

**EVALUATING THE FEASIBILITY OF IMPLEMENTING  
A RISK-BASED INSPECTION SCHEME BY  
BUILDING CONSENT AUTHORITIES  
IN NEW ZEALAND**

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## **Abstract**

The New Zealand residential construction industry is characterised by escalating building costs coupled with low productivity. The building consenting process is suggested as an aspect that requires improvement, and which could improve efficiency in residential construction industry. Current consenting processes are complicated and long drawn with pressure on Building Consent Authorities (BCAs) to deliver a more streamline approach to the process. This situation is exacerbated by current demands for housing as a result of migration, rebuilding programmes and surges in economic and population growth. Government has embarked on a policy shift that would make the construction industry more accountable for their work, with less reliance on BCAs. The current study investigates the building consenting process, and evaluates the feasibility of implementing a risk-based regulatory model in the form of a risk-based inspection scheme by BCAs in New Zealand.

To achieve this aim, the study employed a mixed method approach involving questionnaire surveys and semi-structured interviews with key construction stakeholders. Data gathered were analysed and synthesised and the research findings were validated using subject matter expert interviews. The investigation covered six regions Auckland, Canterbury, Central North Island, Southern, Midlands and Cook Strait regions, providing true representation of the population of construction stakeholders throughout New Zealand.

It was found that the New Zealand building inspection process contained bottlenecks, leading to a plethora of knock-on effects on industry practice. The booking of inspections, regulatory inspection numbers, excessive documentation, upskilling of Licenced Building Practitioners, resourcing Building Consent Authorities were contributing to the bottlenecks in the building consent process. Further, there was a poor understanding of

risk-based regulations that have been introduced into consenting system. This is attributed to poor education and skill levels, inadequate quality assurance processes, and loose implementation of the legislation on risk-based models. However, the feasibility study concludes with recommendations from this study, that risk-based inspection that once designed, piloted and supported well could be fully implemented as a Building Consent Authorities tool in New Zealand. The study recommends for government to lead the full implementation of risk-based inspections with the support of stakeholders. A national framework which sets a minimum qualification based on building regulations and building code compliance with on-going upskilling is required for the whole construction sector. Implementing risk-based models within building regulations will address bottleneck pressures and improve the current productivity in the New Zealand residential construction sector. This research contributes to existing knowledge in the area of risk-based building regulations. In particular, the study makes contribution to risk-based models as building regulatory tools in the house building sector in New Zealand.

## **Attestation of Authorship**

I hereby declare that this submission is my own work and that, to the best of my Knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Author's Signature

## **Dedication**

To the most important people in my life:

My Loving Wife

***Tiana Hine Samasoni***

For your love, support and always believing in me.

My Loving Father

&

My Loving Mother

***Toleafoa Taliaoa Pauuli  
Samasoni***

***Petelonila Samasoni***

Your prayers, sacrifices, and unconditional love have sustained me throughout my Life.

&

My sons

***Jaydan Samasoni***

***Jarel Samasoni***

***Lincoln Samasoni***

“Daddy is home now”



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***"For I know the plans I have for you"*** declares the lord, ***"plans to prosper you, plans not to harm you, plans to give you hope and a future"*** Jeremiah 29:11

# Table of Contents

Abstract .....	i
Attestation of Authorship .....	iii
Dedication .....	iv
Acknowledgements .....	v
List of Figures .....	xiv
List of Tables.....	xvi
List of Abbreviations.....	xviii
List of Publications .....	xx
<b>Chapter 1 Introduction</b> .....	1
1.1 Background to the Study .....	1
1.2 Justification for the Study.....	4
1.3 The research problems of this study.....	9
1.4 Research aim and objectives .....	10
1.5 Research Questions .....	10
1.5.1 Main Research Questions.....	11
1.5.2 Research Sub-questions .....	11
1.6 Methodology overview.....	11
1.7 Scope of the research.....	13
1.8 Thesis structure.....	13
<b>Chapter 2 Literature Review</b> .....	16
2.1 Building regulations in the construction industry .....	16
2.2 The construction industry in New Zealand .....	19
2.3 Building regulations in New Zealand.....	20
2.3.1 The Nordic Model .....	21
2.3.2 Performance based regulations .....	22
2.3.3 The New Zealand Building Code.....	23
2.3.4 The building consent process .....	24
2.4 The building inspection process .....	27
2.4.1 Regulatory building inspectors in the construction industry.....	31
2.4.2 Regulatory building inspector behaviour .....	32
2.4.3 The New Zealand regulatory building inspector.....	34
2.5 Review of reports relating to building regulation .....	36
2.5.1 The Hunn Report and leaky buildings .....	36
2.5.2 The Building Act 2004.....	37
2.5.3 The review of the 2004 Building Act.....	38
2.5.4 Problems with ensuring responsibility sits in the right place.....	39
2.5.5 The Building Amendment Act 2012 .....	41
2.5.6 Restricted building work and licensed building practitioners.....	41
2.6 Issues in New Zealand Building Control Authorities (BCAs) .....	42

