

REPORT
ON
COURSE ON
MULTI-HAZARD BUILDING DESIGN
(FOR THE CARIBBEAN)

Sponsored by US Agency for International Development (USAID)

Organization of American States (OAS)

and

Council of Caribbean Engineering Organizations (CCEO)

held from

November 13-17, 2000

at

Ocean Terrace Inn
Basseterre, St. Kitts

Myron W. Chin, PhD
Representative of CCEO
c/o Faculty of Engineering
The University of the West Indies
St. Augustine, Trinidad.

November 2000

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ACKNOWLEDGEMENTS

The Council of Caribbean Engineering Organizations (CCEO) would like to thank the United States Agency for International Development (USAID) under its PGDM (Post-Georges Disaster Mitigation) Project and the Organization of American States (OAS) for providing the funding to develop the course material used in this course and for providing financial assistance to the majority of participants who attended this course.

Thanks are also due to Mr. Kenneth Parker, Director of the Office of the General Secretariat of the OAS in St. Kitts and Nevis, to Mr. David Keith, Local Coordinator for the OAS and to Mr. Carl Herbert, Acting National Disaster Coordinator of the National Emergency Management Agency (NEMA) St. Kitts and Nevis for providing back-up administrative support for the course.

Finally Thanks are due to the two Course Presenters Messrs. Tony Gibbs and Anthony Farrell of Consulting Engineers Partnership (CEP) Ltd. and to the participants for taking time off their busy schedules to take part in this course.

PREFACE

Over the past two decades the Caribbean region has experienced a dramatic upsurge in the level of destruction caused by hurricane and tropical storms. While storms and related flooding and landslides are the most frequently experienced hazards, earthquakes also pose significant risk to the region.

Most of the decisions regarding a building's ability to withstand the effects of natural hazards are determined during its original design and location. To assist with compiling and disseminating information on building design appropriate to the hazards prevalent in the Caribbean, this course has been developed under the Post-Georges Disaster Mitigation (PGDM) Project by Engineer Tony Gibbs.

The course has been designed so that it could be delivered in two modules:

- A The first module consists of:
 - 1. Hurricane and earthquake hazards in the Caribbean
 - 2. Multi-hazard design – synergies and contradictions
 - 3. Conceptual designs to resist hurricanes and earthquakes

- B The second module consists of:
 - 1. Determination of forces for use in analysis
 - 2. Outline of analytical procedures
 - 3. Detailing

Those not directly involved in designing or checking structures may wish to take the first module only. Those directly involved in the design of structures (either as designers or checkers) would want to take both modules. Those taking the second module are required to take the first module.

The objectives of the course were:

- To provide structural engineers employed by government and in the private sector, with a deeper understanding of the fundamentals of wind and earthquake hazards and of the design processes for resisting these hazards.

- To introduce the course participants to the standards and building codes relevant to the Caribbean region for wind-resistant and earthquake-resistant design.

It is therefore hoped that this course will increase the participants' awareness and understanding of wind and earthquake hazards and of the design processes for resisting these hazards.

In addition, it should provide some course material which could be incorporated in final year undergraduate and postgraduate studies at the University of the West Indies (UWI)

and in continuing education courses for practising engineers through the Engineering Institute at UWI.

Myron W. Chin
Representative of CCEO

GENERAL REPORT ON COURSE

This Course was formally opened by the Minister of Works, Mr. Rupert Herbert, who was also Deputy Chairman of the Disaster Mitigation Council of St. Kitts and Nevis. He emphasised the need for proper construction practices, proper building regulations and effective policing of these regulations in order to be better prepared to withstand future natural disasters. He concluded his address by thanking the OAS, CCEO and Mr. Tony Gibbs for their involvement in developing and presenting the Course and expressed the hope that all the participants would find the course beneficial. Photograph 1 shows Minister Herbert formally opening the Course.

Addresses were also made by the Acting National Disaster Coordinator of the National Emergency Management Agency (NEMA), Mr. Carl Herbert and Mr. Tony Gibbs, the main course presenter.

