometres southeast of Jamaica. The hurricane is expected to severely affect the island in 16 hours. When you look at the clock you see it reads

At what time will Hurricane Barry affect Jamaica? How fast is the hurricane moving?

Teacher:

1. Write the above problem on the board as an evaluation of telling time, measuring them, estimation of time, problem solving, addition of division.

Note: Background information on hurricanes is not necessary but very helpful.

Grade 4 Science

Learning Activities #6

Teacher:

6. As an additional question:

(iii) What could make a large tree uproot? (strong wind, rushing water)

Learning Activity (Contd)

Teacher:

4. Ask pupils to refer to flood map of Jamaica and ask: Are coastal areas particularly susceptible to floods?

Pupils

Discuss: When could the wind blow strong enough to damage plants? Could a flood uproot plants?

Pupils

Discuss: When rains come the ground fills up and rivers fill up and run to the ocean.
Learning Activity #2

Teacher:

2. Ask Pupils:

vii. What happens to the soil of a hillside during heavy rains when

a) The hillsides are bare without plants
b) The hillsides have plants and trees.

Students will discuss:

a) What happens when heavy rains come
b) the effect on their homes, schools, farms and businesses
c) Some ways to improve water and soil runoff.

Note: Water conservation and soil conservation go hand-in-hand. Discuss with students some examples of soil and water conservation:

1) Terracing hillside
2) Water catchments
3) Reinforced riverbanks
4) Water trenches
5) Irrigation
6) Mulching

ix. What happens if soil and water rush down hillside without barriers? With barriers? What sort of barriers are best? (Plants and natural mulch).

Suggestion for integration

Resource Material

The maps used in "the changing shape of Jamaica" can also be compared with flood map of Jamaica.

Grade 4 Language Arts

Learning Activity #6

6. Use a "crisis and relief" situation for minis, skits and dialogue. Students can think of several different characters, imagine and act out. Note and discuss with pupils the type of communication which occurs during a crisis. What can impede someone from understanding a life and death situation? How do they think these characters would react to a given crisis?
Grade 4 Social Studies

Weeks 4 & 5 p. 91

Topic: Food for Jamaica: Distribution

Objective: Identify ... For example: Hurricane destroying crops.

Learning Activities: #10

Teacher:

10. Natural Disaster can cause break down in transportation and communication. A second part of this simulation could be a community cut off by flooded roads. Discuss with students: (1) What the people of the area could do to survive? (ie local resources, boats, alternative routes, etc). (2) What could the people of the district do to prevent the flooding so they won't be cut off next time? (3) Have you or area ever been stranded? Relate with personal discussion.

Pupils

Recall past natural and man-made events which stopped or slowed down food production and distribution. Discuss how these might have been prevented.

Note:

Related Story: Mutiny on the Bounty
Captain Bligh was carrying breadfruit trees for a starving Jamaica in 1793. Jamaica had been hit by a severe hurricane which wiped out all its food crops.

"The breadfruit was introduced into the West Indies in 1793 from Tahiti. Capt. Bligh in the ship Providence brought plants to St. Vincent and Jamaica after an earlier attempt failed aboard the mutiny ship Bounty in 1789*


Grade 4 Music

Learning Activity #1

Teacher:

1. Encourage students to imitate the various sounds of a storm using body sounds. When several different sounds have been explored, separate students into groups according to how many different sounds you want.

Pupils

Use separate rhythm, beat and sounds (ie blowing, tapping, clapping, stomping feet, whistling etc) to create an orchestra of a storm. Practice body sounds of a storm and produce a steady rhythm or beat.
Teacher: (contd)

Let each group practice the
different beat and rhythm of the
sounds repeating at given intervals.
Then let them perform the 'Sounds'
all together. You can explain
that this is how orchestra and bands
work.

Example: One group "plays"
rhythm, the next beat. Then they
all "play" together.

---

Grade 4 Social Studies

Topic: Building in Jamaica

Objectives: be able to assess if a building is likely to be safe from hurricane.

LEARNING ACTIVITIES:

3. Provide pupils with a check list which they can use to assess if a building is safe from hurricanes. Each point should be discussed beforehand. They should note if:
   a. the building is on a flat firm site.
   b. the walls are strong and straight.
   c. the windows are at least 36 inches from the nearest corner.
   d. the roofs are sealed.
   e. zinc sheets are nailed on securely.
   f. the verandah can break away from the main roof.
   g. the building is square or rectangular as opposed to 'U' shaped or 'L' shaped.
   h. The house is securely attached to the foundation.
   i. The overhang of the roof is less than eighteen (18) inches.
LEARNING ACTIVITIES

TEACHER

8. ... ask why we specify clean. Discuss the damage that can be caused to water mains and sewerage mains during a disaster like a hurricane or an earthquake. Why should we boil water for drinking after a hurricane?

PUPILS

Identify sources of pollution especially of water (See Grade 4 Social Studies week 7 & 8. Learning activities 4)

SOCIAL STUDIES

UNIT 3

LEARNING ACTIVITIES

3. Discuss the roles of the Office of Disaster Preparedness, the National Disaster Committee and the Parish Disaster Committee. Discuss the importance of having disaster plans. Invite the coordinator of the Parish Disaster Committee to talk to pupils. Showing a film on a natural disaster would be effective.

PUPILS

3. ... Describing the damage done by at least two actual disasters that have done major damage to the island. Describing the precautions they can take before, during and after a hurricane. Prepare questions for the resource person.

GRADE 5 UNIT 4

TERM 1 - 3

LEARNING ACTIVITIES

6(viii)

PUPILS

Discuss the resources that would be needed after a hurricane. How priorities are decided upon, problems in ensuring that the victims get the aid.
### MAINTENANCE ESTIMATES FOR GOVERNMENT SCHOOLS FOR 1992 (ST. KITTS ONLY)

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| TOTAL                  | 259141.98 | 31043693.30 | 4656554.43 |

**NOTE:** MAINTENANCE ESTIMATE IS BASED ON 1.5% OF THE REPLACEMENT COST.

### BASIC NEEDS TRUST FUND PROJECT

#### BUILDING MAINTENANCE

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**EC $ 1,021,550.00 EC $ 190,100.00**

* FUNDED FROM OTHER SOURCES THAN BNTF.
ANNEX STKN 5

1. School buildings are already the subject of design changes to take technical account of hurricanes post-Hurricane Allen and Hurricane Hugo. Extensive damage sustained by schools in "Gilbert" and "Hugo" is now taken into account in all subsequent construction (as indicated by construction drawings; see PP Report).

2. Schools are often unnecessarily large buildings compared to the apparent size of the community they serve; there may be more than one type of school eg: primary and secondary; and there may also be a community centre and/or a church building also used as emergency shelter.

3. What is the percentage of community populations as non-masonry dwellings is compared to the floor area of schools in those communities. Floor area per person is an average of 11 square feet (4.5 sq meters) (Mission Report analysis of information in Caricomprit Miss Mavis Census 1981). This suggests that in most cases, floor area for shelter purposes is already adequate, especially other buildings available for the purpose are additional to this assessment.

4. Certainly, school buildings are often overcrowded, but to such an extent (up to double roll numbers to design size) that "additional" additional buildings would have little impact.

5. Sanitary facilities for children (toilets and drinking water) are often very inadequate; requiring increases in number and in areas of schools as hurricane shelters.

6. There is common agreement (Mission Report) that use of school buildings as hurricane shelters involves the following:

- secure windows and doors
- additional space toilet accommodation
- additional doors against wind; fixed and hinged
- hurricane shelters
- communications equipment
- standby generators (regarded as a luxury as refuges are advised to take meet the hurricane...)
- cooking facilities
- maintenance as well as a hurricane with old community;
- structurally sound and maintained hurricane assistance.

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- maintenance as well as a hurricane with old community;
- structurally sound and maintained hurricane assistance.
7. Materials proposed are those in current use: reinforced concrete and concrete blockwork; timber roof structure, nailed sheet metal roofing.

8. Design principles are:
   - plan form ratio of 3:1 length to breadth
   - pitch roof minimum 40 degrees (wind suction reduced and volcanic ash discharged)
   - locally available materials and techniques
   - wall openings and proportions to conform to earthquake resistant recommendations.

9. An additional building containing all these facilities and constructed to these recommendations would be physically separate, advantageous for alternative uses (office, meetings room, storage, communications training [Postscript: and see observations on modifications in Mission Report 5: Barbados ANNEX B3]): and would be appropriate for use in traditional construction as a training medium, compilable and affordable.
A proposed UNESCO Caribbean prototype additional building for the use of primary schools as community hurricane shelters and a UNESCO Caribbean subregional construction training programme.

UNESCO: ED/EAR
James Lewis: Architect
It is proposed that a

UNESCO CARIBBEAN PROTOTYPE ADDITIONAL BUILDING FOR THE USE OF PRIMARY SCHOOLS AS COMMUNITY HURRICANE SHELTERS

is made to be the medium for and the product of a

UNESCO CARIBBEAN SUB-REGIONAL CONSTRUCTION TRAINING PROGRAMME.

- The UNESCO prototype building is designed to contain the following facilities additional to those of most school buildings and especially primary school buildings:
  - secure portable water supply and storage
  - cooking facilities and food storage
  - adult toilet and washing
  - secure and waterproof storage for equipment, books, school records.
Also proposed is the provision of communications equipment and standby power.

The building will be constructed to resist damage from hurricane and earthquake and will be fitted with hurricane shutters.
The building will have multi-purpose school use between hurricanes as e.g.:
  - office space, meeting room, storage space.

One prototype building will be built in each of the five countries of the sub-regional project, viz: Antigua & Barbuda; Barbados; Jamaica; St Kitts & Nevis; & St Vincent & The Grenadines.

- The UNESCO sub-regional construction training programme will use the construction of the prototype buildings as "hands on" training opportunity. Teams of 4 selected trainees from each of the five participating countries will be combined on each site as the construction force, assisted by three "middle management" trainees. There will be a UNESCO Contract Manager/Tutor; and provision for 5 local "day-release" nationals.

On each site, 20 full-time and five part-time trainees; a total of 125 overall. Training certificates will be issued and a video film produced of the construction, illustrating the principles of hurricane and earthquake resistant construction and the application of design and construction techniques. The video will be used for continued training for construction workers, technicians, draughtsmen, architects and engineers, used in conjunction with published illustrated guidelines.

Drawings of the proposed prototype building with a timetable for its construction follow.
Floor Plan:
1:10.

Prototype additional building for the use of primary schools as community hurricane shelters.

UNESCO: ED/EAR.
James Lewis Architect
Alternative layouts incorporating additional building.

Prototype additional building for the use of primary schools as community hurricane shelters.

UNESCO: ED/EAR
James Lewis Architect
Sections
1:10.
( rafters/purlins not shown).

Prototype additional building
for the use of primary school
as community hurricane shelters.

UNESCO: ED/EAR
James Lewis Architect.
Construction notes:

**MATERIALS**

**Walls:**  
6" hollow concrete blocks; steel reinforced [see details]

**Floor:**  
6" concrete slab; polythene membrane; on rammed hardcore.

**Roof:**  
6"x2" wallplate bolted to ringbeam [see details]  
4"x2" rafters; tie6 @ alternate rafters.  
6"x6" ridge beam.  
6"x2" hip rafters.  
10" deep x 4" ogp made-up plywood web main purin.  
5"x2" bay bracing 1/2 rafters; 4"x2" hip to cross wall bcing.

3'x2' battens (on edge) @ approx 2.6"cc & halved onto rafters; extra batten @ ridge and eaves.

Centres of rafters @ approx 24"cc to match centres of roof sheet corrugations  
Eg 'Zalutite' corrugations @ 140mm x 3 = 570mm  
= 22 1/2" rafter cc.

**Roofing:**  
'Zalutite' trapezoidal (or equal; see technical sheet).  
Gauge 25; unpainted.  
15/6" sheets (adjust pitch to avoid trimming).  
NB: no overhang other than to discharge rainwater to gutter.

**Louvres:**  
Jalousie windows (see technical sheet)

**Finishes:**  
Floor: steel-trowel finish; concrete slab or screed.  
Walls: internal: fairfaced blockwork.  
external: sand/cement render; unpainted.  
Ceiling: None.

**FIXINGS**

**Nailing:**  
Roof sheeting: @ every corrugation on batten cc  
(about 25")  
Nails @ rafter cc to go through halved batten into rafter: 4 1/2" nails/round/diamond point/spiral shank/flat head.  
Nails into battens only: 3" ditto.  
(see technical sheet attached).

**Hurricane clips:**  
Galvanized: at every rafter/batten joint.  
rafter/rafter tie.  
rafter/wall plate joint.  
Nailed every hole: 1 1/2" nails.

**Straps:**  
Galvanized: right angle straps (or built in) on cross wall 'gables' @ 315"cc & across 2 no adjacent rafters.  
Main purin strapped to blockwork cross walls (ditto).

