



United Insurance Centre, Lower Broad Street,
Bridgetown, Barbados, W. I.

Professional Guide to

Performance-based Design Upgrade

for the purpose of achieving

Hurricane-resistant Construction

Developed for

UNITED INSURANCE COMPANY LIMITED

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Guidance Notes for Performance-based Design Upgrade

The guidelines recommended here refer to the upgrading of existing buildings. They are also suitable for new buildings already under construction and those to be built in the near future.

- 1/ The condition and strength of your building (especially the roof, windows and external doors) will need to be checked by a Structural Engineer. Any upgrading, if necessary, will be required to comply with the following design criteria, in conjunction with normal practice of safety in respect of strength of materials and building elements.
- 2/ The basis for determining the wind loads for design purposes is the Barbados National Standard BNS CP28 - Wind Loads for Structural Design. This document is virtually identical to the Code of Practice prepared by the Barbados Association of Professional Engineers in 1970 for the Council of Caribbean Engineering Organisations and revised by Consulting Engineers Partnership Ltd and the Caribbean Meteorological Institute under contract to the Barbados National Council for Science and Technology in 1981.

BNS CP28 provides basic wind speeds for most of the states covered by the United Insurance Company Limited.

In using BNS CP28 the following minimum requirements and considerations must apply:

- a/ The topography must be taken into consideration (the S_1 factor)
- b/ In determining the ground roughness, any building within 2 kilometres of the coast must use category 1 in Table 3.

In the Commonwealth Caribbean no locations currently warrant the use of Ground Roughness Category 4.
- c/ Class A must be used for all windows, doors, light-weight roof coverings and their fixings.
- d/ The Building Life Factor (S_2) must not be less than 1.0.
- NB The Practicing Structural Engineer is to use his own discretion and professional judgement in using a higher-than-minimum-code wind speed for those buildings that are constructed in exposed locations and for those buildings required to serve a post-disaster function, eg churches, schools, hospitals, fire stations, police stations and food stores.
- e/ Careful consideration must be given to internal pressure coefficients.

The Practicing Structural Engineer should consider that, even in fully enclosed buildings, the structure and cladding should be designed for the possibility of windows and doors breaking, thus requiring the design to take account of maximum internal (positive or negative) pressures.

For buildings with openings which cannot be closed, the building or relevant portion of the building shall be designed for the maximum pressure difference due to the airflow around the building. These pressure differences can be as large as 6 kPa, but can be reduced by designing pressure-balancing air inlets and outlets.

For the purpose of determining internal pressures in accordance with BNS CP28, all window openings, whether glazed or not, shall be regarded as potential dominant openings unless approved protection against debris penetration is provided.

External doors shall be considered to be potential dominant openings unless the doors and their fixings are shown to be adequate to resist wind and debris loading simultaneously.

Where doors, windows and cladding are considered not to constitute potential dominant openings, the internal positive pressure coefficient may be reduced to a minimum of +0.2.

Protection of openings shall be considered adequate if it can be shown to be capable of resisting the test prescribed by Dade and Broward Counties of Florida (2-inch by 4-inch by 8-foot timber travelling at 35 miles per hour).

- 3/ Special attention should be given to obtaining manufacturers' certifications of proprietary items such as solar hot water systems, windows, sliding doors and roller-shutter doors.
- 4/ The Design and Observation/Supervision Certificates will be given by the Practicing Structural Engineer on the satisfactory completion of the repairs and modifications to your building.



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**Initial Inspection Report
for Performance-based Design Upgrade**

This report forms part of the Observation/Supervision Certificate

Structural Element	Existing Size, Spacing and Fastenings	Recommended Upgrade
Roof cladding		
Purlins		
Rafters and trusses		
Concrete roof beam		
Eaves and verandah tie-down details		
Solar hot-water system		

Structural Element	Existing Size, Spacing and Fastenings	Recommended Upgrade
Air-conditioning equipment		
Windows		
Doors		
Other elements		

Inspections carried out by: _____

Qualifications: _____

Address: _____

Signature: _____

Date: _____



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Standard Form for Upgrading Existing Structures for Hurricanes