The Course comprised of two modules viz:-

Module A which consisted of:

- Hurricane and earthquake hazards in the Caribbean
- Multi-hazard design – synergies and contradictions
- Conceptual designs to resist hurricanes and earthquakes

and Module B which consisted of:

- Determination of forces for use in analysis
- Outline of analytical procedures
- Detailing

Four participants completed Module A which was delivered during the first two days of the Course viz. Monday November 13 and Tuesday November 14, 2000. Certificates of Participation were given to the following four participants who successfully completed Module A:

- Mr. Murchison Best, Director of Public Works, St. Kitts and Nevis
- Ms. Arlene Edwards, Interior Designer, St. Kitts and Nevis
- Mr. Gene Oliver Elmes, Architect, St. Kitts and Nevis
- Ms. Daphne Degazon-Hobson, Architect, Nevis

Module B was delivered during the remaining two and a half days viz: Wednesday November 15, 2000 to Friday November 17, 2000 and sixteen (16) participants successfully completed both Modules A and B. Certificates of Participation were presented to the following sixteen (16) participants by Mr. Kenneth Parker, Director, Office of the General Secretariat of the OAS in St. Kitts and Nevis during the closing ceremony of the Course on Friday November 17, 2000 (See Photograph 2 which shows Mr. Kenneth Parker presenting a Certificate of Participation to Mr. Lester Blackett of Nevis).

1. A. Cochrane from Barbuda Council, Public Works, Barbuda

2. E. Cornelius, Building and Civil Engineer, Ministry of Public Works, Antigua
3. A. Crump, Town and Country Planner, Development Control Authority, Antigua
4. C. Barry Davis, Chief Architect, Ministry of Public Works, Antigua
5. D. Mack, Civil/Project Engineer, Antigua Public Utilities Authority, Antigua
6. D. Butcher, Senior Structural Engineer, Robert Wells Structural Engineers, Tortola, British Virgin Islands
7. L. Blackett, Civil Engineer and Director of Environmental and Natural Resources, Premier's Ministry, Nevis
8. L. Elmes, Civil Engineer/Partner, Elmes Associates, St. Kitts
9. E. Glasford, Manager/Owner (Architectural Designer), Edwin Glasford Associates, St. Kitts
10. L. Pemberton, Engineer, Public Works Department, St. Kitts
11. M. Richardson, Graphic Engineer, TDC, St. Kitts
12. T. Hughes, Project Site Engineer, Housing and Urban Development Corporation, St. Lucia
13. M.A. Alfred-St. Louis, Ag. Development Control Officer, Ministry of Planning, St. Lucia
14. J.C. Edward, Senior Civil Engineer, Housing and Urban Development Corporation, St. Lucia
15. M. Chin, Senior Lecturer, Department of Civil Engineering, UWI, Trinidad
16. K. Sirju, Lecturer, Department of Civil Engineering, UWI, Trinidad

Full details of Modules A and B and the Course Programme are given in Appendix 1.

Appendix 2 gives the Course notes handouts distributed during the course.

Appendix 3 gives the complete List of Participants with their addresses and contact details (See Photograph 3 which shows all the participants with the two Presenters).

Appendix 4 gives the Biographical sketches of the two presenters viz: Mr. Tony Gibbs and Mr. Anthony Farrell.

An evaluation of the Course was carried out by asking the participants to complete an evaluation questionnaire at the end of the Course and 20 of the 22 participants submitted their completed questionnaires i.e. a 90.9% response.

On the basis of this response, Appendix 5 gives a summary of the responses to the evaluation questionnaire from which it is to be noted that 100% found the venue was a good one and 75% responded that the Course met their professional expectations. 70% rated Modules A and B as very good and 10% as excellent. 80% found that the length of the course was adequate, 10% too long and 5% too short.

CONCLUDING REMARKS

On the basis of the evaluation and feedback from the participants, it can be concluded that the Course was a success and that the majority of the participants found it useful, valuable and worthwhile.

