



5. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF THE RESEARCH

The research can be summarised as follows:

5.1.1 Chapter 1

In this chapter the problem and its setting are described. Specific reference is made to the regulatory needs of the built environment and existing shortcomings of the NBR are identified. The most pressing of these are

- the lack of an appropriate instrument to ensure uniform implementation, and
- the limited inclusion of sustainability principles.

The statement of the main problem is divided into specific sub-problems, and the associated hypotheses are formulated for testing.

The delimitations are listed to define the scope within which the study was conducted. The assumptions are largely based on the existing Act (Act 103 of 1977) and the multi-lateral agreements on sustainability that were ratified by South Africa. The goals and objectives of the study are listed in brief.

The research context is discussed in detail, referring to the researcher's paradigm. Next the research design is presented and it serves as a roadmap for the research journey ahead. Lastly, the importance of the study is discussed, and the researcher's expertise to comment on the topic is touched upon.

5.1.2 Chapter 2

Chapter 2 starts off with a brief description of Hammurabi's code, and how the origin of building regulations can be linked with the growth of human settlements. A building regulation is defined, as well as the relationship between a building regulation and a building standard. Lastly, different approaches to formulating standards are concisely reviewed.

The origin of building regulations in Southern Africa is traced, and it is measured against the accepted definition of a building regulation.



Act 103 of 1977 is discussed in detail, referring to its original goals, particular sections and the development of the NBR. The chapter identifies the pertinent sustainability issues.

This chapter achieves the first defined goal of the study:

To determine the origin and goals of the current edition of the NBR.

The second last goal listed in Chapter 1 is also accomplished, namely:

To identify specific passive design criteria that would have a limited impact on developmental costs, for possible inclusion in the NBR and the administrative processes thereof.

Table 13 explicitly lists 16 different passive design criteria for possible inclusion in the NBR to achieve a more sustainable South African built environment. The identified criteria originate from SANS 10400 Edition 2, SANS 204 Edition 1, and Part XA Edition 1. In Table 14 a checklist is provided to assist the BCO in the implementation of these passive design criteria.

5.1.3 Chapter 3

The purpose of Chapter 3 is to determine whether the regulations contained in the NBR are implemented uniformly in South Africa. The main problem is aligned with specific goals, and research methods are listed to achieve these goals. A pilot study is initiated, based on Stats SA Building Statistics, Report No. P5041.3 (2009). The study area is then reviewed in accordance with Building Statistics Report Number P5041.1 (2010). The different NBR implementation tools utilised in the study area are presented for comparison.

This chapter addresses the second goal listed in Chapter 1:

To determine how various Local Authorities implement the requirements of the NBR, and whether this is done uniformly across South Africa.

5.1.4 Chapter 4

Chapter 4 focuses on the research method to obtain the relevant data, and deals with a questionnaire presented to BCOs at a one-day convention organised by the NRCS.



The aim of this questionnaire is to determine the opinion and judgement of the BCO concerning the NBR, because the BCO is the most significant role-player in the plan approval process. The following specific aspects are considered:

- *Are BCOs aware of the origin, methods of implementation and goals of the NBR?*
- *Are BCOs willing to support the uniform implementation of the NBR?*
- *Are BCOs aware of recent developmental changes to the NBR?*
- *Are BCOs willing to implement new regulations that focus on sustainability in the existing administration system of the NBR?*

The progress made in addressing the main problem and its associated sub-problems is reviewed.

The proposed questionnaire for the BCOs is introduced, together with the responses thus collected. Finally, the data is interpreted in anticipation of the findings, conclusions and recommendations addressed in Chapter 5.

Chapter 4 achieves two of the main goals of Chapter 1:

- *To determine whether the relevant role-players (i.e. the BCOs) are aware of recent developmental changes to the NBR.*
- *To determine if Building Control Officers (BCOs) are willing to implement new regulations on sustainability in the existing administration system of the NBR.*

The final goal (partly addressed in Chapter 2) was reached in Chapter 4:

- *To identify specific passive design criteria that would have a limited impact on developmental costs, for possible inclusion in the NBR and the administrative processes thereof.*



5.2 FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The findings of the study are presented against the background of the particular problem statements and consequential hypotheses.