**Rainwater:**  
Galvanized gutters to rainwater collection banks.

**Locks:**  
All external & store doors to be padlocked.

**Shutters:**  
All windows to be fitted with demountable external hurricane shutters.

UNESCO: ED/EAR  
James Lewis Architect
ZALUTITE
ZINC/ALUMINIUM ALLOY COATED STEEL

The old type galvanize is now obsolete and being replaced by a new generation ZINC/ALUMINIUM COATED. NO WHITE RUST, 2-4 TIMES LONGER LIFE. Can be painted at once. Conforms to rigid building codes. In use worldwide over last 18 years.

FEATURES

- The corrosion resistance of zinc and aluminium
  Zalutite is a steel that is hot-dip coated with an alloy composed primarily of zinc and aluminium (by weight 55% Al, 43% Zn, 2%). So to combine their properties of corrosion resistance, zinc and aluminium give better protection while zinc also protects sacrificial, all cut edges or damaged areas.

- From exhaustive tests carried out in Britain, Australia and Canada 25 gauge is considered a reasonably substantial gauge for general buildings. Thinner gauges such as 26G/27G and thinner gauges are not recommended and have short life.

Zalutite's surface pattern is especially attractive in unpainted applications; its apparent semi-matt white appearance is especially suitable for roofing. The excellent quality of its surface is easily painted, either for aesthetic reasons or for greater protection and even longer life.

- Proven record of performance
  Zalutite was developed by the Bethlehem Steel Corporation in the USA and launched there in 1972 under the registered trademark Galvaume. Since then it has established a record of proven performance worldwide.

Zalutite has resistance to both oxidation and discolouration at temperatures up to 315°C.

VERY IMPORTANT: Coating Grade. We do not supply with a ALUMINIUM/ZINC coating of less than 185 G/M² for external roofing or cladding. Some companies are supplying 150 G/M² but this is unsatisfactory and should only be used for internal use.

TOTAL FOOTAGE PER TONNE: 930’
Sheets per ton 10 1/2 x 3” x 25G (.5mm)

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MANUFACTURED BY ORAN ALUMINIUM PRODUCTS LTD.
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TEL. 436-6813 FAX 436-8807

UNESCO • BD/ EA• X. J•
155 Galvanized Steel Sheets @ 6’
133 @ 7’
116 @ 8’
103 @ 9’
93 @ 10’
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ZALUTITE
ZINC-ALUMINIUM ALLOY COATED STEEL

ALUMINIUM STRIP HARDWARE
for 4 inch louvres

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ANNEX STKN 7

Damage to education facilities
(Source: Co-ordinator: CARNEID: 27 November 1989)

ST. CHRISTOPHER/NEVIS

DAMAGE TO EDUCATION FACILITIES

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I've witness accounts of Hurricane "Hurco"
St Kitts & Nevis: September 1989
(Source: Byron Moses C M)

"Hurco" left Nevis a much poorer country than it was, damaging or destroying some 65% of the houses there, destroying crops, and leaving some four thousand homeless. On the island of St Kitts, similar damage was done. The effect of "Hurco" on some schools was so severe that they had to operate on shift system whereby some students attended in the morning and some in the afternoon. Both the Technical College and the Teachers' Training College had to be housed elsewhere, temporarily.

"In the foreday morning about 3.30am. I was in my bed and some gravel stone from the roof started to drop on me. I got up, went in my front room, and while looking out the window, I saw a house roof blow off and went towards my calf. At that time my girlfriend and the children were sleeping. I woke them up that they could see what was going on, but soon they got frightened - and not long after, my house roof blew off. My girlfriend and the children ran out to the Community Centre for shelter and as I was out my back door, a piece of galvanise flew across my face" (Conaree Village, St Kitts).

"De wind started to blow de house roof. Me tie it down to keep it from blowing off and de wind blow harder. And all of a sudden the house roof came off I was frightened and all of us started hawling. We all run went over the Charles Town Secondary School for shelter..." (Patricia Isaac, Stoney Grove, Nevis).
ANNEX STKN 9

Letters to the Hon Minister of Education, St Kitts and to
The Premier of Nevis

9 November 1991

The Hon Sidney Morris
Minister of Education, Youth and Community Affairs:
Communications, Works and Public Utilities
Ministry of Education
Basseterre
St Kitts

Dear Minister

UNESCO Participation Project No 5168

It is my pleasure to submit to you, the Report prepared
during my mission to St Kitts and Nevis: "Hurricane Resistant
Construction of New School Buildings on St Kitts".

A copy of this Report has been sent to The Hon Dr Simeon
Daniel, Premier, Nevis.

Yours sincerely

9 November 1991

The Hon Dr Simeon Daniel
Premier
Nevis

Dear Premier

UNESCO Participation Project No 5168

It is my pleasure to enclose a copy of my Report prepared
under the above UNESCO Participation Project for St Kitts & Nevis
during my mission (which is now concluded) and visits to St Kitts
and to Nevis: "Hurricane and Earthquake Resistant Construction of
New School Buildings on St Kitts".

Yours sincerely

James Lewis
Architect RIBA
UNESCO Consultant
UNESCO/TEFAR
3. ANTIGUA & BARBUDA

Purpose

a/ To execute UNESCO Participation Programme No 5000.
b/ To undertake fact finding meetings and site visits so as to ascertain or confirm:
   i/ the need for hurricane and earthquake resistant construction training and the form it could and should take for various construction sectors;
   ii/ to ascertain and/or to confirm the function and facilities to be provided by a prototype building for the use of schools (especially primary schools) as community shelters during and after hurricanes.
   iii/ to discuss the need for and status of school curricula material for disaster preparedness and environmental hazards education.

Activities

Individual discussions were held in Antigua at the Ministry of Education & Culture with the Minister (de-brief on last day); the Permanent Secretary; Chief Education Officer; Deputy Chief Education Officer; and the Education Planning Officer. At the Department of Public Works, discussions were held with the Director, Engineers, Chief Architect, and Superintendent of Works. Other discussions were with the National Office of Disaster Services; the Chairman of the Antigua Contractors' Association; Antigua Broadcasting Services Television; and with school principals.

On Barbuda, discussions were held with the Parliamentary Representative for Barbuda; the Chairman of the Works and General Services Committee; and the Headmistress of the All-age School (see Annex AB 1 for discussions held).

Visits to ten primary or secondary schools in Antigua, accompanied by a Department of Public Works Engineer or the Superintendent of Works; and to the one school on Barbuda (see Annex AB 2 for schools visited).

Findings

Hurricane "Hugo" (September 1989) damaged 16 schools on Antigua (see ANNEX AB 3 and also ANNEX AB 4 and ANNEX MR 3 for disaster incidence).

1. The US$ 44,000 for the purchase of building materials, school equipment and teaching materials (letter: Dr Simon Clarke to Minister of Education: 17 September 1991) has not been received (Permanent Secretary: 13 November 1991).
2. Post-Hurricane "Hugo" rehabilitation of 16 damaged schools (see ANNEX AB 3) is virtually complete (worst cases cost US$ 185,185 and US$ 2,222). Technical Assistance under PP 5000 is therefore not required and no requests were received for this activity in response to attention being drawn to this purpose of the Mission.

3. There is no Government policy to improve building construction, although it is generally agreed that it would be advantageous to do so. The need for construction training for all sectors of the industry is widely endorsed.

4. Rehabilitation of damaged schools has been the opportunity to attend at the same time to the maintenance requirements of those schools: in some cases, alterations and changes of material (e.g. asbestos roof sheeting to corrugated metal and the installation of soffit or suspended ceilings).

5. Schools which were not damaged by Hurricane "Hugo" (the larger number) are therefore now in a far worse condition than those that were damaged and which have been rehabilitated. The backlog maintenance requirement in all schools not now rehabilitated is massive. In some cases, there has been virtually no maintenance since schools were built in the 1950s and 1960s, for example. Those damaged by the hurricane were the lucky ones.

6. There is severe overcrowding of some schools (in one case visited, 312 pupils and five teachers in one undivided building of approximately 240 square feet). Many schools have inadequate number and condition of toilet facilities, windows without glass or panel infill, shutters and doors without fasteners (open or closed), and broken furniture and fittings. Many schools are not fenced and cannot be secured against vandalism and illicit use. In the All-age school on Barbuda, 75 infants have no water and no sanitation facilities but have not functioned "for years". In other blocks, electric wiring requires replacement and rainwater discharge is uncontrolled; the low-lying site is quickly waterlogged.

Achievements

1. A talk on design and technical aspects of hurricane and earthquake resistant buildings (and some Antiguan historical perspective: see ANNEX AB 4) given to twelve draughtspersons and technicians of the Design and Control Division (Chief Architect) of the Department of Public Works.

2. Completion of "UNESCO Design Guidelines" to include timber construction (not relevant for schools in St Kitts but relevant in Antigua in a few cases).
1. Issue of "UNESCO Caribbean Guidelines for hurricane and earthquake resistant construction for school buildings" to Chief Architect, Department of Public Works; and to Minister of Education (see ANNEX AB 5).

4. Issue of "Proposed UNESCO Caribbean Prototype Additional Building / UNESCO Caribbean Subregional Construction Training Programme" to Minister of Education, with a request to the Minister for his government's request to UNESCO for the Training Programme (see ANNEX AB 6 for copy of letter to the Minister; 22 November 1991).

5. Technical advice (verbal and as requested) to Engineer, Department of Public Works, on hurricane resistant construction of replacement roof to Public Market, St John's.

6. Verbal proposal for prototype additional building enthusiastically received at Ministry of Education (Permanent Secretary, Chief Education Officer and Deputy Chief Education Officer) with suggestions for appropriate siting.

7. The condition of 75 infants at the All-age School on Barbuda was brought to the attention of the Minister during the debriefing discussion.

Unforeseen matters

1. There are distinct differences between island states of the Caribbean; assumptions of commonality may be inaccurate (eg regarding construction materials or techniques and standards of accommodation and facility. Mission inquiry is necessary before relevance and applicability of "UNESCO Design Guidelines" can be ascertained. Therefore it could not be wholly or accurately applicable to Antigua and Barbuda.

2. The Basic Needs Trust Fund has produced a Report in Antigua (see also under St Kitts & Nevis) on the maintenance rehabilitation needs of primary schools (and clinics) Caribbean Development Bank/USAID: Geotech, St John's, 1991). As in the case of St Kitts & Nevis, the preparation of the Report was coincidentally post-Hurricane "Hugo", but most findings are to do with general pre-Hurricane conditions.

Funding for the maintenance rehabilitation work identified as necessary is not yet ascertained or secured (Postscript: see under Mission Report 6: Barbados).

3. UNESCO matters in Antigua are now allocated to the Ministry of Foreign Affairs.
Lessons learnt

1. It does not require a hurricane to create the need for school building rehabilitation - but it may require a hurricane to bring about rehabilitation. The backlog of maintenance required in all but recently completed (or rehabilitated) schools is so great that a rehabilitation programme is urgently required for that reason alone.

2. "Backlog maintenance" rehabilitation is required in most schools before their safe use as community hurricane shelters could be considered (though several are so designated).

3. It is impractical and therefore of little point, to attempt to otherwise distinguish between hurricane-caused rehabilitation and rehabilitation as a general and constant requirement. In Antigua at the time of this mission, it is the schools that were not damaged by Hurricane "Hugo" that have the greatest rehabilitation need.

4. In view of some school conditions, both structural and sanitary, focus on hurricane caused damage is academic and at this stage, two years after "Hugo" hypothetical and futile.

5. Future hurricanes could create massive damage to schools because of the requirement for "backlog maintenance" rehabilitation; but everyday conditions in schools cause hurricane vulnerability to be perceived as low priority (prior to Hurricane "Hugo" in 1992, there had not been a damaging hurricane in Antigua since 1950).

6. The issue of school building rehabilitation overwhelms lesser issues to do with other aspects of management of school buildings as community hurricane shelters and curricula development (how could curricula on hurricane and earthquake preparedness be included inside schools of such colossal everyday inadequacy that renders to futility the possibility of their emergency use?).

Recommendations

1. UNESCO should participate in the funding of a school building rehabilitation programme, as identified by this mission and detailed by the Basic Needs Trust Fund (BNTF) Project. The amount required for Antigua Primary Schools is ECS 1,988,764 (US$ 531,024 equivalent).

Rehabilitation should be made additionally inclusive of hurricane resistant construction, where accessible and possible, and the provision of lockable hurricane shutters (effective also against vandalism and illicit use) where these are not
(Postscript): Estimated approximate cost per school for hinged and lockable hurricane shutters (based on accurate costing per pair of shutters: St Vincent November 1991):

150 foot long classroom block; shutters both sides:
EC$ 32,300 (US$ 12,148 equivalent)

For three classroom blocks (as above) per school:
EC$ 93,400 (US$ 36,444)

2. UNESCO should proceed with a Caribbean sub-regional construction training programme. Efforts should be made to include more countries than the five at present (Dominica, St Lucia, Grenada ?) and training should be directed towards the construction industry at large, government and private. It is impractical to consider training in construction only for schools.