In addition the two representatives from the Department of Civil Engineering of the University of the West Indies (UWI) will be undertaking a critical review of the Course materials to see which parts could be incorporated in both final year undergraduate and postgraduate studies in the Department of Civil Engineering and in continuing education courses for practising engineers through the Engineering Institute at UWI.

APPENDIX 1

MODULES A AND B AND COURSE PROGRAMME

Multi-hazard Design Course (focussing on wind and earthquake forces)

developed by
Tony Gibbs

Preamble

The course will be so designed so that it could be delivered in two modules:

- A The first module will consist of:
- 1 Hurricane and earthquake hazards in the Caribbean
 - 2 Multi-hazard design – synergies and contradictions
 - 3 Conceptual designs to resist hurricanes and earthquakes
- B The second module will consist of:
- 1 Determination of forces for use in analysis
 - 2 Outline of analytical procedures
 - 3 Detailing

Those not directly involved in designing or checking structures may wish to take the first module only. Those directly involved in the design of structures (either as designers or checkers) would want to take both modules. Those taking the second module are required to take the first module.

Outline of the Course

The itemised outline of the timetable (including days, time periods, subjects and presenters or participants) is shown in the following table. The main presenter for the inaugural course is Tony Gibbs. Subsequent courses may be presented by others, either as sole or multiple presenters.

Day/Time	Subject	Presenter
Day 1 (13Nov2000)		
	A1 Hurricane and Earthquake Hazards in the Caribbean	
08:30-10:00	<i>A1.1 The Hurricane Hazard</i> A1.1.1 formation A1.1.2 climate change and its effect on the windstorm phenomena A1.1.3 factors affecting the wind speed A1.1.4 factors in determining the effect of wind on buildings A1.1.5 examples of failures	Tony Gibbs
10:00-10:30	Refreshments	
10:30-12:00	<i>A1.2 The Earthquake Hazard</i> A1.2.1 the tectonic setting of the Caribbean A1.2.2 seismic events in the Caribbean – causes and history A1.2.3 Seismic Research Unit of UWI and the engineering community A1.2.4 the Pan-American Institute of Geography and History project A1.2.5 the USAID/OAS-CDMP project results and derived “code” values A1.2.6 volcanic activity A1.2.7 tsunamis	Tony Gibbs
12:00-13:30	Lunch	
	A2 Multi-hazard Design	

13:30-15:00	<i>A2.1 Synergies and Contradictions</i> A2.1.1 source of loading A2.1.2 type and duration of loading A2.1.3 predictability of loads A2.1.4 influence of local soil conditions on response A2.1.5 main factors affecting building response A2.1.6 normal design basis for maximum credible event A2.1.7 design of non-structural elements	Tony Gibbs
15:00-15:30	Refreshments	

15:30-17:00	<i>A2.2 The Process of Structural Design</i> A2.2.1 forms and systems and materials A2.2.2 the influence of available construction processes A2.2.3 accommodation of the legitimate requirements of the architect and the electrical and mechanical engineers A2.2.4 ancillary issues A2.2.5 the need to satisfy the contractor A2.2.6 the need to satisfy the investor	Tony Gibbs
Day 2 (14Nov2000)		
	A3 Conceptual Design	
08:30-10:00	<i>A3.1 Conceptual Designs to Resist Hurricanes</i> A3.1.1 geometry or shape or configuration of the building A3.1.2 the siting of the building A3.1.3 the materials of construction A3.1.4 the structural system	Tony Gibbs
10:00-10:30	Refreshments	
10:30-12:00	<i>A3.2 Conceptual Designs to Resist Earthquakes</i> A3.2.1 geometry or shape or configuration of the building A3.2.2 the siting of the building A3.2.3 the materials of construction A3.2.4 the structural system A3.2.5 base isolation and energy absorption	Tony Gibbs
12:00-13:30	Lunch	
13:30-15:00	<i>A3.3 Problems Associated with Detailing and Construction</i> A3.3.1 ductility A3.3.2 durability A3.3.3 construction details (documentation) A3.3.4 quality assurance	Tony Gibbs
15:00-15:30	Refreshments	
	A4 Interaction	
15:30-17:00	<i>A4.1 Exercise</i> <i>A4.2 Tutorial</i> <i>A4.3 Questions and Answers</i>	All
Day 3 (15Nov2000)		
	B1 Determination of Forces	
08:30-10:00	<i>B1.1 Determination of Wind Forces for Use in Analysis</i> B1.1.1 the fundamentals B1.1.2 using CUBiC and BNS CP28 B1.1.3 using ASCE 7-98	Tony Gibbs
10:00-10:30	Refreshments	
10:30-12:00	<i>B1.2 Determination of Earthquake Forces for Use in Analysis</i> B1.2.1 the fundamentals B1.2.2 using CUBiC B1.2.3 introduction to IBC2000	Tony Gibbs
12:00-13:30	Lunch	
	B2 Analysis	