The main problem statement, as formulated in Chapter 1, is:

The purpose of this study is to determine the origin of the current minimum regulations and standards applicable to the built environment of South Africa, and to examine the goals and implementation methods of Act 103 of 1977 and its Regulations (together with the Code of Application (SANS 10400:1990)), in an attempt to achieve uniform implementation of the requirements and align the aforementioned with accepted passive design principles to promote a more sustainable built environment in South Africa.

The main problem is divided into four separate sub-problems. The respective sub-problems are posed in a question format:

1. *What is the origin of the NBR, and have the goals and methods of implementation of the current edition of the NBR (which represents the minimum regulations and standards applicable to the built environment of South Africa) evolved since its origin?*
2. *Are the current regulations and standards, as defined by the NBR, implemented uniformly by the respective Local Authorities?*
3. *Are the most significant role-players in the plan approval process, i.e. the BCOs,*
 - 3.1 *aware of the origin, goals and implementation methods of the NBR, and*
 - 3.2 *are they willing to support the uniform implementation of the NBR, and*
 - 3.3 *are they aware of recent developmental changes to the NBR?*
4. *Are BCOs willing to implement new regulations on sustainability in the existing administration system of the NBR?*

The findings, conclusions, recommendations based on the findings, and recommendations for further study in respect of each question are presented in table

format within the research context (Tables 64-69). This format was selected to facilitate the accessibility of arguably the most important part of the study.

5.2.1 Sub-problem 1 and resulting hypothesis

Table 64: Sub-problem 1 and the associated hypothesis and conclusion

	Sub-problem (Posed as question)	Positive hypothesis	Result
1	What is the origin of the NBR, and have the goals and methods of implementation of the current edition of the NBR (which represents the minimum regulations and standards applicable to the built environment of South Africa) evolved since the origin of the NBR?	It is hypothesised that the goals and implementation methods of the NBR (which represents the minimum regulations and standards applicable to the built environment of South Africa) have evolved since the origin of the NBR.	The positive hypothesis was proved: Positive
Findings based on the desk review			
The first building regulation applicable to Southern Africa could be traced back to a diary inscription by Jan van Riebeeck on 7 January 1660			
Findings based on the questionnaire			
According to the BCOs, the primary focus of the amended Act 103 of 1977, is threefold:			
<ol style="list-style-type: none"> 1. To ensure a healthy built environment 2. To ensure a safe built environment 3. To ensure uniform regulations in the built environment 			
For the BCOs, the following two aspects are of secondary importance in defining the focus of Act 103 of 1977:			
<ol style="list-style-type: none"> 1. To promote sustainability in the built environment 2. To form a basis for future development of the built environment 			
The most contentious aspect is the original goal of the NBR, i.e. to limit inflation in the built environment, clearly indicating a changing perspective (at least in the opinion of the BCOs) since the original inception of the NBR. This was discussed in Chapter 2; see <i>The origin of building regulations in Southern Africa</i> .			
The majority of BCOs indicated their agreement with the fact that SABS 0400-1990 (or SANS 10400) represents both the minimum requirement for a building project as far as the applicant is concerned, and the maximum requirement that the LA, and therefore the BCO, could expect from a building project.			
The above aspect was discussed in Chapter 2; see <i>The changing objectives of Act 103 of 1977 and the NBR</i> .			
Should there be any uncertainty about the obligations of the owner or the			

<p>expectations of the BCO, it could lead to the introduction of conditions that are not essential to the requirements of the NBR. This situation would ultimately result in unnecessary expenditure, thereby negating the original goal of the NBR.</p>
<p>Conclusion</p> <p>Through the aforementioned research it is possible to conclude that the goals and implementation methods of the NBR (which represent the minimum regulations and standards applicable to the built environment of South Africa) have evolved over time.</p>
<p>Recommendations based on the findings</p> <p>The DTI, the SABS with its appropriate sub-committees, the NRCS and the LAs (with specific representation by the BCOs) need to establish a forum to facilitate communication regarding important issues pertaining to the NBR.</p> <p>A channel of communication is necessary to ensure that the BCO (who takes responsibility for the implementation of the NBR through his appointment by the LA), interprets the NBR in the same way as the NRCS, SABS and DTI respectively.</p>
<p>Recommendations for further studies</p> <p>None</p>