Difficulties encountered

1. At the time of my arrival, the purpose of the Mission appeared not to be understood by Ministry of Education Officers (see ANNEX AB 7: itinerary; second page; penultimate paragraph).

2. Except for schools visits and for one itinerary visit out of town (but not return), transport was not provided.

3. There were no drawings prepared (and therefore none were available) for timber construction of additional classrooms.

4. A meeting scheduled with the Development Control Authority did not materialise.

5. Antigua has been a turning point. In a project intended, and which would in any case inevitably, evolve as it proceeds, it has been difficult (and sometimes not possible) to discuss ideas or seek information upon which to establish assured conclusions. Government officers have not, in some cases, been available, due to travel out of state, and deputies do not always exist. Project time has not allowed for the circumvention of these difficulties.

6. A consultant in the field should not be required to undergo the additional anxieties and time consuming activity and concern involved in the local issue of DSA payment and his subsequent security of overlarge (at the time) amounts of cash. US$ 2230 in local currency cash due to currency restrictions (EC$ 8856) in maximum denominations of EC$ 100. UNDP transferred the
total payment due, including that authorised for payment in Barbados (Postscript: in St. Vincent, transfers had to be made back to Barbados dollars, requiring Treasury authorisation).

Support received

Ministry of Education interest and enthusiasm greatly appreciated. Basic Need Trust Fund assistance in securing a (part) copy of their Antigua Report (on final day) also greatly appreciated.

Arrival: Late afternoon Tuesday 12 November 1991.
Departure: Late afternoon Saturday 23 November 1991.
Working days: 8

ANNEX AB 1

Discussions held

Mr Everton Cornelius, Engineer, Department of Public Works.
Mr Charlesworth Davis, Chief Architect, Head: Design and Control Division, Department of Public Works.
The Hon Hilborne Frank, Parliamentary Representative, Codrington, Barbuda.
Mr Whitfield M Harris, Chief Education Officer, Ministry of Education, Youth Affairs and Culture.
Mr Cedric Henry, Engineer, Department of Public Works.
Miss Lenore Henry, Headmistress, Holy Trinity School, Codrington, Barbuda.
Mr B Jones, Chairman, Works and General Purposes Committee, Codrington, Barbuda.
Mr Thomas Joseph, Managing Director, Quality Builders Ltd, Chairman: Antigua Contractors' Association.
Mr James Knowles, Education Planning Officer, Ministry of Education and Culture.
Mr Frank Liburd, Director, ABS Television, Ministry of Information, Scotts Hill (Extended telephone conv'tion).
Mrs Cornelia Michael, Educator, National Office of Disaster Services, Ministry of Home Affairs.
Mr D Michael, Permanent Secretary, Ministry of Education, Youth Affairs and Culture.
Mr Curtis Nicholas, Superintendent of Works, Department of Public Works.
Mr Trevor Parker, Production Manager, ABS Television, Ministry of Information, Scotts Hill.
Senator Bernard Percival, Minister of Education, Youth Affairs and Culture.
Mrs E Sheppard, Deputy Chief Education Officer, Ministry of Education, Youth Affairs and Culture.
Mrs Georgette Webson, Headmistress, Golden Grove Primary, St John's.
ANNEX AB 2

Schools visited

Antigua Girls' High
Antigua Grammar
Clare Hall Secondary
Five Islands Primary
Golden Grove Primary
Green Bay Primary
Holy Trinity, Codrington, Barbuda
Mary Piggot Primary & Post-primary
Princess Margaret Secondary
T N Kirnon Primary
Villa Primary
### ANNEX AB 3

**DAMAGE TO EDUCATION FACILITIES**

**ANTIGUA/BARBUDA**

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<tr>
<th>NAME OF SCHOOL</th>
<th>TOTALLY DAMAGED</th>
<th>MAJOR DAMAGE</th>
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*Source: Co-ordinator CARIFEST*
A multi-hazard history of Antigua*

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Visiting Fellow
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Bath, U.K.

Antigua experiences earthquakes, droughts and hurricanes. To isolate for study each of these as they occur, would be to over simplify the inter-relationships between the after-effects of one and the occurrence and the effects of the next. Moreover, there will be conditions arising from factors outside the natural disaster spectrum which bear upon, and are themselves affected by, all of these phenomena.

This interplay of events and conditions is readily illustrated in the case of island countries, which have a natural and clearly defined containment. Such inter-relationships suggest a complex human-ecological system which must be recognized if environmental balance and compatibility are to be maintained — particularly in respect of hazards. This documentary analysis of the colonial era in Antigua, has to conclude for the time being with questions concerning the environmental effectiveness of imported systems of administration which, with no knowledge of comparable natural hazards, assumed sectoral separation.

Key words: Antigua; Multi-hazard history; Antigua: colonial administration; Island vulnerability; Droughts and hurricanes; Antigua: earthquake hazard.

INTRODUCTION

Islands are an anachronism. Seemingly insignificant in global terms of size or population, they have often been of crucial strategic importance to world powers. Always heavily dependant upon trade but vulnerable to world economic and political fluctuations that they are unable to control, islands were early victims of protectionism and then colonialism. Able to contain their epidemics and sometimes to escape tropical cyclones that are caught by larger land masses, islands nevertheless sustain highest proportional social and economic damage when disasters are sustained. Whereas natural disasters were once an impediment to colonial profit they now may be the vehicle of favours for political advantage — a new disaster imperialism.

Disasters in history may be examined in a number of ways. First, disasters may have had implications for contemporary events so that history itself may have been directed by disasters (Stevenson, 1912); second, certain disasters may be examined in isolation, from records which exist of single catastrophic events (Hughes, 1983); third, disasters of similar kinds may be recorded from all sources as a global or regional review of for example, earthquakes or storms (e.g. Eiby, 1957; Kerr, 1976); and fourth, disasters of all kinds may be assessed from available records concerning one location selected for study (Hewitt and Burton, 1971).

There are certain academic satisfactions accruing from the isolation of disasters from other subject matter and from the specific or general collection of data concerning them. Study of disasters of all kinds in situ to one place however, more closely reflects the experience over time of natural hazards, the part they may have played in history and the part each has played upon accumulated physical, social and institutional vulnerability to those which followed.

The degree and extent shown by random example to which certain changes may have followed often disastrous failure (Davis, 1983) has to be balanced by systematic observation and evidence of how change may have been the cause or exacerbator of recurrent subsequent disaster of the same or a different type. In the history of the human ecological context that is thus revealed, response to one disaster may have exacerbated vulnerability to another. Form may have followed failure, but that did not necessarily stop the overall vulnerability process.

Certain global and general conclusions can be abstracted with regard, for instance, to earthquakes and other disasters upon building construction, but such a global collection would implicitly mean the abstraction of each earthquake from its local context into an amalgam of subject matter from which global conclusions concerning earthquake effects could be drawn, but which are then of only limited usefulness for their re-integration with a specific context.

The environmental reality of places where earthquakes are experienced is that one earthquake precedes the next. Where one earthquake or tremor may have caused peripheral settlement, cracking, or other instability, the next may cause greater damage than if the first had not occurred. More significantly, earthquakes occurring in multi-hazard areas have a bearing upon, and their consequences will themselves be affected by, conditions created by disasters of all kinds.

The integration of disasters with other events in history will also reveal more of the specific reality of each social and natural environment. For example, one effect in March

*The material upon which this article is based forms some of the Annexes to a Report to UNCTAD (at the request of UNDRO) on the social and economic effects of natural disasters in island developing countries (Lewis, 1982). The Report contains material on Antigua, Cape Verde, Comoros, the Cook Islands, the Maldives Islands and Western Samoa (UNCTAD, 1983). Abbreviations used: WMMS — Wesleyan Methodist Missionary Society; DC — Department of the Colonies (Colonial Reports); CO — Colonial Office (Colonial Reports).
1889 of hurricane upon the ships of three navies assembled in Apia Harbour (Western Samoa) was the subsequent negotiation of the Treaty for the Pacific instead of war (Stevenson, 1912); and the earthquake of 1843 in Antigua had a serious effect upon the emergent communities of then only recently emancipated slaves (Woodcock, 1843).

Abstraction of events from their historical contexts may have the misleading consequence of attributing a seriousness to earthquake or volcanic eruption that external observers might exaggerate. In their contexts however, some events that would perhaps be serious elsewhere are not considered serious at all (e.g. eruption of Fogo, Cape Verde Islands. UNCTAD. 1983). Indigenous interpretations and perceptions of hazard must be the basis for their environmental evaluation and assessment. Drought in Antigua would not have been considered drought in the Cape Verde Islands, used to and capable of resisting far greater extremes (UNCTAD, 1983).

Drought in Antigua meant loss of sugar production and other exports, of serious consequence to colonial administrators. In this respect however, a distinction has to be made between indigenous administrators and those in the corresponding metropolis, who were often in conflict and often about how “the natives” were to be treated after a disaster (UNCTAD, 1983).

THE EARTHQUAKE OF 1843

Earth tremors had been a common occurrence during the eighteenth (and early nineteenth?) century. On 16th May 1778 “. . . the earth shook violently three or four times . . .

many of the whites as well as negroes were much alarmed and ran out into the street” (Luffman, 1789). But “At 20 minutes before 11 o’clock on Wednesday morning the 8th February (1843) Antigua was visited by a dreadful earthquake . . . there arose clouds of dust from every part of the town, the crack of falling buildings was heard, blended with the piercing shrieks of the people and accompanied with that horrid heaving and trembling of the earth beneath our feet . . . Almost every piece of masonry in St John’s is in ruins” (Cheeseborough, Rev. H: 10th February, WMMS, 1843). The stone dwelling houses and stores were crashed and crushed . . . the wooden buildings waved to and fro. . . . The damage done is immense. In the capital (St John’s), some of the finest stores are a mass of ruins . . . and in many parts the earth is opened, forming deep fissures” (Woodcock, 1843).

In St John’s, the courthouse, police-office, arsenal, new jail, and barracks were “fearfully dilapidated. The Register Office, treasurer’s office, Governor’s Secretary’s Office (just erected) and the Colonial Bank were all much injured.” All the stone buildings on Barbuda (except one schoolhouse) were destroyed. At the dock-yard of English Harbour the “wharves all rocked and rent; in some places they have sunk down to the margin of the sea, in others they are literally heaved up. . . .” (Woodcock, 1843).

Five stores built since the fire of 1841, and seven others, three taverns (one three-storey in brick); a brass and iron foundry (“the only one of its kind in the West Indies”), a bakery, private dwelling houses (“that is those built of stone or brick”), “almost every kitchen and oven on the island” and cisterns were destroyed or very severely damaged. All the 172 sugar mills and estates received damage, 35 were
entirely destroyed, 82 irreparably damaged; 52 partially damaged; and "works, dwelling houses, labourers' cottages attached to those mills shared their fate in equal proportions." Numerous "free-villages" built by their own labour by ex-slaves were destroyed (slavery was abolished by Great Britain by a Law passed in 1834). "Many of the estates that have fallen prey to the earthquake have been established since emancipation, by men who have exerted themselves to the utmost . . . and how they will be able to rebuild them it is impossible to say. Indeed it will take many years to restore Antigua to its former position" (Woodcock, 1843).

St. John's Cathedral was badly damaged and declared "unfit for public service" and several parish churches were destroyed or badly damaged, as were eight chapels or mission houses, one "not much, being a wooden structure." The largest, the Eberneezer Chapel requiring £3,000 to be rebuilt according to an estimate from HM Civil Engineer who advised "To rebuild in stone would require less by about £500, and though the building would be liable to be damaged by earthquakes it would be less exposed to the ravages of fires and hurricane which are of more frequent occurrence" (Keightly, 18th February, WMMS: 1843). St. John's had been destroyed by fire in 1841, and it seems that much re-building had been completed in "fire-proof" masonry. It is a source of contemporary comment that masonry buildings suffered most damage in the earthquake of 1843. Many houses were left with their outer masonry walls collapsed and with the inner wooden walls supporting the roof; houses entirely of wood remained standing.

"Nearly all our (Methodist) members in both town and country, are sufferers . . . some of them to an almost ruinous extent. Even the labourers, of whom a large proportion had invested the savings of eight years (since emancipation) of toil in the dwellings they had built have been reduced to such a state of destitution by the destruction of their tenements as to be literally homeless and penniless. . . ." (Keightly, WMMS: 1843).

There were various estimates of deaths, from 12—40, and total damage to the island including the loss of the sugar crop, was placed at £2 million.