13:30-15:00	<i>B2.1 Outline of Analytical Procedures- I</i>	Tony Gibbs
15:00-15:30	Refreshments	
15:30-17:00	<i>B2.2 Outline of Analytical Procedures- II</i>	Anthony Farrell
Day 4 (16Nov2000)		
08:30-10:00	<i>B2.3 Introduction to Dynamic Analysis</i>	Anthony Farrell
10:00-10:30	Refreshments	
10:30-12:00	<i>B2.4 NEHRP Analysis</i>	Tony Gibbs
12:00-13:30	Lunch	
	B3 Detailing	
13:30-15:00	<i>B3.1 Detailing for Hurricanes</i> B3.1.1 timber B3.1.2 masonry B3.1.3 glazing B3.1.4 roof coverings	Tony Gibbs
15:00-15:30	Refreshments	
15:30-17:00	<i>B3.2 Detailing for Earthquakes</i> B3.2.1 masonry B3.2.2 concrete B3.2.3 steel	Anthony Farrell
Day 5 (17Nov2000)		
	B4 Interaction	
08:30-10:00	<i>B4.1 Exercise</i> <i>B4.2 Tutorial</i>	All
10:00-10:30	Refreshments	
10:30-12:00	<i>B4.3 Discussion</i> <i>B4.4 Questions and Answers</i>	All
12:00-13:30	Presentation of certificates and lunch	All

APPENDIX 2

COURSE NOTES HANDOUTS

APPENDIX 3

LIST OF PARTICIPANTS

USAID/ OAS/CCEO/COURSE

ON

MULTI- HAZARD

BUILDING DESIGN

(For the Caribbean)

November 13th - 17th 2000

At

Ocean Terrance Inn

Basseterre, St. Kitts

LIST OF PARTICIPANTS

ANTIGUA AND BARBUDA

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APPENDIX 4

BIOGRAPHICAL SKETCHES OF PRSENTERS

- Mr. Tony Gibbs
- Mr. Anthony Farrell

Presenter – Mr. Tony Gibbs

Tony Gibbs is a civil engineer specializing in structures and practising mainly in the Caribbean. He did his undergraduate studies at Queen's University of Belfast and he was a Commonwealth Scholar at the University of Leeds.

His engineering career included assignments with Norman and Dawbarn at the UWI campus in St. Augustine; Ove Arup & Partners in London and Caribbean Construction Company in Jamaica. He is now the Consultant and Director of Consulting Engineers Partnership Ltd. with offices in four Eastern Caribbean islands and two cities in England.

He is a Past President of the Barbados Association of Professional Engineers; Past Vice President of the Institution of Structural Engineers (UK), a Fellow of the Institution of Civil Engineers (UK) and a Fellow of the American Society of Civil Engineers.

Mr. Gibbs has acted as Associate Project Manager for the Caribbean Uniform Building Code; Chairman of the Barbados Metrication Board; Deputy Chairman of the Barbados National Council for Science and Technology and he is now the Chairman of the Barbados Building Code Advisory Committee. He was a member of the Joint Board of Moderators (UK) 1995 team assessing the UWI B.Sc. Civil Engineering degree programme.