2.6.1	The Auckland Plan 2012.....	42
2.6.2	Auckland Council building control challenges .....	44
2.6.3	Christchurch earthquakes .....	47
2.6.4	Christchurch building control challenges.....	49
2.7	The characteristics of building regulations .....	51
2.7.1	Lack of accountability.....	51
2.7.2	Regulatory building non-compliance.....	53
2.7.3	Inconsistency in regulatory building enforcement.....	55
2.8	Suggestions for improving regulatory building inspection .....	57
2.8.1	Competencies and training.....	60
2.8.2	Quality Assurance .....	62
2.8.3	Third-party review .....	64
2.8.4	Self-certification.....	65
2.9	Risk-based regulations .....	66
2.9.1	Risk-informed building regulations .....	69
2.9.2	Risk-based building inspections.....	72
2.10	Regulatory regimes.....	74
2.11	Implementing risk-based regulatory policies .....	78
2.12	Implementation of risk-based building regulations abroad.....	80
2.12.1	Risk-based building regulations in the USA.....	81
2.12.2	Risk-based building regulations in Hong Kong.....	83
2.12.3	Risk-based building regulations in Australia.....	89
2.12.4	Risk-based building regulations in the United Kingdom.....	93
2.12.5	Risk-based building regulations in New Zealand .....	98
2.13	Establishing the knowledge gap .....	102
2.14	Summary .....	109
<b>Chapter 3 Research Methodology .....</b>		<b>111</b>
3.1	What is research?.....	112
3.2	The Process of Conducting Research.....	112
3.3	Types of research.....	115
3.3.1	Exploratory research .....	116
3.3.2	Explanatory research.....	117
3.3.3	Descriptive research.....	117
3.4	Research methodology .....	118
3.5	Analysis of the research problem .....	119
3.6	Philosophical assumptions .....	122
3.6.1	Ontological background.....	123
3.6.2	Epistemological background.....	123
3.6.3	Ontological and epistemological position of the research .....	124
3.7	Research paradigm .....	125
3.7.1	The positivist paradigm.....	128
3.7.2	Interpretivism .....	129
3.7.3	Pragmatism.....	130

3.7.4	Mixed-method research.....	132
3.7.5	Qualitative research.....	135
3.7.6	Quantitative research.....	136
3.7.7	Qualitative verses quantitative research.....	137
3.7.8	Selection of research approach.....	139
3.8	Research design.....	141
3.8.1	Typologies of mixed-method research for the current study.....	142
3.9	Pilot study.....	143
3.10	Research issues.....	144
3.10.1	Ethical considerations.....	144
3.10.2	The principle of partnership.....	146
3.10.3	The principle of participation.....	146
3.10.4	The principle of protection.....	146
3.10.5	Privacy and confidentiality.....	147
3.10.6	Social and cultural sensitivity of the participants.....	147
3.10.7	Research scope.....	148
3.10.8	Research limitations.....	149
3.10.9	Reliability.....	150
3.10.10	Validity.....	151
3.11	Sampling frame.....	153
3.11.1	Unit of analysis.....	153
3.11.2	Sampling approach.....	153
3.11.3	Questionnaire survey – purposive sampling.....	155
3.11.4	Interviews – purposive sampling.....	157
3.12	Data collection strategy.....	157
3.12.1	Questionnaire survey.....	160
3.12.2	Computer-assisted and web-based surveys.....	161
3.12.3	Interviews.....	162
3.13	Data management.....	165
3.13.1	Data clean-up exercise.....	167
3.14	Data analysis strategy.....	168
3.14.1	Descriptive statistics.....	169
3.14.2	Inferential statistics.....	169
3.14.3	T-tests.....	169
3.14.4	Correlation.....	170
3.14.5	Thematic analysis.....	171
3.14.6	Quantitative data analysis.....	172
3.14.7	Qualitative data analysis.....	173
3.14.8	QSR NVivo 10.....	174
3.15	Chapter summary.....	175
<b>Chapter 4</b>	<b>Analysis and Presentation of Questionnaire Survey Results.....</b>	<b>176</b>
4.1	Questionnaire administration.....	177
4.1.1	Invitation to participate.....	177