Setbacks to economic recovery

An Act was immediately passed requiring "inhabitants to pull down all injured buildings, in order, if possible to guard against any further accidents. In case of neglect, a committee is appointed to do so, and £100 sterling granted
In spite of increased expenditure for relief and reconstruction, the necessary increase in imported materials produced duty revenue for government funds. An excess of revenue over "a very liberal expenditure" and a balance in hand at the end of 1845 of £13,717, 11 shillings and 10 pence* was recorded (DC, 1845). "The increase in the actual receipts has arisen for the most part, from the augmented consumption of dutiable goods, and particularly the productions of the United States; although the declared value of imports generally was less in 1845 than the preceding year." However, "the net excess of expenditure amounts to £8,232 sterling, which has been caused, in great measure, by the unavoidable and heavy expense incurred in rebuilding the Cathedral and restoring other public buildings..." There is no record of how the decision was taken to rebuild the Cathedral from public funds; but the cost of rebuilding was a source of irritation to HM Governor.

There was an accompanying decrease in the value of exports for 1845 of £107,530 indicating "a considerable failure in the produce of island staples" (Table 1). The year 1846 saw a diminution in both imports and exports as compared with 1845. "Falling off of imports appears to be chiefly attributable to a diminished quantity of supplies being introduced in the past year from the United States; arising partly perhaps from the more contracted demand for them than in previous years, when an unusual quantity of supplies of various kinds was required for the restoration of damages occasioned by the earthquake of 1843, and partly perhaps from the very short crop of 1846 causing money to be less freely circulated" (DC, 1846).

The Colonial Report for 1847 is unusual in its inclusion of a detailed statement of accounts comparing 1847 with 1846. Significant increases in expenditure are shown for highways, purchase of land, and "cost of iron tanks for fort-house" (rebuilding). There are decreases for 1847 shown, amongst other items, for forts and parishes, indicating perhaps lesser expenditure in 1845 more closely following the earthquake. The largest item of decrease (1,940, 16 shillings and a half penny) is in fact against the item for " Expenses from earthquake," with a aggregate expenditure (1846/1847) of £9,791. Revenue accounts showed increases on almost all duties and licences, the marked decrease in tariff duties. "Expenses of Earthquake" for 1847/1848 were £2,060, and that year showed an even more marked falling off of post-earthquake reconstruction expenditure.

Parliament in London sanctioned an advance to Antigua in 1844 "towards remedying the destructive consequences of the earthquake in the preceding year." At the end of 1854, the consequent public debt was £65,000 and "the reductions which have been lately conceded by HM Government by the amount of the annual instalments of repayment of the principal, from one tenth, to one twentieth, and of the interest from a rate of 5 to one of 3 1/2 per centum, have rendered this obligation a comparatively light and easily manageable one" (Governor MacKintosh, DC, 1855). These concessions had been hard fought for (reading between the lines of Colonial Reports) and the obligation eased only temporarily. Governor Hamilton, in his report for 1856 wrote "The heaviest liability under which the Colony suffers is the loan from Her Majesty's Government on the occasion of the calamitous earthquake of 1843. I do not now allude to the bulk of the amount lent, which was appropriated to the relief of the necessities of the individual sufferers, but to that portion of it which was retained for the public service, and was expended in the repairs of public buildings... the strain of this engagement is only now beginning to be felt." The advance was made available in the form of loans by the Antiguan administration to borrowers who were due to repay by instalments to coincide with Antigua's ten yearly repayments to HM Treasury in London. "Had the petition to HM Government been for the remission of the portion which must be raised by taxation on a community only just recovering from the struggle of competition between free-labour and slave-grown sugar, their proceedings would at least have met with sympathy, even if they had not met with concurrence..."

In 1860 "the debt to the Government has been reduced to £14,857 yet, as no separate provision has been made for the liquidation of any part of it, and as the ordinary income of the Colony was inadequate for that purpose, the means by which it has been reduced have been obtained by local

| Table 1. Antigua: Exports 1844 and 1845 (Source: DC, 1845) |
|-------------|-------------|-------------|
| Item        | 1844        | 1845        | Deficit    |
| Sugar       | 15,357      | 11,809      | 3,548      |
| Tierces     | 1,562       | 1,012       | 550        |
| Barrels     | 4,512       | 2,745       | 1,767      |
| Molasses    | 9,020       | 8,780       | 240        |
| Arrow-root  |             |             |            |
| Sugar       |             |             |            |
| Tierces     |             |             |            |
| Barrels     |             |             |            |
| Molasses    |             |             |            |
| Arrow-root  |             |             |            |

*A hogshead was 15 hundredweight (average); three tierces = 2 hogsheads, 1 hogshead = 8 barrels. A puncheon was a large cask holding from 72 to 120 gallons.
loans, indicated by the debt due to the Savings Bank and issue of Treasury Notes. By the subsisting arrangement the debt to the Government is to be reduced in 1865 to £10,000 by the payment of annual instalments; and such £10,000 are being paid in moities in the years 1866 and 1867' (DC, 1861).

The earthquake loan disappeared from Colonial Reports only in 1868. In 1867 construction commenced of a waterworks which continued for three years at a cost of £30,000, and a capacity of 500,000 gallons. This measure of attention to recurrent drought had had to wait until the burden of the earthquake loan had disappeared.

DROUGHT

Throughout the period of colonial administration in Antigua the most important crop was sugar cane. Its success or failure in any year was the indicator of success or failure of the Colony. Although Colonial Reports make reference in varying degrees to living conditions and other social factors, there is an over-riding concern for income from sugar production and the success of a Governor's term of office was clearly dependent on revenue.

International fluctuations in the price of sugar itself, had a much more serious impact than any other factor up to about 1900. Low prices often confounded high production, but in 1895 when very low prices accompanied very low production it seemed that the sugar industry was doomed to extinction — saved only by a rise to average production in 1896 (Watts, 1906).

Before 1898 cane disease was the prevailing factor influencing production. It took many years of experience to distinguish the effects of disease and drought but successful experiment with resistant cane brought disease under control by 1898. Thereafter the relationship between rainfall and sugar production became clear, though still masked in small degree by changes in agricultural methods, variations in acreage, new varieties of cane, and factory efficiency. The years immediately following 1900 were below average, due entirely to deficient rainfall and the damage caused by hurricane in 1899 (see below). Thereafter, the construction and equipping of centralized sugar factories and the introduction of mechanized ploughing and transportation, indicated a confidence in the future of the industry and as it turned out a period of increased annual average production.

The relationship between rainfall and sugar production was examined in a retrospective study of the 25 years 1930—1954, years of rainfall values being grouped and set against annual sugar production of the same years (Table 2: Auchenleck, 1956).

The average rainfall for the longer period of 76 years (1874—1949) was lower at 43.26 inches, than that in the Table. Years of rainfall significantly below this average were 1874; 1875; 1882; 1905; 1910; 1912; 1920; 1921; 1922; 1925; 1928; 1930; 1939; 1947. In addition to these sixteen years of severely low rainfall, there were a further seventeen years with rainfall below average. As Antiguan rainfall was gathered from a number of measurement stations, it is likely that some local conditions were worse, and some better, than the national averages. Over the same 76 years (1874—1949) there are however, only fourteen years where drought has been a significant claim in the Colonial Records. It can be accepted therefore that drought conditions, when officially reported as such, were economically and socially serious in the national experience.

Drought in 1863—1865 had an obvious impact on a mortality of 47.8 per 1,000 population. A total of 5,223 deaths were recorded for the period, 14.4% of the population. The sugar crop of 1874 was the smallest since 1864, and the total value of all exports fell accordingly from £170,977 in 1873 to £106,705 in 1874. Related years are shown in Table 3.

Table 3. Antigua: Exports and imports 1871—1874 (source: DC, 1875)

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports (£)</th>
<th>Exports (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1871</td>
<td>175,740</td>
<td>247,630</td>
</tr>
<tr>
<td>1872</td>
<td>200,577</td>
<td>153,190</td>
</tr>
<tr>
<td>1873</td>
<td>176,156</td>
<td>159,777</td>
</tr>
<tr>
<td>1874</td>
<td>146,758</td>
<td>106,705</td>
</tr>
</tbody>
</table>

Subsequently, at the end of 1912, Antigua had "suffered from three successive years of drought, which caused considerable distress in country districts. . . . The drought culminated in an almost complete failure of (water) supply in St. John's, and for some days an acute water famine prevailed" (CO, 1913).

The beneficial effect of hurricane in bringing rainfall and ending a serious three years period of drought was apparent in 1924: "Hurricane brought damage of several thousand pounds but also brought relief in the form of welcome rains" (CO, 1925). Rainfall for the year was 41.57 inches, the heaviest on 27th August (preceding the hurricane of the 28/29th), and was almost ten inches above that of the preceding year.

HURRICANES

As in the last case noted above, hurricanes on and near to Antigua have frequently brought beneficial rain, and to
sugar production the benefits of employment and income at all levels. Their immediate consequences have nevertheless sometimes been very serious, most significantly in 1681; 1772; 1780; 1792 and 1804, although a total of 22 have been collated for the period of 183 years 1664—1846 (Garriott, 1900).

The hurricane of 1848, though of serious impact, receives scant mention in the Colonial Report for the year, still preoccupied with the aftermath of the 1843 earthquake. The hurricane of 8th September 1899 caused damage to houses, but no loss of life, though "much damage to the nuts of the labouring classes, who consequently suffered from exposure and distress" (CO, 1899). Its part in the run of poor years of sugar production after 1900 has already been mentioned above.

The hurricane of 28—29th August 1924, which ended three years of serious drought, caused "moderate" damage. A relief fund established by the Lord Mayor of London reached £4,000 which was "devoted to the relief of peasants and labourers and the reconstruction of their dwellings" in Nevis, Montserrat, Tortula, St. Kitts Nevis, as well as Antigua, whose share was £1,356, 5 shillings and 9 pence. Of this amount, a sum of £500 (1) was placed on deposit "as the nucleus of a fund to meet further similar disasters" (CO, 1925).

Contributions of clothing and food were sent from other West Indian Colonies and England, the French West Indian Colonies, the Government of the Virgin Islands; and the S.A. The cost of reconstructing and repairing Government property was met partly from a £10,000 grant from Parliament (London) and from Surplus Funds (the total cost is not given). Total aggregate revenue for the year 1924—1925 was £78,983, 8 shillings and 9 pence, and total national expenditure was £85,244, 9 shillings and 9 pence — a rare excess of expenditure over revenue (CO, 1925).

Following the hurricane of 1928 a special Commission visited Antigua to assess and report upon hurricane damage (Collens, 1928). Under "General Observations and Recommendations" their Report stated:

"1. Peasant houses. We have in all cases taken into consideration the age and condition of the houses at the time of the hurricane, and the ability or otherwise of the owner to meet the total or partial cost of repairs or rebuilding. The allocation of any hurricane funds for such destitute owners can in our opinion be left in the hands of the local authorities."

"2. Damage to Government Buildings, Services, Telephone System, Press etc. . . . (we) have differentiated between actual damage caused by hurricane effects and damage which may be attributed to normal wear and tear or natural causes . . . have endeavoured . . . to apportion the estimated cost of renovation or renewals between Hurricane Relief Funds and the funds of the Presidency concerned. . . ."

At this time (1928) Antigua was the principal seat of Government in the Leeward Islands Colony, which comprised the Presidencies of Montserrat, Dominica, Nevis, St. Kitts and Antigua.

"3. In view of the well-known periodicity of hurricanes in these islands we would recommend that some general form be drawn up for universal use in each Presidency indicating the nature of damage, and its assessed value and the quantity of nails, lumber, boards, and shingles, if any, issued as relief or estimated as required for reconstruction."

Damage was assessed in categories: (a) for private houses (exclusive of estate property); (b) for private houses (requiring some possible assistance); (c) for private houses (poor and destitute persons) and (d) for Government property. Total damage assessments for Category (c) came to £2,900; for Category (d) to £2,527, a sum £355 less than the local estimate. The Commission recommended special consideration for rebuilding the poor house at a cost of £2,500 (extra to come from Presidential Funds) "as the Poor House is 28 years old having been hastily built to house Boer War prisoners, but never used for the purpose."

In 1927 the principal author of the 1928 Report had amended a (then existing?) hurricane code (Collens, 1927) which focused principally on domestic precautions concerning shutting down for the prevailing wind, and warning symptoms of a falling barometer. "Mutual telegrams (were to be) exchanged between islands of the Leeward Island Colony by the West Indian and Panama Telegraph Company." A red flag with a square black centre would be hoisted as storm warning signal at Rat Island signal station. If a hurricane was to be definitely expected (or at night), "two detonating rockets will be fired in rapid succession from the hill near the Botanic Station." The 1928 Report does not comment on the efficacy of these measures of hurricane preparedness.