5.2.2 Sub-problem 2 and resulting hypothesis

Table 65: Sub-problem 2, and the associated hypothesis and conclusion

	Sub-problem (Posed as question)	Negative hypothesis	Result
2	Are the current regulations and standards as defined by the NBR, implemented uniformly by the respective LAs?	It is hypothesised that the various LAs do not implement the current regulations and standards as defined by the NBR in a uniform manner.	The negative hypothesis was proved: Positive
Findings based on the pilot studies			
Although limited to the largest contributors to the built environment of South Africa, the pilot study on the tools used to implement the NBR (Chapter 3) clearly illustrates the varied approaches to plan approval among the respondents.			
Findings based on the questionnaire			
<p>The BCOs do not agree that certain parts of the South African built environment should be exempt from the NBR. The study specifically pointed out that</p> <ul style="list-style-type: none"> • all official government buildings should be <u>subject to the full approval procedure</u>, and • government-subsided housing <u>should fall under</u> the approval mandate of SABS 0400-1990 and that of the BCO. <p>The BCOs indicated that a system could be implemented to incorporate existing government-subsidised housing in the formal sector. The following proposal was generally accepted by the BCOs:</p> <p>As soon as any alterations or additions are made to a government-subsided</p>			



house, it should fall under the formal sector, adhering to all the relevant requirements of SABS 0400-1990 (or SANS 10400).

The possibility of introducing two different codes under SABS 0400-1990 (or SANS 10400), was met with ambivalence by the BCOs. In other words, it could be argued that the BCOs are not sure whether there should be two different codes; one applicable to the formal segment of the South African built environment, and a separate code for informal settlements.

Conclusion

Through the aforementioned research it is possible to conclude that the various LAs do not implement the current regulations and standards as defined by the NBR in a uniform manner.

Recommendations based on the findings

No building in the formal sector of the built environment should be exempt from the plan approval process.

Although it would represent a compromise in the opinion of the BCOs, government buildings and subsidised housing could possibly be incorporated as special categories for planning approval.

Presently, the informal sector is not included in the Code, and this remains problematic.

Recommendations for further studies

The inclusion of government-subsidised housing in the formal sector of the built environment should be further investigated. The possibility of an incremental approach to achieve such inclusion should be investigated. The study could also address the positive benefits of home ownership and access to funding from the formal banking sector.

Regulatory requirements for the informal built environment should be further investigated. These communities face the largest risks with regard to fire and health. Additionally, this sector could derive the most benefit from the implementation of passive design criteria since it can least afford the costs associated with heating.

Although it would represent a compromise in the opinion of the BCOs, the researcher would suggest investigating the possibility of two different codes, one applicable to the formal segment and a separate code for informal settlements. This could prove a viable option when addressing the existing complexities of the South African built environment.

5.2.3 Sub-problem 3.1 and resulting hypothesis

Table 66: Sub-problem 3.1, and the associated hypothesis and conclusion

	Sub-problem (Posed as question)	Negative hypothesis	Result
3.1	Are the most significant role-players in the plan approval process, i.e. the BCOs, aware of the goals and implementation methods of the NBR?	It is hypothesised that the most significant role-players in the plan approval process, i.e. the BCOs, are not aware of the goals and implementation methods of the NBR.	The negative hypothesis was proved: Null
Findings based on the desk review			
The original goals of Act 103 of 1977 are to ensure uniform implementation and to limit inflation.			
Findings based on the questionnaire			
<p>The Code for the Application of the NBR (SABS 0400-1990 or SANS 10400) is a document valued by the BCOs, and in their opinion the Code</p> <ul style="list-style-type: none"> • ensures uniform regulation of the built environment, • is an appropriate administrative instrument, • is an accessible document that is easily understandable, and • is structured logically in accordance with all the necessary stages of a construction project. <p>According to the BCOs, the plan submission form, checklist for plan approval and notice of approval reflect the requirements of the Code (SABS 0400-1990 or SANS 10400). This seems somewhat contradictory, especially when compared with the findings of Sub-problem 2. However, the responses seem to indicate that the Code (SABS 0400-1990 or SANS 10400) does not necessarily provide answers to all the questions/issues that a BCO has to address daily.</p>			
Conclusion			
Through the aforementioned research it is possible to conclude that the BCOs (as the most significant role-players in the plan approval process) are aware of the goals and methods of implementation of the NBR.			
Recommendations based on the findings			
In future, the BCOs should play a participatory role in identifying existing shortcomings of the NBR. The BCOs are ideally positioned to suggest possible solutions for the identified problems, and the existing administrative processes concerning the standards will continue to ensure objectivity.			
Recommendations for further studies			
The study exposed a limitation of the Code, i.e. the limited assistance available to the BCOs when it is necessary to interpret the requirements of the NBR. Further investigation regarding the daily requirements (i.e. the interpretation of the NBR) of the BCOs is crucial in order to develop an appropriate method of addressing this need.			