4.1.2	Response rate .....	177
4.2	Summary of responses to the survey .....	178
4.3	Structure of the survey questionnaire .....	179
4.4	Demographic information of research participants (Section A).....	180
4.4.1	Geographic information of participants .....	180
4.4.2	Experience in the construction industry .....	181
4.4.3	Experience as a professional .....	182
4.5	Regulatory balance in New Zealand (Section B) .....	183
4.5.1	Building regulatory documents .....	183
4.5.2	Government's 2009 review of the Building Act 2004 .....	185
4.5.3	Government's 2009 review of the building consent types.....	186
4.5.4	Responsibility and accountability of stakeholders .....	188
4.6	Risk-based building inspections (Section C).....	190
4.6.1	Stakeholders' understanding of risk-based inspection.....	190
4.6.2	Building inspectors' and designers' risk association with current notifiable inspections.....	191
4.6.3	Building inspectors' and designers' thoughts on risk-based building ....	195
4.7	The building inspection process (Section D) .....	197
4.7.1	Designers' views on the building inspection process .....	200
4.7.2	Designers' views on carrying out regulatory building inspections.....	201
4.7.3	Participants' overall opinions of the professionalism and competence of building stakeholders in regard to Building Code compliance .....	202
4.8	Descriptive statistics: Notifiable inspections in terms of risk rating.....	204
4.8.1	Descriptive statistics: Notifiable inspections requiring regulatory inspection .....	205
4.8.2	Correlations and T-test of responses to Section 4.7 to 4.9.....	207
4.8.3	Participants' ranking of membrane tanking as high risk, and the requirement of regulatory inspections.....	208
4.8.4	Review of current building inspections and consideration of implementing a UK risk-assessment approach .....	209
4.8.5	Relaxation of regulatory inspections in New Zealand and consideration of a UK risk-assessment approach .....	210
4.8.6	Risk-based inspection scores of designers and building (T-test).....	210
4.8.7	Comparing notifiable inspections in terms of risk-rating scores between designers and building inspectors (T-test) .....	211
4.8.8	Comparing notifiable inspections requiring regulatory involvement scores between designers and building inspectors (T-test) .....	213
4.8.9	Overall summary of correlations and T-test.....	216
4.9	General comments extracted from the open-ended questions.....	216
4.9.1	Theme 1: Lack of skills and understanding in the construction industry	217
4.9.2	Theme 2: Risk-based models in the construction industry .....	219
4.9.3	Theme 3: Responsibility balance in the construction industry .....	221
4.9.4	Theme 4: Quality control in the construction industry .....	223
4.9.5	Theme 5: Licenced building practitioners.....	225

4.9.6	Theme 6: Education in the construction industry .....	226
4.9.7	Theme 7: Building inspectors .....	227
4.10	Summary .....	229
<b>Chapter 5</b>	<b>Analysis and Presentation of Interview Findings .....</b>	<b>232</b>
5.1	Analysis of interviews .....	233
5.2	Demographic information about the interviewees .....	233
5.3	Theme 1: Building consenting process .....	235
5.3.1	Notifiable increase in residential housing .....	237
5.3.2	Booking building inspections.....	239
5.4	Theme 2: Building inspection .....	241
5.5	Theme 3: Risk-based inspections .....	245
5.5.1	Reduced regulatory inspections .....	249
5.5.2	Self-regulation.....	250
5.5.3	The leaky-home saga.....	251
5.5.4	Quality control .....	252
5.6	Theme 4: Licensed Building Practitioners (LBP) .....	254
5.7	Theme 5: Product manufacturers, suppliers and homeowners.....	258
5.8	Theme 6: Building Inspection improvements .....	263
5.9	Summary of the research findings .....	265
5.10	Chapter summary .....	268
<b>Chapter 6</b>	<b>Validation of Key Research Findings.....</b>	<b>270</b>
6.1	Demographic information of subject matter experts (SMEs).....	270
6.2	Research validation and themes .....	271
6.3	Research verification of building regulation documents in New Zealand .....	272
6.4	Opinions of SMEs on these New Zealand building regulation issues .....	272
6.4.1	Low awareness or use of DBH Simple House Design.....	273
6.4.2	Low awareness or use of DBH multi-use consent .....	274
6.4.3	Low awareness of the Government review of the Building Act 2004 and associated documents .....	275
6.5	Research verification on the Building inspection risk association.....	275
6.5.1	Building inspection regulatory intervention .....	277
6.5.2	Stakeholders' professionalism and competence to Building Code compliance .....	278
6.6	Research verification on risk-based inspections.....	279
6.6.1	Current notifiable inspections .....	280
6.6.2	Participants in favour of a United Kingdom model of risk-assessment of building projects and the reduction of regulatory inspections .....	280
6.6.3	The New Zealand construction industry is not ready for a risk-based approach .....	281
6.7	Construction stakeholders' themes, issues and improvements .....	281
6.8:	SME suggestions on improvements .....	292
6.9:	SMEs suggestions on risk-based consenting process .....	294
6.10:	Summary of SME verification and key inputs into research findings .....	296