In 1950 there were two serious hurricanes (in addition to two serious fires) in St. John's (CO, 1950). The first, on 21st August brought winds of up to 100 miles/hr and severe destruction in rural areas, deaths of livestock, and extensive local damage. Altogether 488 houses were destroyed and 636 houses were damaged — "many being rendered uninhabitable." The second hurricane, ten days later on 31st August, brought 165 miles/hr winds and greater damage in the capital of St. John's than in rural areas. There was considerable damage to Government, private, and commercial dwellings and "leaving out an account of large houses, which were either insured by their owners or whose owners could afford to repair them unaided, 1,348 small houses were completely destroyed and 2,343 damaged in both hurricanes." In Antigua 6,477 people were made homeless. In Barbuda, an additional 84 houses were destroyed, 109 damaged, and 320 people made homeless. The total of 6,792 homeless were 15% of the total population of the Colony.

His Majesty's Government (London) made a grant of £50,000 for relief, and the British West Indian Government made gifts of clothing, food and medical supplies. Jamaica gave £5,000. American and French territories also gave relief supplies. The homeless sheltered for many weeks in churches, schools and halls.

No further damaging hurricanes have been reported in the period up to and beyond the end of the colonial
administration in 1967, although droughts again recurred during this interval.

THE EARTHQUAKE OF 1974

There were no significant foreshocks for the earthquake of Richter magnitude 6.7 which occurred at 05.51 hrs on 8th October 1974. That there were no deaths was attributed to the early hour of the event, when few people would have been about and places of work, centres of congregation and commerce, and public buildings would have been unoccupied (Tomblin and Aspinall, 1975).

Severe damage was inflicted upon Government buildings, the port, and infrastructural services of roads, electricity and telephones, and water supply. Government buildings severely damaged and rendered uninhabitable were Parliament, Judiciary, Treasury, Central Registry, two Government Ministries, the Secretariat of the East Caribbean Common Market, the Public Health Service Complex, the Library, Printery and Prison. The Anglican Cathedral, rebuilt after the 1843, earthquake received some significant damage; the Prison was built in 1735 and had been severely damaged in 1843. The list of Government buildings damaged in 1974 is very similar to those damaged in 1843, and the reasons much the same, all being of unreinforced masonry or inadequately constructed reinforced concrete frame buildings. Half of the total accommodation being utilized for Government operations were rendered unusable (ECLA, 1974).

The authorities of a country where drought is more frequent than earthquake were quick to make emergency repairs to damaged water mains and dams which reserved drinking water. Principal industrial damage was to the oil refinery, rupturing tanks and pipelines, causing a severe pollution hazard (and fire risk) and as the island's largest employer, the laying off of up to one third of the workforce. The private sector suffered severely and an immediate scarcity of bread resulted from the destruction and damage caused to bakeries. Lobster reefs were damaged by the fisheries sector.

The 132 years that had elapsed since 1843 had made the private sector suffer severely and an immediate scarcity of bread resulted from the destruction and damage caused to bakeries. Lobster reefs were damaged by the fisheries sector.

Three areas of concern were expressed for housing. First was with the 40 homeless households; second, with 800 habitable but damaged housing where there was no insurance coverage and family earnings were too low to effect repair without assistance; and third, concern with damaged housing with insurance cover inadequate to compensate the full cost of repairs. Housing losses were sustained mainly in the rural areas, and mostly to buildings of traditional construction inhabited by the lowest income earners (ECLA, 1974).

The 132 years that had elapsed since 1843 had made the Anglican and Catholic Cathedrals, parish churches and chapels eligible for reconstruction assistance as Places of Historical and Cultural Interest as essential elements in the history of the country. The same period represents a significant interval of seismic quiescence and it should be observed that this quiescence was not ended by the 1974 earthquake, which was perhaps two orders of magnitude less than the 1843 event.

CONCLUSIONS

Colonial government was not a monolithic overburden. Disagreement and dispute between the local governor in Antigua and the Department of the Colonies in London over earthquake loan repayments continued for twenty-five years. Here the metropolitan authority was the most heavy-handed, but in the Comoro Islands after severe hurricanes in 1904 and 1905 it was the visiting officers representing Metropolitan government in Paris who were less onerous in their assessments of compensation on behalf of the indigènes and who more heavily reassessed the colony (UNCTAD, 1983). Issues that continue to preoccupy administrators of post disaster assistance were being debated in the same terms in Antigua in 1928, as was hurricane preparedness. The impossibility of cooking post-hurricane rice, unknown in the Cook Islands, was a subject of polite but emphatic correspondence of the then incumbent missionary 143 years ago (UNCTAD, 1983). The poorer resilience of masonry structures in respect of earthquakes but their value against wind and fire were well known and consequently well observed in Antigua in 1843.

It is a simple matter to abstract these observations but it is the inter-relationships of issues which is of predominant importance — and which a separation of studies would obscure. The effects of hurricane on a country still suffering from earthquake; the influence of fire upon building construction methods that increase vulnerability to earthquakes; the beneficial effects of a hurricane ending prevalent drought; delay to water storage programmes caused by the imperatives of earthquake loan repayment to the metropolitan government; and the effects of earthquake on the settlements of recently emancipated slaves are all evident from these outline histories of hazards in Antigua.

These complex human-ecological inter-relationships in respect of hazards cannot logically be separated from the study of disasters. All things come together in islands to a degree not often encountered at national levels in sub-continental or metropolitan countries. This characteristic is of crucial importance for management and development planning — in islands or at local levels of larger countries.

Systems of government adopted or inherited from former colonial powers assumed an administrative separation wholly inappropriate to both the place and the environment of islands. They also assumed the pre-eminence of economic factors on behalf of their colonies, which has been largely redressed by nationally elected governments. Now with different values therefore, are inherited systems of administration the most appropriate to the management of hazards and other environmental issues, of which after all the former metropolitan powers had no direct experience of their own?
REFERENCES


Collens A.E., Leeward Islands Hurricane Warnings and Amended Hurricane Code. Antigua (1927).

Collens A.E., Leeward Islands; Report of the Committee Appointed to Assess Hurricane Damage of September 11—12, 1928. Antigua (1928).


Department of the Colonies (DC), Reports on the Past and Present State of Her Majesty's Colonial Possessions: For the years 1845—1848, 1849—1850, 1850—1851, 1852—1853, 1854—1855, 1856—1857, 1858—1859, 1860—1861, 1862—1863, 1864—1865, —1887.


Lewis J., The economic and social effects of natural disasters on the least developed and developing island countries: With special reference to Antigua and Barbuda; Republic of Cape Verde; Comoros Federal Islamic Republic (and Mayotte); Republic of the Maldives; Western Samoa. A report for UNCTAD VI Belgrade 1983 (Commissioned by UNDRO) (October 1982).


Woodcock, A Narrative of the Late Awful and Calamitous Earthquake in the West India Islands of Antigua, Montserrat. Nevis. St. Christopher, Guadaloupe and etc. on 8 February 1843; Written by an Eye-Witness. London (1843).
Contents

Principles:

Earthquake resistance
- Plan shapes for buildings
- Spacing & proportion of openings

Hurricane Resistance
- Roofs

Construction:
- Concrete & concrete block
- Timber
- Roof connection to ring-beam
- Timber roofs
- Nails & nail fixings.

Principles:
Earthquake resistance

Buildings of a simple rectangular plan, with a maximum length of three times the width, perform best in earthquake conditions.

Plan shapes of buildings:

a: desirable plans

b: long, undesirable plans

c: use of separation to improve plans.
Spacing & proportion of openings:
Openings should be set away from corners by a distance equal to a minimum of one quarter the height of the opening (with an absolute minimum of 18 in).

The total length of all openings in outer walls between consecutive cross walls not to exceed half the outer wall length.

The horizontal distance between two openings not to be less than half the height of the shorter opening.

UNESCO: ED/BAR
James Lewis Architect.
**Principles:**
*Hurricane resistance: roofs.*

**Roof shape:**
Wind blowing around and over a roof creates an external suction in addition to external pressure. The sum of these two pressures is the total wind force on any part of the building. Roofs of less than 20° pitch are subject to stronger external suction. Hipped (pitched) roof ends are structurally advantageous.

**Roof pitch:**
- **Most preferred:** steep roof 40 - 45 degrees: hipped ends.
- **Preferred:** low pitch: hipped ends.
- **Least preferred:** steep roof: gable ends.
- **Not recommended:** low pitch roof: gable ends.
  single (mono) pitch roof.

**Roof overhang:**
Severe local pressures on a roof at eaves/verge corners, verges and verge/ridge meetings. Roof overhangs, which have become fashionable, should be severely minimised or discontinued. Traditional roofs rarely used overhangs.

**Verandah roofs:**
Though structurally restrained, verandah roofs are extremely vulnerable to high winds. Discontinuous construction of verandah roofs may serve to protect the main roof should the verandah roof be destroyed.
Outer/cross-wall junction
Horizontal reinforcement: galvanized 'Durawall' or similar or 2 no. 1/4" or 3/16" ms bars: every third course.

Foundations: Fill with 1:3:6 concrete to G3/4 above

Construction:
Concrete & concrete block

Tie-down bolts for timber headplate

Door or window opening

Core reinforcement

Intermediate core reinforcement

Junction reinforcement shown adjacent

Foundation reinforcement: provide 3" concrete cover

Reinforcement: 10 or 12 mm sq at all corners, both sides of door & window openings, and at cross-wall junctions. Intermediate core reinforcement at 400 mm (approx) between cross-walls/openings. Reinforced cores filled with concrete. Reinforcement lap: 18" wire tied x 3.

UNESCO: ED/EAR
James Lewis Architect
Construction:
Timber.

Rafters to timber frame connections:
Galvanized metal strap 1/2" x 1" wide nailed to top rail of wall frame with four 2" nails at each end of strap—two nails in edge of strap and three on underside.

Batten double nailed to rafter with 4" nails.

Galvanized metal strap 1/2" x 1" wide at least 6" up foot of wall stud: nailed each end x 4: 2" nails.

1/2" diameter bolts set into concrete/blocks in a number 8 turned into footings below. 1/2" x 2" x 2" steel washer.

Galvanized metal strap 1/2" x 1" wide twisted and nailed x 4: 2" nails.

1/2" bolts set into concrete pier.

Intermediate loft support: set in concrete with reinforcement bar bent over.

Except where nails are to be fully clad with well-nailed rigid boarding or plywood, diagonal timber braces should be let into the framing: use 1" x 4" braces double nailed at each intersection.

James Lewis: Architect.
Construction:
Roof connection to ring beam.

3" x 2" purlins/handled onto 4" x 2" rafters

Galvanized metal strap
100 x 25 mm double
nailed each end 50 mm (2") nails
2 straps per joint.

6" x 2" wall plate

Galvanized hurricane clips: one each side:
nailed all holes 2" nails

1/2" bolts & plates through wall plate set in ring beam concrete & between every rafter.

Rafters screwed into wall plate.

Ring beam: 9" x 6"
4 x 1/2" bars
14 @ 9" cc.

6" blockwork
(for reinforcement see detail sheet)

UNESCO: ED/EAR
James Lewis Architect
Construction:
Timber rooves.

- Galvanized corrugated roofing sheet.
- Roofing nails or hook bolts at every corrugation at ridge, eaves and first sheet at a gable end — elsewhere every other corrugation.

Galvanized steel edging strip nailed to rafter at 4" cc.

Square twisted roofing nail.

Mild washer
Sealing washer
1/4" dia hook bolt.

UNESCO: ED/EAR
James Lewis: Architect
Construction:
Nails & nail fixing.

Nails:

Much hurricane damage is related to nail fixed sheet roofing: the cause of structural damage and consequent rainwater penetration; and the origin of windborne debris which may cause death, injury and/or damage to other buildings. It is appropriate therefore to consider nails and nail fixing in detail.

Preferred nails for roofing:

Large headed nails should be used for the fixing of sheet roofing: the gauge of sheeting should also be specified as Gauge 25 minimum.

Spiral nails provide greater withdrawal resistance and are particularly effective against shock loads in hurricanes and earthquakes. Ring threads are not recommended for this purpose.

