S.A. Claim Experiences and the Development of A Building Quality Inspection Index for Houses

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• Challenges in quality construction
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NHBRC Mandate in Brief

- to **regulate** the home building industry;
- to **establish and promote ethical and technical standards** in the home building industry; and
- to **improve structural quality** in the interests of housing consumers and the home building industry.

NHBRC was established by an Act of Parliament (Housing Consumers Protection Measures Act, 1995)
Mandate of NHBRC

• The Act requires that the NHBRC shall:

“enrol and inspect the categories of homes that may be prescribed by the Minister”
Root causes for structural failures
Design

- Appointment of competent person to perform engineering design works; and
- Specialised engineering expertise required in certain areas.
Materials

- use of inappropriate materials and technologies;
- The quality of the materials used, in particular the concrete, does not meet Standards in some instances;
- No standards for other building materials and products
Workmanship

- quality of construction varies across the board;
- general poor workmanship and “cutting corners”;
- lack of appropriate attention given to structural detailing such as connections;
- late enrolments or non-enrolment of homes with the NHBRC warranty scheme – no inspection.
Total Remedial Claims

millions

2009 2010 2011 2012 2013 2014

Super-Struct ($-Value)  Super-Struct (R-Value)
2014 Distribution of claims

- Foundation: 4%
- Sub-Structure: 30%
- Sup-Structure: 9%
- Roof: 57%
Super-Structure Claims

Decline in claims
What is Quality?

- Quality – “Fitness for purpose”
- Quality – “Uniformity and dependability”
- Two aspects of quality:
  - features: more features that meet customer needs = higher quality
  - freedom from trouble: fewer defects = higher quality
Problem Statement

- Relatively few quality assessment systems in place to monitor and capture aspects of construction quality in a structured and consistent way.
Background to CONQUAS

- CONQUAS – Construction Quality Assessment System
- Launched by CIDB Singapore in 1989
- The main objectives of the introduction of the CONQUAS system in Singapore were:
  - to introduce a standard quality assessment system for construction projects,
  - to make the quality assessment objective; and
  - to enable the assessment to be carried out systematically, within reasonable cost and time.

Within eight years of its implementation the average Conquas score improved steadily from about 68% to 75%
CONQUAS

• CONQUAS has 3 main components;
  – Structural;
  – Architectural; and
  – Mechanical/electrical.

• System is aimed at commercial type building based on selective sampling

• Sampling is based on floor areas of buildings

• A review of CONQUAS and its applicability to Singapore showed huge differences with the South African built environment

• However, the principle of CONQUAS was seen to be appropriate to South Africa
## Singapore vs South Africa

<table>
<thead>
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<th>SINGAPORE</th>
<th>SOUTH AFRICA</th>
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| **Geographic/Climatic** | • Fairly small and flat tropical island  
• uniform climatic conditions, dominated by moist coastal air and cyclonic wind/rain events. | • Land surface is significantly larger  
• Wide spectrum of altitudes, geological formations and climatic zones |
| **Socio-Economic**   | • Culture of attention to detail  
• high rate of employment, as well as high living and educational standards  
• has access to a large pool of skilled/educated labour. | • Diverse cultures  
• high rate of unemployment (25.5%)  
• Historical challenges on quality of living and educational standards  
• Skills base needs to be improved |
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<th>SINGAPORE</th>
<th>SOUTH AFRICA</th>
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<tbody>
<tr>
<td>Spatial</td>
<td>• Like elsewhere in Asia, and as a result of the lack of urban space and the lifestyle expectations of the community, most of the development in Singapore is high-rise.</td>
<td>• Apart of the centres of large cities, most housing developments are single-storey.</td>
</tr>
<tr>
<td>Developmental</td>
<td>• The entire Singaporean development and construction industry is centralised and strictly controlled.</td>
<td>• Decentralised system, with Provincial Govts and or Local Authorities responsible for developments</td>
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Building Quality Inspection Index for Houses (BQIH)

- BQIH is a Construction Quality Assessment System developed by the NHBRC and the Scientific Council (CSIR).
- The principle of the system is similar to CONQUAS.
- Developed so that the home building industry has a standard quality assessment system, achieved by measuring constructed works against workmanship standards and specs.
Principles of BQIH

• The system should follow the broad philosophy of CONQUAS in respect of its aims, the structure (i.e. division into building components) and the principle of relative weights.