Mr. Gibbs' special interests are in the fields of reinforced and prestressed concrete; thin shell and folded-plate structures; collaborative design in multi-disciplinary teams and designing against the natural hazards of hurricanes and earthquakes. He is particularly interested in the interrelationship between engineering and insurance.

In 1991 he received the International Award "For (his) Very Significant Contributions to Hurricane Loss Reduction and hurricane Safety in the Caribbean" at the US National Hurricane Conference; and an award "In Recognition of (his) Contribution to the Advancement and Promotion of Structural Engineering in the Caribbean" from the Barbados Association of Professional Engineers. In 1998 he received the award of "Career of Excellence in Engineering" from the Association of Professional Engineers of Trinidad and Tobago.

ANTHONY FARRELL

CURRICULUM VITAE

Profession: Consulting Civil/Structural Engineer

Date of Birth: 31st January, 1942

Years with Firm: 32 **Nationality:** Trinidadian

Membership in Professional Societies:

Fellow of the Association of Professional Engineers of Trinidad and Tobago.

Fellow of the Institution of Civil Engineers, U.K.

Fellow of the Institution of Structural Engineers, U.K.

Member of the Barbados Association of Professional Engineers.

Experience History:

Mr. A. Farrell is the Senior Director of CEP Ltd.

On graduation from U.W.I., St. Augustine, in 1965, Mr. Farrell first worked as a junior engineer with the Bridges Section, Highways Division of the Ministry of Works in Trinidad.

In 1966, Mr. Farrell joined CEP Ltd., (then David Key and Partners). He was employed as an assistant engineer in Trinidad but was immediately seconded to Barbados with David Key Associates, now Consulting Engineers Partnership. He worked under the direction of senior engineers on design, detailing and supervising of various reinforced concrete and steel structures, including multi-storey buildings and shell and folded plate structures.

In 1969 Mr. Farrell traveled to England to pursue an M.Sc., course in structures at Leeds University. This was completed with distinction.

Mr. Farrell moved to Dominica in 1971 where he was put in charge of the Dominica office of Consulting Engineers Partnership. He became an associate of the practice in 1972 and a full partner in 1973.

During his time in Dominica, Mr. Farrell carried full design responsibility for all projects under his control. He worked on reinforced concrete folded plate structures (Teachers' Training College - Roseau), design and supervision of the shore facilities of the Dominica Deep Water Port, the Burton Building in Roseau, the Roseau River protection works as well as the construction supervision of the Police Headquarters and the Computer Centre projects in Roseau.

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ANTHONY FARRELL

CURRICULUM VITAE

Experience History (Cont'd):

In 1974 Mr. Farrell returned to Trinidad and has been in charge of many projects in load-bearing masonry, reinforced concrete and structural steel.

Amongst these are: TELCO Thompson Exchange at Cross Crossing, various Telephone Company towers and Caribbean Home Insurance Co. (CHIC) Building, Port of Spain, offices for the Guyana and Trinidad Mutual Life Ins. Co., the Nealco Properties Shopping Centre at Aranjuez and the extension of the Royal Bank offices at Independence Square, which incorporated slip-formed cores.

From 1975 to 1985, the main project for which he was responsible was the Financial Complex, Port of Spain, which houses the offices of the Central Bank and Ministry of Finance. This project with an overall cost of TT\$420 million, incorporates twin 22-storey reinforced concrete towers together with other low-rise structures, all founded on Raymond step taper piles. The designs were done to the then, latest earthquake engineering requirements.

From 1985 on Mr. Farrell has also been in charge of several prestigious projects, among which are the following:

25000 tonne reinforced concrete grain storage silos complex for the National Flour Mills, Trinidad and Tobago.

Structural design for the Algico Plaza, an 18,300 sq. m. 9 level reinforced concrete office complex in Port of Spain.

Office Complexes for Maritime Life Caribbean Ltd., Guardian Life of the Caribbean Ltd., Rhand Credit Union, Colonial Life Ins. Company and Barbados Mutual Life Assurance Co.'s new headquarters on Queen's Park West, Port of Spain, the Chancery for the British High Commission in Port of Spain and the Blind Welfare Association, as well as the Chaguanas Fire Station for the Fire Service, the Police Administration Centre and several district police stations for the Trinidad and Tobago Police Service.