(Design Criteria: BNS CP28 - Wind Loads for Structural Design)

For use by professional civil/structural engineers

Notes:

- 1 This report form is in three sections
 - a/ **Sections 1 and 2**
To be filled out at the time of first inspection.
 - b/ **Section 3**
To be filled out at the time when the Engineer considers the property to have been satisfactorily upgraded, or to be of a standard that needs no further upgrading.
- NB It is important to note that the building may not be considered as being upgraded or of sufficient hurricane resistance unless section 3 is completed.
- 2 The format of this report form has been developed for use by professional civil/structural engineers who are registered to practice in the country of the property or who are Chartered Structural Engineers. United Insurance Company Limited will not be held responsible for the accuracy of the information provided.

SECTION 1

1.1 Building owner: _____

1.2 Property location: _____

1.3 Approximate age: _____

1.4 Structure: _____

1.5 Topography factor _____

1.6 Ground roughness _____

1.7 Building size:

Length (m) _____

Width (m) _____

Height (m) _____

1.8 Pressure coefficients:

External Roof (Cpe) _____

External Walls (Cpe) _____

Internal (Cpi) _____

SECTION 2

2.1 Classification for resistance to hurricane damage

- a/ Purpose of Inspection: To establish deficiencies and to recommend remedial action to make good deficiencies within reason with a view to minimising future hurricane damage.
- b/ Classifications for hurricane resistance are scheduled for the building components in their present state and for the same components after completion of recommended action based on the following scale which indicates along the top of the scale the range of basic wind speeds in m/sec.

< 40	40 - 47	48 - 54	55 - 60	> 60
very bad	bad	fair	good	very good

2.2 Upgrading works required

See table on accompanying sheet.

2.3 General notes: _____

We certify that we have inspected the premises described above and have made the recommendations detailed herein for upgrading these premises. The report, however, recognizes that only representative sampling of the structural components has taken place, and that the inspection has not covered those components which are embedded or otherwise out of view. In such cases the structural components which cannot be seen are deemed to be either similar to those within view or in the case of embedded items, of sufficient strength to resist the design loading.

Date of our first inspection: _____

Signed: _____

Registration: _____

Chartered Engineer's certificate: _____

Company/Firm: _____

SECTION 3

3.1 Building owner: _____

3.2 Property location: _____

3.3 Date(s) of inspection(s) during and after upgrading (or initial date of inspection if no upgrading is considered necessary):

3.4 Date of final inspection:

We consider that as of the last date given in this section, the building is likely to be of a reasonable level of hurricane resistance within the limitations stated in Section 2 above.

Signed: _____

Registration: _____

Chartered Engineer's certificate: _____

Company/Firm: _____

Site Inspection Report

Engineer: _____

Job No: _____

Project: _____

Inspection Requested By: _____

Inspection Made On: _____

Work Inspected: _____

Work Approved: _____

Instructions: _____

Work to be re-inspected: _____

If the Contractor considers the execution of any work resulting from the instructions above involve a variation, he shall obtain approval from the Engineer or Architect in conformity with the Contract requirements.

Inspected by: _____

Contractor's Representative: _____

Site Instruction Report

Engineer: _____

Job No: _____

Project: _____

Instruction Requested By: _____

Instruction Made On: _____

Instruction: _____

If the Contractor considers the execution of any work resulting from the instructions above involve a variation, he shall obtain approval from the Engineer or Architect in conformity with the Contract requirements.

Instruction Given By: _____

Contractor's Representative: _____

Certificate of Practicing Structural Engineer

DESIGN

This form is to be used for:

PERFORMANCE-BASED DESIGN UPGRADE

Owner's name: _____

Building: _____

Location: _____

DOCUMENTS ATTACHED - if and as required by the Insurance Company:

Drawing Numbers: _____

Specifications: _____

Calculations: _____

Building class: _____

Building age: _____

Construction: _____

Builder: _____

I/We* certify that:

- 1/ I am a/we are* Practicing Structural Engineer(s)* actively involved in the field of Structural Engineering.
- 2/ I/We* have carried out/checked* the structural design calculations for the above building.