5.2.4 Sub-problem 3.2 and resulting hypothesis

Table 67: Sub-problem 3.2, and the associated hypothesis and conclusion

	Sub-problem (Posed as question)	Negative hypothesis	Result
3.2	Are the most significant role-players in the plan approval process, i.e. the BCOs, willing to support the uniform implementation of the NBR?	It is hypothesised that the most significant role-players in the plan approval process, i.e. the BCOs, are not willing to support the uniform implementation of the NBR.	The negative hypothesis was proved: Null
Findings based on the questionnaire			
<p>The research showed that the majority of respondents agreed that changes to the NBR are necessary, although this might have a significant impact on their daily operation.</p> <p>The participants are in overwhelming agreement that a national standardised submission and approval pro forma is required.</p>			
Conclusion			
Through the aforementioned research it is possible to conclude that the most significant role-players in the plan approval process, i.e. the BCOs, are willing to support the uniform implementation of the NBR.			
Recommendations based on the findings			
It is evident that there is a distinct need to formulate a national standardised submission and approval pro forma. This pro forma would most probably assist in the uniform implementation of the requirements set by the NBR. A secondary goal of the proposed pro forma is to support the BCOs in the execution of their mandate to implement the NBR.			
Recommendations for further studies			
Once the design proposal for a national standardised submission and approval pro forma has been completed, it should be tested for possible universal implementation in the South African built environment.			

5.2.5 Sub-problem 3.3 and resulting hypothesis

Table 68: Sub-problem 3.3, and the associated hypothesis and conclusion

	Sub-problem (Posed as question)	Negative hypothesis	Result
3.3	Are the most significant role-players in the plan approval process, i.e. the BCOs, aware of recent developmental changes to the NBR?	It is hypothesised that the most significant role-players in the plan approval process, i.e. the BCOs, are not aware of recent developmental changes to the NBR.	The negative hypothesis was proved: Null
Findings based on the desk review			
The idea of inflation should be extended to curb spiraling environmental costs associated with the built environment.			
Findings based on the questionnaire			
The responses indicate that the majority of the respondents are aware of the respective standards for SANS 10400 (Parts A-H, J-W) that have been published to replace the amended Code of Practice for the Application of the NBR (SABS 0400-1990).			
The BCOs' awareness of the following is limited to approximately 50%:			
<ul style="list-style-type: none"> • The voluntary standard SANS 204: 2008 (Parts 1, 2 + 3) that focuses on energy efficiency in buildings) • The standard 10400-XA: 2010 (Energy usage in buildings) • The standard SANS 10400-O: 2010 (Lighting and ventilation) 			
However, the responses indicated that very few of the BCOs actually made any comment on the above standards, and this should be an area of concern.			
Conclusion			
Through the aforementioned research it is possible to conclude that the most significant role-players in the plan approval process, i.e. the BCOs, are aware of recent developments in the NBR.			
Recommendations based on the findings			
The findings point to the necessity of establishing a formal channel of communication between the implementing officer, specifications writer, standards authority, government department and ministry.			
As an interim measure, a representative from the BCO fraternity could possibly be elected (although no formal structures are currently in place to facilitate this) to be co-opted to the relevant SABS technical committee.			
A measure to be considered is electronic communication with all BCOs when standards are proposed, altered, etc.			
Recommendations for further studies			
None			