• Both structural and architectural aspects of house construction should be considered.

• However, in line with the NHBRC mandate, the system should focus on assessing aspects of the quality of basic construction that affect the structural performance and safety of housing units.
Principles of BQIH

• Important aims applicable to the South African situation were identified as:
  ➢ the provision of an objective method for evaluating the performance of building contractors,
  ➢ the identification of good and bad construction practices, and
  ➢ identification of the training needs of contractors.

• The system should be inclusive of the entire spectrum of the housing industry – from the affordable to the high-income sector.
Principles of BQIH

• The system should be self-contained, straightforward, concise and practicable.
• The appraisal should be based on visual assessment of relevant items, assuming access to and verification of relevant technical documentation pertinent to the site.
• No destructive investigations and testing will be permitted.
Development Process of BQIH
• The BQIH adopts the following six basic building ‘components’:
  1. Foundations;
  2. Floors;
  3. Walls;
  4. Roofs; and
  5. electrical & plumbing.
• Scores range from 0% to 100%
## Weighting of Building Components

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<tr>
<th>Reference</th>
<th>Description</th>
<th>Weighting (%)</th>
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<tr>
<td>1</td>
<td>Foundations</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Floors &amp; stairs</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Walls</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Roofs</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Electrical &amp; plumbing</td>
<td>10</td>
</tr>
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Appraisals

• Each component in CONQUAS has detailed questions regarding compliance and has two options:
  0 - Non compliance
  1 - Compliance

• In South Africa, this approach will be:
  – Too restrictive;
  – Disqualify large portions of housing units; and
  – Distort appraisal of structural elements

• Introduced an intermediate score of 0.5. Refers to quality that is generally acceptable with a few permissible non-compliance.
Assessment

• Scoring is carried out only once without any provision for re-working and subsequent re-scoring.

• Encourage the culture of “doing things correctly right from the beginning”
BQIH Acceptance of Results

• Houses with a score of more than 85% are generally good and pose little structural integrity risk;

• Houses between about 50% to about 85%, generally require remedial works, ranging from minor to major structural repairs; and

• Houses less than 50% are not acceptable and need to be demolished
Typical Assessment of a Housing Project

• BQIH used on affordable housing project were some of the houses were under construction and some completed
  – Houses under construction 831
  – Completed houses 589
• Houses were not enrolled by the NHBRC
• No inspections were conducted on the houses
General Findings (Top Structure)

- Poor quality bricks
- Insufficient cement in mortar mix
- Poor plaster application to exterior walls
- Poor founding conditions
- Incorrect use of brick-force
- Incorrect or no brick bonding
- Vertical cracks in plaster – Poor quality sand and mix
- Poor storm-water management
Overall BQIH Scores for all Houses

![Bar chart showing BQIH scores with frequency counts. The chart indicates the number of houses falling into different score ranges, with vertical lines at 50, 60, 70, 80, 90, and 100, representing thresholds for Demolish, Rectify, and OK categories.]
Scores for Roofs

![Histogram of BQIH scores with frequency on the y-axis and BQIH score on the x-axis.](image-url)
Score of Foundations

![Graph showing the frequency of BQIH scores](image)
Correlation Analysis
BQIH for Mortgaged Houses

Score (%)

Problems with inspections

2007 2008 2009 2010 2011 2012 2013 2014
Benefits of BQIH

• Tool used to identify the problem areas in their business.
• Tool used as performance parameters in the grading of Home Builders. Good performers can therefore use their BQIH Index for marketing purposes.
• Perhaps the most obvious are the benefits to the consumer – i.e. the house owners.
• For local authorities the most important benefit is the ability to make an independent comparison of the relative performance of various contractors involved in the construction process, and the introduction of a quality-driven management system for awarding contract work.
Benefits of BQIH (Cont…)

• From the perspective of the national authorities, implementation of the system will provide a platform for a comprehensive and consistent assessment of the quality of housing stock in South Africa.

• For affordable and social housing, the statistical performance data obtained can form the basis for risk-assessment studies, as well as for budgeting and the allocation of resources (i.e. investment in new developments vs the maintenance and upgrading of existing stock).
CONCLUSION

• The principles and process of development of a quality appraisal system for South Africa has been presented.
• The system is straightforward and concise for quality assessment of all houses across the entire spectrum of housing market.
• System can be used to assess if quality is improving with time;
• System can be used for comparison of quality across different countries.