BUILDING CODES & THE
REGULATION OF THE BUILDING
INDUSTRY

By Mark Francois and Kevin Granger
Where are we?

- No Small Building Code
- No National Building Code
- No Mandatory Registration of Building Professionals
- No licensing of Contractors
- Approval Process poor
- Few Buildings are properly designed for earthquakes
Are we Ready?

Looking at our Risk.
The Built Environment – Overview

Risk

- Hazard
- Vulnerability
- Losses
What do we have to loose – Our Risk
The Hazard - Earthquake
How Vulnerable Are We?

- Building Stock
- Structural Classification
- Design Level
How much can we afford to loose? - POS

Based on a Magnitude 7.5 earthquake

Percentage Distribution of the Total Economic Loss for Port of Spain

US$4,928,619,629.39
How much can we afford to loose? – San’do

Based on a Magnitude 7.5 earthquake

US$6,081,551,866.97
Building Codes- Small Buildings

THE SMALL BUILDING CODE - 
Guide to the Design and 
Construction of Small Buildings - 
TTBS

- Must be Purchased from TTBS
- Need to be made into a Code by Law
- Building Inspectors need to be Trained to use it
- Public Awareness and Training Needed URGENTLY
National Building Code-
Large Buildings

Why a National Building Code?
- Hurricane and Earthquake Hazard values are fixed
- To Protect Citizens Against the use of Codes that are not Appropriate to T&T
- To make Design Professionals Accountable by Law for specific Performance
- Simplify the Approval Process
When can we get a National Building Code?

- A Caribbean Building Code has been in the Making for 5 Years with No End in Sight
- APETT/TTBS has Completed the Technical Work for the Structural Components Based on the IBC
- TTIA/TTBS Have Started the Architectural Parts
- If Government Supports is Available, A National Building Code can be Published in 9 Months.
- It MUST however be Passed into Law
MOWT– Code Recommendation

- Earthquake Loads
  - UBC – 97 (Zone 3)
  - IBC 2000 (under review)

- Reinforced Concrete
  - ACI 318 - 1995
  - BS 8110 – Pts 1,2 & 3

- Structural Steel
  - AISC Manual of Steel Construction (9th Edition)

- BS 5950
Code of Practice – Design Loads

NEHRP Recommended Provisions
for Seismic Regulations for New Buildings and Other Structures
FEMA 853-1/2003 Edition

International Building Code®
A Member of the International Code Family®
2006

Minimum Design Loads for Buildings and Other Structures

BBFL Caribbean Limited
Code of Practice – Steel

AISC 341

AISC 360
Code of Practice – Concrete

Reinforced Concrete

Masonry
Code of Practice – Timber
Building Professions Acts

- Engineering Professions Act Passed in 1985
- Architecture Profession Act Passed in 1992
- Neither Act makes it Mandatory for Professionals to be Registered to Practice
- Land Surveyors, Doctors and Lawyers Must be Registered before they can Practice
- In other Caribbean Countries such as Barbados and St. Lucia there are Greater Levels of Control
Improving the Registration Process - Architects

For Architects the Registration Process Works, as you must have the Following.

- An Accredited Degree
- To be Practicing for Two Years in T&T
- To Pass their Exam
Improving the Registration Process - Engineers

**THE ENGINEERING PROFESSION**

- Civil Engineering:
  - Structural and Geotechnical
  - Highways and Transportation
  - Project Management and Environmental Engineering

- Mechanical Engineering:
  - Air Conditioning
  - Plumbing

- Electrical Engineering:
  - Electronics
  - Communication

- Chemical /Industrial Engineering:
  - Petroleum Engineering
Registered Engineers Allowed to Stamp Building Plans
(THIS IS OUTSIDE OF PLUMBING & ELECTRICAL)

- Civil Engineers          BOETT 04
- Structural Engineers  BOETT 19
- There are only about 17 Registered Structural Engineers
- Therefore only REGISTERED STRUCTURAL ENGINEERS should STAMP BUILDING PLANS
Changes Needed in the Registration Process for Structural Engineers

- Mechanism Needed to Transfer the Appropriate Civil Engineers to the Structural Category
- A special sub-committee should be set up for this
- R.E.’s applying to transfer should prove via portfolio that they are capable of engineering to current standards
- All Engineers wish to register under section 19 should provide a portfolio to the committee
Changes Needed in the Registration Process for Structural Engineers (Con’t)

- Engineers applying to register from overseas should also submit a portfolio or be a Registered Engineer from a jurisdiction that would qualify them.

- For example a Structural Engineer registered in California should be automatically considered subject to an interview.