5.2.6 Sub-problem 4 and resulting hypothesis

Table 69: Sub-problem 4, and the associated hypothesis and conclusion

	Sub-problem (Posed as a question)	Positive hypothesis	Result
4	Are BCOs willing to implement new regulations that focus on sustainability in the existing administration system of the NBR?	It is hypothesised that BCOs are willing to implement new regulations that focus on sustainability in the existing administration system of the NBR.	The positive hypothesis was proved: Positive
Findings based on the questionnaire			
<p>The research indicated that the BCOs hold the following opinions:</p> <ul style="list-style-type: none"> • Development in the built environment should be done in a sustainable manner. • The building regulations should address the future impact that buildings will have on the natural environment. • Buildings should be designed to reduce their total energy consumption to a minimum. • The concept of sustainability should be incorporated in the NBR. • The concept of resource efficiency should be incorporated in the NBR. • The building regulations should control and limit the energy consumption of the building sector. • The concept of ‘green buildings’ should be incorporated in the NBR. • The building regulations should address the future impact that buildings will have on the man-made environment. • The existing administration methods of the NBR could be adapted without difficulty to include additional minimum passive design criteria. • Minimum passive design criteria should be included as additional requirements in the NBR. <p>It is therefore evident that the BCOs are willing to implement new regulations on sustainability within the existing administrative system of the NBR.</p> <p>According to the opinions of the BCOs, the following aspects should be included as additional requirements in the NBR – specifically as part of the plan checklist:</p> <ul style="list-style-type: none"> • Cross ventilation should be provided for the majority of habitable rooms. • Where applicable, water storage tanks should be used to harvest stormwater from roofs for later use in cisterns, irrigation, etc. • All electric water heating should be supported by a renewable energy source to limit electricity consumption for heating. • All electric water-heating cylinders should be fitted with an automatic timer to limit electricity consumption for heating. • Except where the roofing material conforms to a minimum thermal resistance level (R-value), a ceiling should be installed for all habitable rooms to avoid unnecessary heat gain/loss. • Where applicable, all building entrances/exits should be shielded from prevailing winds. • The majority of habitable rooms should face in a northerly direction to avoid 			

unnecessary heating/cooling loads.

- If under-floor heating is installed, under-floor insulation material should also be provided to avoid unnecessary heat loss.

The following components could be included as additional requirements in the NBR, specifically as part of the plan checklist:

- If a habitable room does not face in a northerly or southerly direction, mitigating passive measures (i.e. shading devices, heat reflective glass, screens) should be taken to reduce possible heat gain.
- All exposed glass surfaces, except those facing south, should have a protective roof overhang and/or shading device (i.e. canopy, shutters) to reduce possible heat gain.

The respondents did not agree that the current minimum requirements for the number of ablution facilities for males and females in a development should be reduced.

Conclusion

Through the aforementioned research it is possible to conclude that BCOs are willing to implement new regulations focusing on sustainability in the existing administration system of the NBR.

Recommendations based on the findings

The aforementioned aspects should be incorporated in the NBR as a matter of urgency.

The utilisation of the plan approval process and associated skills of the BCOs could prove an ideal vehicle to render the South African built environment more sustainable.

Recommendations for further studies

In the researcher's opinion, a comparative study on the number of voluntary submissions to 'green' building councils versus the number of submissions that are made because it is a statutory requirement, would indicate a large difference in volumes. However, it would probably highlight the cost implications of putting 'green' strategies into practice. Consequently, a specific study is required that focuses on aspects that would render the largest part of the South African built environment more sustainable while limiting additional costs.

The impact of the requirements of the NBR on the *minimum number of ablution facilities for males and females* should be investigated according to international best practice. The minimum number of ablution service points required by the NBR has not changed since its inception (the author is of the opinion that this number might be unnecessarily high).

Although South Africa is a water scarce country, the current version of the NBR does not prescribe the use of water-efficient cisterns for ablution facilities. This might be an area where water consumption is unnecessarily high.



5.3 CONCLUSION

The study recognises the current administrative procedures of the National Building Regulations (NBR) as a vehicle to put sustainability ideals into practice in the South African built environment. It highlights the different methods currently used on Local Authority (LA) level to implement the requirements of a specific Act of Parliament, in this instance Act 103 of 1977.

During the plan approval process, the BCO plays a pivotal role in advising the LA on the approval of a submission. This administrative procedure could include specific passive design measures as part of the plan application process. The benefits would be as follows:

- Existing minimum requirements would be applied uniformly in South Africa (as required by the NBR).
- A more sustainable environment would be achieved through the inclusion of additional requirements.
- The additional requirements would focus on passive design in an attempt to become aligned with the original goal of the NBR.
- The original objective of the NBR, i.e. to limit inflationary tendencies, would be achieved to a certain extent.

The study identifies the plan submission checklist as an instrument that is part of the existing administrative process and that can be employed to achieve the above benefits. Additionally, the study lists existing NBR requirements that are not, but should be, included in the building plan checklist and also proposes additional requirements. It is argued that the inclusion and active implementation of the above items by the BCO in the existing administrative system of the NBR should contribute significantly to making the South African built environment more sustainable, without resulting in excessive additional costs for building projects.