- 3/ The above-mentioned building work has been designed in accordance with the principles of structural mechanics and, if constructed reasonably in accordance with the documents listed above, shall be capable of sustaining the most adverse combinations of loads to which it will be subjected in accordance with the relevant provisions of Codes of Practice. The relevant Standard Codes, specifications and references relied upon in the design of the building work are as follows:

- 4/ The following structural members have been separately certified and the certification is attached. As the Practicing Structural Engineer, I declare that the design of the components covered by this certification complies with the Codes listed above:

- 5/ This Certificate is valid for five years from date of issue. If substantive repairs or modifications are carried out within this period then a new Certificate may have to be issued.

- 6/ If the design does not comply with the relevant Standard Codes, state in which areas it differs (attach reports if necessary):

7. Basis of Structural Design:_____

Live Load: _____

Design Wind Velocity:_____

Internal Pressure Coefficient (max):_____

Internal Pressure Coefficient (min): _____

External Pressure Coefficient (max): _____

External Pressure Coefficient (min): _____

Terrain Category: _____

(If more than one category is used, indicate direction in respect of each category.)

Safe Foundation Bearing Pressure: _____

- 8/ I/We* have/have not* been engaged to carry out the structural supervision of the construction and will/will not* issue a Certificate to certify that the constructed works are in accordance with the drawings.

** Delete where not applicable.*

All documents covered by this certificate shall be endorsed and signed by the Practicing Structural Engineer.

Name: _____

Qualifications: _____

Address: _____

Signature: _____

Date: _____

Certificate of Practicing Structural Engineer

OBSERVATION/SUPERVISION

This form is to be used for:
PERFORMANCE-BASED DESIGN UPGRADE

Owner's name: _____

Building: _____

Location: _____

DOCUMENTS ATTACHED - if and as required by the Insurance Company:

Drawing Numbers: _____

Specifications: _____

Calculations: _____

Building class: _____

Building age: _____

Construction: _____

Builder: _____

I/We* certify that:

I/ I am a/we are* Practicing Structural Engineer(s)* actively involved in the field of Structural Engineering.

2/ The extent of our supervision was as follows:

3/ Are photographs enclosed with the inspection report? Yes/no*

4/ The following structural members have been certified separately and the certificate is attached. As Practicing Structural Engineer, I declare that this certificate complies with the requirements of the Standard Codes listed in the Design Certificate:

5/ This certificate is valid for five years from date of issue. If substantive repairs or modifications are carried out within this period, then a new certificate may have to be issued.

6/ Other comments and conditions applying to this certificate:

** Delete where not applicable.*

Name: _____

Qualifications: _____

Address: _____

Signature: _____

Date: _____

Read notes overleaf before completing this form.

All of Sections (2) to (6) may not apply to this Certificate.

All documents covered by this Certificate shall be endorsed and signed by the Practicing Structural Engineer.

NOTES

Practicing Structural Engineer

A Practicing Structural Engineer is a legally Registered Professional Engineer or a Chartered Structural Engineer.

Observation

Observation comprises such inspections as the Practicing Structural Engineer considers necessary to ascertain whether the design is being interpreted correctly and whether the works for which he is the professional adviser are being carried out in general accordance with the contract documents.

Observation is only appropriate for routine work being constructed by a competent and reliable contractor and does not provide the more detailed inspection defined under Supervision.

Supervision

Supervision comprises more detailed inspections than those provided by Observation and may involve the employment of one or more resident engineers or clerks of works. Supervision provides a monitoring of the quality of the works carried out by the contractor and provides more assurance that the contractor carries out the works in accordance with the contract documents than would be obtained from Observation.

Supervision does not imply transfer to the Consulting Engineer of any of the responsibilities of the construction contract, nor does it in any way limit the responsibility of the contractor to carry out and complete the works in accordance with the contract documents. The effectiveness of the monitoring is dependent, among other things, on the extent of supervision provided by or through the Consulting Engineer and paid for by the Client.

Neither Observation nor Supervision provides an absolute assurance that the contractor is carrying out the works exactly in accordance with the design and contract requirements.