- A member applying Chartered by the IStuctE should not be automatically considered as Seismic Design is not a requirement for their Charter.
Why More Stringent Requirements for Structural Engineers

- The Caribbean not friendly to Structural Engineers
- Unlike most parts of the world we can be subject to Earthquakes, Hurricanes, Landslides and Tsunamis.
- Earthquakes cause the most concern because they can strike every building and are far more devastating than hurricanes.
- The design for large earthquakes is the only area of structural engineering where the building is not designed fully resist the applied forces.
- The training required for this level of design is far more extensive and totally different to design for moderate to light earthquake areas.
Why More Stringent Requirements for Structural Engineers

- Seismic Design is getting even more complex as the design methodology is shifting to Performance Based Design
Approval of Building Structures

- At the Regional Corporations and City Councils there are almost no Engineers experienced in Earthquake Resistant Design.
- Ministry of Works is currently the only agency that has some competence in Structural Design.
- Many buildings that have received approvals do not meet code requirement of UBC 97 or IBC.
- Final approvals are not linked to Inspection documentation.
Building Inspectors should be trained in the Small Building Guide which must be the document on which Small Buildings are Approved.

It is unlikely that State Agencies will ever develop sufficient numbers of the quality of Structural Engineers needed for the approval of “large “ buildings.

The French have solved these issues in their Caribbean Island by privatizing the Structural Approval process using a system initiated by Insurance Companies called “Bureau de Control”.

This may take some time to introduce. We can start by the automatic approval of independent peer reviewed designs.
Contractor Licensing

- None Exist To Date!
  - Only self-regulation is practiced.
  - Prequalification is the only means of classification available to the public and private sector.
  - Short Listing of Contractors are often based on past relationships.
  - The TTCA has prepared a position paper for Contractor Licensing. It has been submitted to a Cabinet sub-Committee over a year ago.
  - This is very important for the development of the industry and the protection of the public.
What do we need to know?

Earthquake Design Philosophy
## Seismic Design – Philosophy

<table>
<thead>
<tr>
<th>Earthquake Excitation</th>
<th>Normal Excitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always dynamic Loading</td>
<td>Generally static loading</td>
</tr>
<tr>
<td>Design shaking rare or very rare (approx. recurrence interval 475 years)</td>
<td>Constant Loading or occur frequently</td>
</tr>
<tr>
<td>Magnitude and direction generally unknown</td>
<td>Magnitude and direction known</td>
</tr>
<tr>
<td>Loads applied indirectly by moving the base</td>
<td>Loading applied directly to the structure</td>
</tr>
<tr>
<td>Not economically viable to prevent excessive or permanent deformation</td>
<td>No yield under service loads and deformation limits are imposed</td>
</tr>
</tbody>
</table>
Seismic Design – Philosophy
Seismic Design – Philosophy

Building Performance Levels

- Operational
- Immediate Occupancy
- Life Safe
- Near Collapse

Ground Motion Levels

- Frequent Earthquakes (50% - 50 years)
- Design Earthquake (2/3 of MCE)
- Maximum Considered Earthquake (2% - 50 years)

Performance for Group I Buildings
Performance for Group II Buildings
Performance for Group III Buildings

BBFL Caribbean Limited
Irregular Configurations

- T-Shaped Plan
- L-Shaped Plan
- U-Shaped Plan
- Cruciform Plan
- Other Complex Shapes
- Setbacks
Irregular Configurations

\[ \delta_{\text{max}} < 1.2 \delta_{\text{avg}} \quad \text{No irregularity} \]

\[ 1.2 \delta_{\text{avg}} \leq \delta_{\text{max}} \leq 1.4 \delta_{\text{avg}} \quad \text{Irregularity} \]

\[ \delta_{\text{max}} > 1.4 \delta_{\text{avg}} \quad \text{Extreme irregularity} \]

Irregularity 1b is NOT PERMITTED in SDC E or F.
Irregular Configurations
What to Really Look for?

Detailing Issues
Detailing Issues – Failures

Olive View Hospital
Detailing Issues – Failures

Olive View Hospital, 1971 San Fernando Valley earthquake

Spiral Confinement
Virtually NO Confinement
Detailing Issues – Failures
Detailing Issues – Poor Deetailing
Detailing Issues – Failures
Detailing Issues – Recommended
Has it been done it Right?

Quality Assurance
Quality Assurance

- Classification of members of the project team and assigning clear responsibilities
- Ensuring that work is being checked at regular intervals
- Proper testing of material and recording of results.
- Insist on Quality Assurance Documentation
- Training, Awareness and Certification
- Referenced Technical Specification and Calculations
Special Inspections are required for all buildings (except buildings classified as *small*) constructed in Trinidad and Tobago.

For Steel buildings continuous special inspections are necessary for welding in accordance with AISC 341 unless the welder is certified (see exceptions).