Recently completed projects include three multi-storey blocks of luxury apartments known as The Towers, at Westmoorings, and West Mall Expansion, also at Westmoorings, Trinidad; and in the capital, Port of Spain, the Head Office for the Royal Bank of Trinidad and Tobago on Park Street; Offices for Price Waterhouse, Victoria Ave., the Laquis Building, London Street, and the IDB New Country Offices.

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ANTHONY FARRELL

CURRICULUM VITAE

Experience History (Cont'd);

Current projects include Amoco's new Head Office, Queen's Park Plaza in Port of Spain, Trinidad, Ministerial Offices, Grenada, the National Gas Co.'s Pier 4 at Savonetta, Trinidad, and Foundations and Pipe Rack Designs for the Titan Methanol Plant, Trinidad.

Mr. Farrell maintains special interest in earthquake engineering and in computer Aided Design and Draughting (CADD).
He is the director directly responsible for CEP's computing facility.

Education:

1955 to 1961 - Queen's Royal College - Trinidad.

1962 - 1965 - University of the West Indies - St. Augustine Campus, Trinidad.
Upper Second Class Honours. B.Sc., in Civil Engineering.

1969 - 1970 - Leeds University, England.
M.Sc, (with distinction) in Structural Engineering.

Employment Record:

1974 - present: Director, CEP Ltd., - Trinidad.

1971 - 1974 Engineer-in-charge
Associate (1972), then
Partner (1972).

1969 - 1970 (late) Leeds University

1966 - 1969 Assistant Engineer, Consulting Engineers Partnership, Barbados.

1965 - 1966 Engineer with Bridges Section, Highways Division, Ministry of Works - Trinidad.

Languages: English – Excellent

APPENDIX 5

EVALUATION OF THE COURSE

USAID/OAS/CCEO COURSE ON

MULTI-HAZARD BUILDING DESIGN (FOR THE CARIBBEAN)

November 13-17, 2000

at

Ocean Terrace Inn, Basseterre, St. Kitts

EVALUATION QUESTIONNAIRE

1. Did you attend Module A only? (Nov 13-14, 2000) Yes No
2. Did you attend Module A and B? (Nov 13-17, 2000) Yes No
3. How would you rate the Module(s) you attended overall?
Excellent Very Good Good Fair Poor
4. What was the length of the course
Adequate? Too Long? Too Short?
5. Did the course meet your professional expectations? Yes No
6. How do you rate the Presenters?
Tony Gibbs Excellent Good Fair Poor
Anthony Farrell Excellent Good Fair Poor
7. Will you recommend this course to other professionals? Yes No
8. What were the most interesting parts of this course?
"EARTHQUAKE FORCES AND DESIGN"
"CONCEPTUAL DESIGN FOR HURRICANES AND EARTHQUAKE"
"DETAILING FOR MULTI-HAZARDS"
9. How would you rate the Administrative arrangements for this course?
Excellent Good Fair Poor
10. Was the venue a good one? Yes No
11. Any other comments?
"MORE PROFESSIONALS NEED EXPOSURE TO THIS MATERIAL"
"A SITE VISIT SHOULD BE INCLUDED"
"ALL LECTURE NOTES SHOULD BE ON CD-ROM"
"COURSES OF THIS NATURE ARE EXTREMELY USEFUL AND TIMELY. I THOROUGHLY ENJOYED AND BENEFITTED FROM THIS COURSE"

PHOTOGRAPHS

PHOTOGRAPH 1 Minister Rupert Herbert Opening Course

**PHOTOGRAPH 2 OAS Representative Kenneth Parker
presenting Certificate of Participation to
Mr. Lester Blackett of Nevis**

**PHOTOGRAPH 3 Group of Participants with two
presenters**

N.B. See File [stkittscoursephotos123](#) for photographs.