Corrosion resistant coatings should be specified for all external construction purposes.
## Construction

### Types of Nails

<table>
<thead>
<tr>
<th>Type of Nail</th>
<th>Head</th>
<th>Shank</th>
<th>Point</th>
<th>Material and Finishes</th>
<th>Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common (Spike)</td>
<td>F</td>
<td>C,S</td>
<td>D</td>
<td>S.E</td>
<td>3 ga - 6 ga</td>
<td>4&quot; - 14&quot;</td>
</tr>
<tr>
<td>Eavestrough (Spike)</td>
<td>C,S</td>
<td>C.S</td>
<td>N</td>
<td>S</td>
<td>5 ga - 4 ga</td>
<td>5&quot; - 10&quot;</td>
</tr>
<tr>
<td>Standard or</td>
<td>F</td>
<td>C,R,S</td>
<td>D</td>
<td>C.S</td>
<td>15 ga - 2 ga</td>
<td>1&quot; - 5&quot;</td>
</tr>
<tr>
<td>Common</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17 ga - 3 ga</td>
<td>7/8&quot; - 1 3/4&quot;</td>
</tr>
<tr>
<td>Box</td>
<td>F,LI</td>
<td>C,R,S</td>
<td>D</td>
<td>S</td>
<td>16 ga - 2 ga</td>
<td>1-1/8&quot; - 3-1/4&quot;</td>
</tr>
<tr>
<td>Finishing</td>
<td>Bd</td>
<td>C,S</td>
<td>D</td>
<td>S</td>
<td>12 ga - 11 ga</td>
<td>2&quot; - 2-1/2&quot;</td>
</tr>
<tr>
<td>Flooring and Casing</td>
<td>Cs</td>
<td>C.S</td>
<td>Bt.D</td>
<td>S</td>
<td>15 ga - 11 ga</td>
<td>3/4&quot; - 2-1/2&quot;</td>
</tr>
<tr>
<td>Concrete</td>
<td>Cs</td>
<td>S</td>
<td>Con.</td>
<td>Blt.D</td>
<td>11 1/2 ga</td>
<td>1-1/2&quot; - 2-1/2&quot;</td>
</tr>
<tr>
<td>Siding and Clapboard</td>
<td>F.O</td>
<td>C.S</td>
<td>D</td>
<td>A.S</td>
<td>13 ga - 9 ga</td>
<td>3/4&quot; - 2&quot;</td>
</tr>
<tr>
<td>Clinch</td>
<td>F,LI</td>
<td>C,S</td>
<td>Cb</td>
<td>S</td>
<td>14 ga - 10-2/3 ga</td>
<td>3/4&quot; - 2&quot;</td>
</tr>
<tr>
<td>Hardwood Flooring</td>
<td>Cs</td>
<td>C.S</td>
<td>Bt</td>
<td>S</td>
<td>12 ga - 11 ga</td>
<td>2&quot; - 2-1/2&quot;</td>
</tr>
<tr>
<td>Gypsum Wallboard</td>
<td>Dw,F</td>
<td>C.R,S</td>
<td>D.N</td>
<td>S</td>
<td>13 ga - 12-1/2 ga</td>
<td>1-1/8&quot; - 2&quot;</td>
</tr>
<tr>
<td>Underlay and</td>
<td>F,Cs</td>
<td>C.R</td>
<td>D</td>
<td>S</td>
<td>14 ga - 10-2/3 ga</td>
<td>3/4&quot; - 2&quot;</td>
</tr>
<tr>
<td>Underlay/Subfloor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12 ga - 9 ga</td>
<td>3/4&quot; - 2&quot;</td>
</tr>
<tr>
<td>Roundwire Sash Pins</td>
<td></td>
<td>C</td>
<td>D</td>
<td>S</td>
<td>13 ga - 9-3/4 ga</td>
<td>3/4&quot; - 2&quot;</td>
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<tr>
<td>Roofing</td>
<td>L,F</td>
<td>C,R,S</td>
<td>D</td>
<td>A.S</td>
<td>14 ga - 12-1/2 ga</td>
<td>1-1/4&quot; - 1-3/4&quot;</td>
</tr>
<tr>
<td>Wood Shingle</td>
<td>F</td>
<td>C</td>
<td>D</td>
<td>A.S</td>
<td>13 ga</td>
<td>1-1/4&quot; &quot;</td>
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<tr>
<td>Gypsum Lath</td>
<td>F</td>
<td>C,S</td>
<td>D,N</td>
<td>S</td>
<td>16 ga - 15 ga</td>
<td>1&quot; - 1-1/8&quot;</td>
</tr>
<tr>
<td>Wood Lath</td>
<td>F</td>
<td>C,S</td>
<td>D</td>
<td>S</td>
<td>16 ga - 15 ga</td>
<td>1&quot; - 1-1/8&quot;</td>
</tr>
</tbody>
</table>

Note: Sizes and lengths are approximate and may vary depending on specific applications.
### Construction:
Nail heads, shanks & points.

<table>
<thead>
<tr>
<th>Heads</th>
<th>Type</th>
<th>Abbrev.</th>
<th>Remarks</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countersink</td>
<td>Flat</td>
<td>Cs</td>
<td>For nail concealment; light construction, flooring, and interior trim.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drywall</td>
<td>Dw</td>
<td>For gypsum wallboard.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finishing</td>
<td>Bd</td>
<td>For nail concealment; cabinetwork, furniture.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flat</td>
<td>F</td>
<td>For general construction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>Li</td>
<td>For tear resistance; roofing paper.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flat</td>
<td>O</td>
<td>For special effects; siding and clapboard.</td>
<td></td>
</tr>
<tr>
<td>Smooth</td>
<td>Smooth</td>
<td>C</td>
<td>For normal holding power; temporary fastener.</td>
<td></td>
</tr>
<tr>
<td>Spiral</td>
<td>Spiral</td>
<td>S</td>
<td>For greater holding power; permanent fastener.</td>
<td></td>
</tr>
<tr>
<td>(or Helical)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roped</td>
<td>Roped</td>
<td>R</td>
<td>For highest holding power; permanent fastener.</td>
<td></td>
</tr>
<tr>
<td>Diamond</td>
<td>Diamond</td>
<td>D</td>
<td>For general use; 65° angle; length about 1.5 x diameter.</td>
<td></td>
</tr>
<tr>
<td>Blunt</td>
<td>Blunt</td>
<td>Bt</td>
<td>For harder wood species to reduce splitting, 45° angle.</td>
<td></td>
</tr>
<tr>
<td>Diamond</td>
<td>Long</td>
<td>N</td>
<td>For fast driving, 25° angle; may tend to split harder species.</td>
<td></td>
</tr>
<tr>
<td>Diamond</td>
<td>Duckbill</td>
<td>Db</td>
<td>For clinching small nails.</td>
<td></td>
</tr>
<tr>
<td>Conical</td>
<td>Conical</td>
<td>Con</td>
<td>For use in masonry; penetrates better than diamond.</td>
<td></td>
</tr>
</tbody>
</table>

*Illustration of nail heads, shanks, and points.*
### Construction:

#### Nails: Materials & Finishes

<table>
<thead>
<tr>
<th>Materials</th>
<th>Type</th>
<th>Abbrev.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aluminum</td>
<td>A</td>
<td>For improved appearance and long life; increased stain and corrosion resistance.</td>
</tr>
<tr>
<td></td>
<td>Steel-mild</td>
<td>S</td>
<td>For general construction.</td>
</tr>
<tr>
<td></td>
<td>Steel-high-carbon hardened</td>
<td>Sc</td>
<td>For special driving conditions; improved impact resistance.</td>
</tr>
<tr>
<td></td>
<td>Stainless steel, copper and silicon-tin</td>
<td>E</td>
<td>For superior corrosion resistance; more expensive than hot-dip galvanizing.</td>
</tr>
<tr>
<td>Finishes and Coatings</td>
<td>Bright</td>
<td>B</td>
<td>For general construction, normal finish, not recommended for exposure to weather.</td>
</tr>
<tr>
<td></td>
<td>Blasted</td>
<td>Bl</td>
<td>For increased holding power in hardwood; thin oxide finish produced by heat treatment.</td>
</tr>
<tr>
<td></td>
<td>Heat treated</td>
<td>Ht</td>
<td>For increased stiffness and holding power; black oxide finish.</td>
</tr>
<tr>
<td></td>
<td>Phoscoated</td>
<td>Pt</td>
<td>For increased holding power, not corrosion resistant.</td>
</tr>
<tr>
<td></td>
<td>Electro-galvanized</td>
<td>Ge</td>
<td>For limited corrosion resistance, thin zinc plating, smooth surface; for interior use.</td>
</tr>
<tr>
<td></td>
<td>Hot-dip galvanized</td>
<td>Ghd</td>
<td>For improved corrosion resistance, thick zinc coating, rough surface; for exterior use.</td>
</tr>
</tbody>
</table>

#### How To Use Tables

1. Determine the types of material to be fastened, magnitude and kinds of loads, exposure (interior or exterior), appearance requirements and the quantity of nails needed to do the job.
2. Use the National Building Code of Canada as a guideline to determine required lengths, numbers and spacing of nails. Where codes do not cover requirements, calculate number and size of nails using design procedures in this publication.
3. Select a nail type, size, style, material and finish that will do the job properly. If the job cannot be done with standard types consult a manufacturer.
4. Standard dimensions of common wire nails, spikes and common spiral nails are given in Table 4. For other nails refer to CSA Standard B114, "Wire Nails, Spikes and Staples," and to manufacturer's product literature.
5. Abbreviations used in tables are relevant to this district only.
ANNEX AB 6

Letter to the Hon. Minister of Education, Youth Affairs and Culture

St John's, Antigua
22 November 1991

Senator Bernard Percival
Minister of Education, Youth Affairs and Culture
Ministry of Education, Youth Affairs and Culture
St John's
Antigua & Barbuda

Dear Minister

UNESCO Participation Programme Request No 5000

It is my pleasure to enclose copies of the following documents:

1. UNESCO Caribbean Guidelines for Hurricane and Earthquake resistant construction for school buildings: completed during my mission in Antigua & Barbuda. A copy has been left with Mr Charlesworth Davis, Chief Architect, Department of Public Works.

2. A Proposed UMZSCC Sub-regional Training Programme, utilising the construction of a Proposed Prototype Additional Building for Schools. Your comments to UNESCO on this Proposal would be welcomed as would your Government's request to take part in the construction training programme.

3. A copy of the UNESCO publication "Cyclone resistant rural primary school construction: a design guide".


May I thank you for the kind assistance received from your Ministry during my Mission to Antigua.

Yours sincerely

James Lewis Architect RIBA
UNESCO Consultant
UNESCO: ED/EAR
ANNEX AB 7

Itinerary for the UNICEF Mission Assisted by the Education Planning Officer

6th November, 1991
E.C.Y.A. 28/34 - A

VISIT OF MR. JAMES LEWIS
UNESCO CONSULTANT

Kindly refer to minute of even number, dated 28th October, 1991, dealing with the Consultant's visit. According to the responses received, the following tentative itinerary is set out below.

Where persons have indicated that they will be out of the State during Mr. Lewis's visit, it is being suggested that other members of staff who in any way are concerned with building codes, architectural drawings, etc., could be detailed to meet with Mr. Lewis alternatively. It may also be quite useful for Mr. Lewis to meet with groups of relevant persons, such as members of staff of development Control Authority, Design and Control Division of the Ministry of Public Works and Communications, and other members of the Contractors' Association.

Mon.11th November: Arrival

(1) Courtesy call on the Minister of Education, Culture & Youth Affairs (Permanent Secretary, Chief Education Officer and Deputy Chief Education in attendance). 9:30 a.m.

(2) Director of Public Works (Please consider a convenient time for Mr. Curtis Nicholas to be involved). 11:00 a.m.

Mr. Cedric Henry, Engineer (Selected site visits during the p.m.) 9:30 a.m.

Mr. Everton Cornelius, Engineer (Selected site visits during the p.m.) 9:30 a.m.

Staff Members of Design and Control Division of the Ministry of Public Works 9:30 a.m.
Monday 18th November:

Staff of Development Control Authority
(Selected site visits to be arranged).
9:00a.m.

Tuesday 19th November:

Mr. Thomas Joseph, President of Contractors Association
(Follow-up meeting with other Members of the Association may be arranged).
10:00a.m.

Wednesday 20th November:

Free.

Thursday 21st November:

1. Final meeting with Director, Engineers, etc., at Ministry of Public Works.
   (2) Final discussions with Minister of Education and Staff.
2:30p.m.

Friday 22nd November:

Departure.

Kindly bear in mind that this itinerary is tentative. According to the purpose of Mr. Lewis's visit, it may be necessary to modify these arrangements. Every effort will be made to notify you in time if this happens.

Since the undersigned will not be available during the week of 11th - 15th November, all communications on the matter should be directed to the Deputy Chief Education Officer who may be reached through the following numbers: 462-4656, or 462-0955.

Your co-operation will be greatly appreciated.

James Knowles
Education Planning Officer

JK/do' b.
4. ST VINCENT & THE GRENADINES

Purpose of Mission

To acquaint the Government of St Vincent and the Grenadines with results of the Mission so far; to discuss the proposed prototype additional school building and the proposed training programme; to assess St Vincent needs in these and other respects; and to assess conditions of schools designated as disaster relief centres.

Activities

Discussions on two occasions with the Hon Minister for Education, Culture, Youth, Sports and Women's Affairs; the Permanent Secretary for Education; Deputy Chief Education Officer; Education Planner (on two occasions); Chief Engineer, Ministry of Works and Communications; Technical Adviser, Central Planning Division; School and Technical College Principals; Technical college Staff; and the Director General of the St Vincent Red Cross Society (see ANNEX STVG 1 for discussions held).

Visits were made to five rural primary schools accompanied by the Education Officer; Primary (see ANNEX STVG 2 for schools visited).

The St Vincent Mission coincided with extremely heavy rains, "the wettest November in living memory" (see ANNEX STVG3).

Findings

1. Four of the five schools visited were selected by the Ministry as having particular structural problems upon which advice would be welcomed (see Achievements below). Because time available for site visits was very short (and access difficult due to weather conditions), visits were restricted to the south and south-east sectors of St Vincent. Though not typical therefore, there is at least one other school with a comparable problem.

2. There are some schools where vulnerability to the sea, to river erosion, to flooding, or to landslip and settlement, render them entirely unsuitable for use as community disaster relief centres (St Vincent terminology taking account of the use of such centres for disasters other than hurricane. In 1979, schools and other buildings were in use as shelter for 5000 people for two and a half months during and after the eruptions of Mt Soufriere). All schools are designated as "emergency shelters". The last damaging hurricane in St Vincent was "Emily" in 1987, and previously "Allen" in 1980 (see ANNEX MR 3).
3. There is no Government policy to improve building construction, although it is generally agreed that it would be advantageous to do so.

4. Functional and technical school design guidelines are required by the Ministry of Education (Education Planning Officer) from which to prepare terms of reference for the Ministry of Works design and construction of new school buildings. As the post of Ministry of Works Architect is vacant, this request from the Ministry of Education is the more significant. It is additional to and has greater priority than guidelines for the use of schools as disaster relief centres or for hurricane and earthquake resistant construction as such - although these aspects should be integrated into a wider technical assistance package.

5. A programme is in progress to cater for school refurbishment, expansion or replacement costing US$ 1.1 - 1.5 million (equivalent) for which construction guidelines would be useful (and a technical assistance package timely).

6. A Basic Needs Trust Fund school maintenance survey has been undertaken and some funding received to augment the Government maintenance budget.

7. Architectural/environmental/civil engineering services are required for advice on protection or relocation of some schools which, because of their siting, are vulnerable to sea surge, sea level rise, river erosion of foundations, etc.

Achievements

Left with the Minister of Education are a copy of UNESCO’s "cyclone resistant rural primary school construction - a design guide"; and "UNESCO Caribbean Guidelines for hurricane and earthquake resistant construction for school buildings" (see ANNEX AB 5) and "A Proposed UNESCO Caribbean Prototype Building and a sub-regional construction training programme" (see ANNEX STKN 6) prepared during this mission. A request has been made to the Minister for comments and consideration of a request from the Government of St Vincent and the Grenadines to take part in the training programme (the Secretary-General to UNESCO in St Vincent is aware of these requests).

Outline advice has been given where requested, separately to the Minister and to the Education Planner, regarding Byera Primary (reconstruction and protection from sea-surge, sea level rise, river erosion of foundations); Greveys Primary (severe cracking due to water-induced ground movement); South Rivers Methodist (river bank erosion); and Evesham Methodist (groundwater discharge erosion).
Recommendations

Because there has been no recent hurricane damage to school buildings in St Vincent, the problem of "backlog maintenance" is of greatest general priority. In addition, some schools require immediate special construction and structural protection from environmental hazards of a different kind (see Achievements above). This should be arranged promptly by UNESCO; advice on the submission of a formal request has been given, of which the Secretary General for UNESCO is aware.

Assistance with general school design is also required. It has been suggested to the Education Planner and to the Secretary-General to UNESCO that general material on tropical school design is available from UNESCO and should be requested. This should be provided as a matter of urgency while Caribbean specific information is being prepared (or technical assistance being mobilised).

Difficulties encountered

Very heavy rain which had commenced on Friday 23 November, continued through the Saturday, Sunday and Monday and intermittently during the week (see ANNEX STVG 3). Landslips and road blockages were caused. Ministry of Works officers were consequently away from their desks or heavily preoccupied with weather contingencies during this St Vincent mission. An appointment with the Director of Planning was cancelled for similar reasons. Road conditions limited accessibility to schools and the number of schools visited in the time available.

It would have been politically appropriate and advantageous to the mission to have visited schools on Bequia, Union Island and Mustique of the Grenadines. The short time allocated to the St Vincent Mission made this impossible.

It has been judged that the interests and needs of the St Vincent Government have priority over further preparation of the Project Document (PD) Some notes for the PD have been commenced, but it is further judged not possible to attend to the PD as a whole until the Mission in five countries is completed.

Working conditions do not in any case lend themselves to the preparation of a complex document; dampness, inadequate natural or artificial light, inadequate space, inadequate time for the application of long, uninterrupted and concentrated work periods. There are also matters of principle to be discussed in Barbados (as fax message to Hubert Charles: 25 November 1981).

This consultant is in a condition of severe project exhaustion. Since the Paris briefing on 7/8 October (almost two months ago) there have been three half days leave/recreation.
Rest days should have been allocated in the itinerary.

DSA: Two and a half hours out of a very short itinerary have had to be spent (in addition to commission, fees and charges) in obtaining permission from Treasury and in Bank processing to change the over large transfer of DSA from Barbados back to Barbados dollars (Barbados is outside the Organisation of East Caribbean States).

Support received

Excellent and patient guidance and assistance from the Secretary-General to UNESCO, Ministry of Education. Transport (with an excellent driver on difficult and dangerous roads) provided for out of town appointments and duties.

Departure: Midday Friday 29 November 1991.
Working days: Four and a half.

ANNEX STVG I

Discussions held

Mr Errol Belgrave, Lecturer in Building Construction, Technical College, Kingstown.
Mrs E Boyie, Headmistress, South Rivers Methodist Primary, South Rivers.
Mrs W Butler, Headmistress, Byera Anglican Primary, Byera.
Mr Stanley Campbell, Deputy Chief Education Officer, Ministry of Education, Kingstown.
Mr Geoffrey Cato, Chief Engineer, Ministry of Communication & Works, Kingstown.
Mr Jerome Davis, Headmaster, Evesham Methodist Primary, Evesham.
Mr John Horne, Minister of Education, Culture, Youth, Sports and Women's Affairs.
Mrs Monica Huggins, Deputy Principal, Technical College, Kingstown.
Mr Jack, Acting Principal, Technical College, Kingstown.
Mr Colin S Jones, Architect & Planner, Technical Adviser, Central Planning Division, Kingstown.
Miss Marcia Kirby, Secretary-General to UNESCO, Ministry of Education, Kingstown.
Mr Lennox Lewis, Education Officer, Primary, Ministry of Education, Kingstown.
Mrs Yvonne Patterson, Director General, St Vincent Red Cross, Kingstown.
Mr Jonathan Peters, Parliamentary Representative, North Central Windward Constituency.
Mrs Anselma Soso. Permanent Secretary to the Ministry of Education, Kingstown.
Mr Doyle Stephen. Construction Forman, Jochem Construction, Kingstown (Site: New Kingstown fishmarket Extension, St Vincent Marketing Corporation, Kingstown).
Mr R Sutherland. Headmaster, Greggs Primary, Greggs.
Mrs M Trotman. Headmistress. Stubbs Government Primary, Stubbs.
Mr Cools Vanloo. Education Planner, Ministry of Education, Kingstown.

ANNEX STVG 2

Schools visited

Byera Anglican Primary
Greggs Primary
Evesham Methodist Primary
South Rivers Methodist Primary
Stubbs Government Primary

Schools in passing

North Union Secondary
Belmont Government Primary
DISASTROUS RAINS!

Weatherman forecasts more rainfall

The wettest November in living memory is also expected to be the most expensive for this country.

The damage to private and public property by the heavy rains, particularly on Sunday, is expected to run into millions of dollars.

Throughout mainland St. Vincent there were numerous landslides, roads were ripped up, crops destroyed, one bridge collapsed and electricity and water supplies disrupted.

In the Grenadines, there was also some measure of damage to the infrastructure and the Union Island airport had to be shut down periodically over the past week.

The greatest damage, however, appeared to have been done at Greggs, where the entire road at Walter's Village was torn out. One villager, whose house was almost carried away, said when she heard her house shaking, she thought the place was being hit by an earthquake. "I was truly frightened - I couldn't even sleep on Sunday night," the mother of two recounted. "I added, 'My outside toilet was thrown down and I have to use another neighbour's. No vehicles at all could come in here; and I believe if the rain came like how it came Sunday night, the village will have to be evacuated.'

The incident was said to have damaged pipelines in the area, causing the villagers to be out of water for four days.

At Cedars, part of a ridge on which a house is built slid away leaving the house in a precarious position. Parts of Byrea Hill broke off but not enough to affect the flow of traffic. During the intensity of the rain Kingstown itself remained a spectacle. Near The Vincentian and around Secure Foods and along Back Street water was up to knee height, that later pushed engineers back to the drawing board to adjust the width of the gutters so as to prevent further flooding.

The rainy spell began on November 2 and its pattern that has been experienced throughout the Caribbean Over 21 inches of rain was dumped on St. Vincent up to Tuesday and the forecast is for more fall over the next few days.

Coleen Wins Canadian Caribbean Queen Title

Vincentian Coleen Pompey, was crowned the 1st Canadian Caribbean Cultural queen before a large audience at the annual Caribbean Bash sponsored by the Canadian and Caribbean Excelerator Fraternal Association in Toronto on Sunday.

Miss Pompey won from a field of four contestants from Jamaica, Antigua and Barbuda and Barbados. She portrayed aspects of Vincentian culture in dance and dress. She also had a perfect score in her questions.

The guest speaker at the event was Mr. Ron Layne, St. Vincent and the Grenadines Ambassador to the United States and permanent representative to the United Nations. The crowd responded enthusiastically to the ambassador's stirring address.

At the end of the speech the ambassador presented a copy of the Prime Minister's book, Caribbean Crusader to Mr. Vincent Samuel, the Municipal founder of the association. Mr. Samuel expressed his deep appreciation of the gesture and pledged to continue to work for unity and co-operation in the Caribbean community in Canada.

The Association, comprising patriotic Vincentians in Canada, has provided such financial assistance to some students and on Wednesday Mr. Anthony Robertson, one of its members, handed over the cheque in the offices of the Vincentian to Ms. Merle Doily, liaison officer.
5. BARBADOS

Purpose of Mission

To inform appropriate ministries and departments of the Barbados Government of the Mission so far; to acquaint them with the outcome to date; to assess conditions and needs of schools regarding emergency community use of school buildings; to discuss curriculum development to take account of hurricanes and other environmental phenomena; and to work with the UNESCO Consultant on curriculum development and training.

Activities

Inaugural and closing meetings were held with the Permanent Secretary, Projects Officers, and Administrative Officers, and other meetings with the Building Officer and with Architects and draughtsmen of the Ministry of Education; also with the Permanent Secretary, Ministry of Justice and Public Safety and staff of the Central Emergency Relief Organisation; the Director of the Caribbean Disaster Emergency Response Agency; Town Planning Officer, and the Chief Technical Adviser, United Nations Centre for Human Settlements, Barbados (see ANNEX B1 for discussions held).

A description of the Mission was given to a joint meeting of 25 members of the Barbados Association of Professional Engineers and Barbados Institute of Architects.

Visits were made to eight primary and secondary schools accompanied by officers and Consultant Architect of the Educational Projects Implementation Unit of the Ministry of Education (see ANNEX B2 for schools visited).

Findings

1. Hurricane incidence in Barbados has been significant (see ANNEX MR 3) but so also have long periods of hurricane inactivity. There has not been a seriously damaging hurricane since "Janet" in 1955. Nevertheless, Barbados has a considerable and long reputation for its high level of awareness and organisation with regard to hurricanes and hurricane preparedness generally. This is reflected within the Ministry of Education by the advanced integration in school design of facilities for emergency community use.

2. Two school building programmes, the first commenced in 1978 and the second not yet completed, have developed and incorporated "shelter blocks" with hurricane shutters, toilet accommodation, emergency water supply and adjacent outdoor covered areas.
3. There are 12 secondary and 93 primary schools, of which many older buildings are in use. All schools are designated as emergency shelters in three categories with regard to a variety of possible disaster events.

4. The same high degree of awareness and concern for hurricanes generally is reflected in a professional approach to the development of schools' curricula and an enthusiastic acceptance of the need to incorporate material on natural hazards.

5. There is a stated perception at Ministry level of the relationships that exist between housing construction quality, the probable demand for public shelter, and the construction quality of buildings designated as emergency shelters. The higher the perceived constructional standard of housing, the less is likely to be the need for community shelter in hurricanes, especially where the constructional quality of buildings so designated is recognized as being lower than that of housing.

6. The Chief Project Officer of the Caribbean Development Bank, Barbados, has stated that funding is not available for the works of maintenance identified in the Basic Needs Trust Fund Project on Maintenance of Schools and Health Buildings. The Reports were produced for the purposes of project identification and as part of a regional campaign on maintenance awareness. Further, a recent evaluation of the Bank's activities in this respect has pointed to the lack of people qualified and able to guide education projects of this kind and that the Bank is likely therefore not to achieve all it set out to. A pledge of US$ 15 million is expected but that sum is required to be matched by another donor: project termination date is 30 September 1992.

7. The Chief Technical Officer of the United Nations Centre for Human Settlements (Habitat) has described a project which has produced Building Guidelines for the Organisation of Eastern Caribbean States. The overall project includes assistance with building legislation, training for building inspectors, and the production of a video film based upon the effects of Hurricane "Hugo" in domestic construction in Montserrat. He sees the need to avoid overlap, and therefore for collaboration in the training of artisans for construction in general "were UNESCO to identify funds for a training programme".

Achievements

The Deputy with the Permanent Secretary, Ministry of Education, copies of UNESCO's "Cyclone resistant rural primary school construction - a design guide" and of the produced material prepared during this Mission "UNESCO Caribbean Guidelines for Hurricane and Earthquake resistant construction for school buildings" [see ANNEX AB 5] and "A reported UNESCO prototype
additional building and a subregional construction training programme" (see ANNEX STKN 6). A request has been made for the Barbados Government to comment on the proposed additional building and construction training programme as these had been prepared so far (outside of Barbados).

Unforeseen results

The high level of awareness and commitment to hurricane preparedness and the high level of advanced school design (in new buildings) suggests that the "prototype" building may not be as applicable in Barbados as elsewhere. This must be dependent upon the Barbados Government interpretation of need inclusive of schools not seen during this short Barbados mission.

There have been suggestions from architects and engineers that, in Barbados, construction standards are adequate and that training may not be necessary.

Lessons experienced

The Ministry of Education undertakes school construction, through its own Educational Project Implementation Unit and building maintenance through its own Buildings and Maintenance Section. The Ministry of Works and Communication is not involved. All construction work and 93 percent of all maintenance work is let by tender to the private sector of the construction industry.

Interaction of technical and training expertise is required in the production of construction manuals for trainers and learners, training video production, construction training workshops and CPD modules, and for visual and audio-visual materials for a variety of subjects and grade levels for infusion by teachers and for other interest groups: eg technical and vocational training institutes, polytechnics and colleges.

Of particular relevance to this Mission is the need to integrate elements of building construction and of building maintenance into emergency shelter managers' expertise and duties.

Recommendations

1. That the provision of the prototype additional building for Barbados should be reconsidered (subject to the requirements of the Barbados Government/Ministry of Education (see ANNEX B3).

2. That Barbados is the most appropriate location and context for the development of curricula materials applicable in the sub-region.
3. That further opportunity be provided for the interaction of technical and training expertise in the production of all visual and audio-visual training materials and for curricula development.

Difficulties encountered

1. The curriculum development aspect of the Mission had not been appreciated by the otherwise well informed and well organised Ministry of Education.

2. Insufficient time in Barbados to do justice to the involvement of UNESCO Consultant on curricula development and training. The contribution by the UNESCO Consultant in curricula development and training has been valuable, but it is unfortunate that her participation was not reflected in the itinerary for this contract. More time is necessary for continuation of the generative and creative integration of training and technical expertise now briefly commenced, as the crucial prerequisite for all construction training and curriculum development elements of the proposed project. What little has taken place has been in brief interludes between appointments, not having had the benefit of joint time allocated and programmed for the purpose.

3. It is impossible to complete the Project Document within the time allocated to the Barbados itinerary:
   a/ because the few intervals have been allotted to discussion with the UNESCO Consultant in curricula development and training;
   b/ thinking and ideas that have been the outcome of those few discussions need now to be incorporated in the Project Document;
   c/ the state of project exhaustion (see St Vincent Mission Report) and now of delayed shock for this Consultant (see § below).

4. More time out of a short itinerary has had to be spent in the Barbados Central Bank in obtaining permission and making arrangements to take out of Barbados the remainder of cash that was transferred to Antigua. Had the payment been made in Barbados in US$ traveller's cheques as authorised, these difficulties would not have occurred.

5. Hubert Charles' report on damage to schools by Hurricane "Hugo" in Antigua an St Kitts would have been useful in those locations and at the commencement of the mission instead of here in Barbados at the end.

6. At 22.30 hours in the evening of 2 December 1991, this Consultant was attacked by two men with the purpose of robbery on the side of a main road. Although robbery was thwarted, injuries were sustained: a cut arm, severe bruising,
sprains and a suspected broken rib. The incident was reported to the local police, descriptions given of the assailants, and half the night spent in hospital casualty treatment and X-ray.

The ensuing week of the mission, and subsequently to date, has been extremely difficult, with interrupted sleep and delayed/impeded recovery from shock and exhaustion.

Support received

Efficient, detailed and informed attention by the Ministry of Education; attentive and helpful assistance by CARNEID Director and staff (a fax message from St Vincent to the Director CARNEID requesting an early discussion and with additional itinerary items was promptly accommodated).

Working days: 5.

ANNEX B1

Discussions held

(With the exception of that with the Chief Technical Adviser to UNECSO Barbados, all discussions were with the participation of the UNESCO Consultant on curriculum development and training)

Mr Kenneth Agar, Senior Education Officer, Curriculum Development, Ministry of Education.
Mr James Armstrong, Chief Technical Adviser, United Nations Centre for Human Settlements (Habitat), Bridgetown.
Mr Glyne A Barker, President, Barbados Association of Professional Engineers, Bridgetown.
Mr Victor Bedford, Buildings Officer, Buildings and Maintenance Section, Ministry of Education.
Mrs Maureen Bell, Headmistress, West Terrace Primary.
Mr George Bradshaw, Senior Teacher, West Terrace Primary.
Mr Raphael Cave, Director of Training, National Training Board, Bridgetown (extended telephone conversation).
Miss Mabel Chandler, Permanent Secretary (Ag). Ministry of Education.
Mr Hubert Charles, UNESCO Representative to Barbados and Eastern Caribbean and Co-ordinator CARNEID, St Michael.
Mr Jeremy McA Collymore, Regional Co-ordinator, Caribbean Disaster Emergency Response Agency, St Michael.
Mrs Rosalind Corbin, UNESCO Consultant, UNESCO/CARNEID, St Michael.
Mr Curtis Duene, Junior Draughtsman, Education Implementation Unit, Ministry of Education.
Mr Darwin Goodridge, Project Manager, Education Project Implementation Unit, Ministry of Education.
Mr Carlson Gough, Chief Project Officer, Infrastructure Division, Caribbean Development Bank, Bridgetown (extended telephone conversation).
Miss Ermine Holmes, Principal (Ag), Grantley Adams Memorial Secondary.
Miss Barbara Howard, Headmistress, Cuthbert Hoost Primary.
Mr Hyslock B Hunte, Consultant Architect, Education Project Implementation Unit, Ministry of Education.
Miss Johana Jordan, Secretary/Treasurer, Deighton Griffith Secondary.
Mr R O Jordan, Permanent Secretary, Ministry of Justice & Public Safety.
Mr Trevor Leach, Town Planner, Town & Country Planning Office, Ministry of Housing & Lands.
Miss G Lovell, Headmistress, St Joseph Primary.
Mr R Marvel, Science Officer, Ministry of Education.
Mr C McOnegal, Architect, British Development Division, Barbados (extended telephone conversation).
Mr R E Miller, Supervisor of Emergency Services (Ag), Central Emergency Relief Organisation, Ministry of Justice & Public Safety.
Mr Greydon Nesfield, Administration Officer, Education Project Implementation Unit, Ministry of Education.
Mr John Nunn, Senior Teacher, Queen's College Secondary.
Mr R V Phillips, Senior Administration Officer, Ministry of Education.
Mr Joseph Riley, Assistant Supervisor, Emergency Services, Central Emergency Relief Organisation, Ministry of Justice & Public Safety.
Ms Barbara Taylor, Senior Administrative Officer, Ministry of Justice & Public Safety.
Mr Leton Thomas, Principal, Sir Arthur Lewis Community College, Castries, St Lucia.
Mr Hamilton Williams, Headmaster, St Matthias Primary.

ANNEX B2

Schools visited

Christchurch Girls Primary
Cuthbert Moore Primary
Deighton Griffith Secondary
Grantley Adams Memorial Secondary
Queen's College Secondary
St Joseph Primary
St Matthias Primary
ANNEX B3

Some considerations for the Prototype Additional Building:

1. The use of the word "prototype" should be discontinued, due to interpretation implying technical innovation; recommended alternative "demonstration building".

2. The provision of a small additional building to a school campus has advantages in its appropriateness as community workshop, seminar and meetings for adult education, where the school itself could remain secured. Its use as a community adult education centre should be emphasised.

Greater participation by the community in "every day" school use will increase community participation and care in community use of school facilities as emergency shelters.

Increased community use of schools will assist the reduction of vandalism and illicit use.

3. A small adjoining building can readily be available for small numbers of evacuees from small, local (and therefore potentially more frequent) disasters and emergencies - without disturbing the functioning of the school and its teaching facilities.

4. During the use of school buildings as emergency community shelters there is the need for spaces set aside for a variety of special uses appropriately accommodated in such an additional building: eg

- office space for evacuee registration
- private space for counselling and personal rehabilitation
- meditation and prayer groups
- first aid and medical care
- nursery care for children
- nursery care for mothers, babies and small children
- seminar and study groups

5. Siting must be as close as possible to existing buildings which must be structurally sound and free from maintenance issues.

A covered way may be required to link the demonstration building with existing buildings.

6. Consideration should be given to the provision of a larger parking area with at least one large size propane gas cooker, a refrigerator, and emergency lighting provision; and a
lockable food store adjacent.

7. In addition to storage provided for school use, community emergency shelters require storage for their own use (blankets; lanterns; buckets; towels; first aid; items and records).

ANNEX MR 1

UNESCO Headquarters, Paris

Discussions held

Mr Rudolfo Almeida, Chief, Educational Architecture Unit (EAR).
Mr M Leslie Atherley, Acting Director, Educational Policies & Management (EPS).
Mr John Beynon, Director, Education/Co-ordination, Evaluation & Operations (ED/CEO).
Mrs Anne Goodwin-Diaz, Educational Architecture Unit (EAR).
Mr A Shankanga, Chief, Education/Operations & Projects (ED/OPS).
ANNEX MR 2

References


Tomblin, John Natural Disasters in the Caribbean: A review of hazards and vulnerability Seismic Research Unit, University of the West Indies. 1979.


ANNEX MR 3

The table below provides a list of hurricanes and earthquakes that occurred in Antigua and Barbados. The table is sourced from various reports and records.

<table>
<thead>
<tr>
<th>Hurricane</th>
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<td>ANTIGUA</td>
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</tr>
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<td>1681</td>
<td>1600</td>
</tr>
<tr>
<td>1772</td>
<td>1778</td>
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<tr>
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</tr>
<tr>
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<td>1974</td>
</tr>
<tr>
<td>1980 (David)</td>
<td></td>
</tr>
<tr>
<td>1939 (Huco)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>BARBADOS</td>
<td></td>
</tr>
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<td></td>
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<td>1848</td>
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<tr>
<td>1870</td>
<td></td>
</tr>
<tr>
<td>1955 (Janet)</td>
<td></td>
</tr>
<tr>
<td>1990 (Allun)</td>
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<td>1997 (Elida)</td>
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**Jamaica**

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<td>1689</td>
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<td>1722</td>
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<td>1903</td>
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<td>1917</td>
<td>(3)</td>
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</tr>
<tr>
<td>1951</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>(TS)</td>
</tr>
<tr>
<td>1980</td>
<td>(Allen)</td>
</tr>
<tr>
<td>1985</td>
<td>(Kate)</td>
</tr>
<tr>
<td>1988</td>
<td>(Gilbert)</td>
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**St Kitts/Nevis**

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<td>1633</td>
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</tr>
<tr>
<td>1692</td>
<td>(Port Port)</td>
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<td>1772</td>
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</tr>
<tr>
<td>1788</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1930</td>
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<td>1950</td>
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<td></td>
<td>1969 Nevis)</td>
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<td>1974</td>
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<td>1989</td>
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**St Vincent**

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<td>eruption 1812 (1)</td>
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<tr>
<td>1902</td>
<td>(2)</td>
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<td>1971</td>
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<tr>
<td>1979</td>
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<td>1980</td>
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</tr>
<tr>
<td>1986</td>
<td>(TS Danielle)</td>
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<tr>
<td>1987</td>
<td>(Emily)</td>
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(1) 1600 (MR) or 39 (7T) dead.
(2) 1500 dead.