6.10.1	Summary of building regulatory documents:.....	296
6.10.2	Summary of building inspection risk association: .....	297
6.10.3	Summary of risk-based assessment concept: .....	297
6.10.4	Summary of construction stakeholders' findings for SME validation....	297
6.10.5	Summary of SME suggestions for improvements necessary within the building consent process: .....	299
6.10.6	Summary of SME suggestions regarding the risk-based consenting process:.....	299
6.11:	Overall Summary .....	300
<b>Chapter 7 Synthesis of Research Findings and General Discussion .....</b>		<b>301</b>
7.1	Synthesis.....	301
7.2	Building regulations .....	302
7.2.1	Existing legislation use and understanding of risk-based models.....	303
7.2.2	A lack of skills and knowledgebase in the construction industry .....	304
7.2.3	Quality control in the construction industry .....	306
7.2.4	Professionalism and competence of building stakeholders.....	307
7.3	The building consent process in New Zealand.....	309
7.3.1	The building consent process .....	310
7.3.2	Responsibility and accountability in the building consent process.....	310
7.3.3	Excessive documentation during the consenting process .....	311
7.3.4	Resourcing of Building Consent Authority staff .....	312
7.4	The building inspection process In New Zealand .....	313
7.4.1	The building inspection process.....	313
7.4.2	Booking stage.....	313
7.4.3	Regulatory inspection numbers.....	314
7.5	The regulatory building inspector .....	316
7.5.1	Building inspector inconsistency with training output .....	317
7.5.2	Allocation of building regulatory resources.....	318
7.6	Risk-based regulations in New Zealand.....	319
7.6.1	Risk-based inspections .....	320
7.6.2	Designers' views on performing regulatory building inspections .....	322
7.6.3	Notifiable inspections in terms of risk ratings .....	323
7.6.4	Notifiable inspections requiring regulatory inspection .....	324
7.6.5	Risk-based models implementation mechanism .....	325
7.7	Other relevant areas suggested for improvements.....	326
7.8	Summary .....	326
<b>Chapter 8 General Conclusion and Recommendations.....</b>		<b>328</b>
8.1	Fulfilment of the research questions .....	328
8.1.1	What is a risk-based building inspection?.....	330
8.1.2	What alternative approaches to risk-based building regulation exist overseas? .....	331
8.1.3	What risk-based building regulation concepts have been adopted in New Zealand, and are they affective?.....	332

8.1.4	What is the construction stakeholders’ understanding of risk-based inspection as a regulatory tool?.....	333
8.1.5	What are the key stakeholders’ experiences with risk-based building inspections? .....	335
8.1.6	How does the New Zealand building consent process currently operate in specific building inspections? .....	336
8.1.7	What would be a possible mechanism to implement risk-based inspection as a BCA tool? .....	338
8.2	Recommendations .....	341
8.2.1	Recommendations for future studies.....	343
8.3	Contribution to existing body of knowledge .....	345
8.3.1	Contribution to regulatory building consent authorities .....	345
8.3.2	Contribution to the housing building sector.....	346
8.3.3	Contribution to the construction industry .....	346
8.4	Conclusion.....	347
	References .....	350
	Glossary of Building Terms .....	371
	Appendix A: Ethics Approval.....	375
	Appendix A2: Participant Information Sheet.....	376
	Appendix A3: Consent Form .....	379
	Appendix B1: Survey Questionnaire .....	380
	Appendix B2: House Developers Questions.....	386
	Appendix B3: Validation Exercise.....	388
	Appendix C1: SME Interview.....	393
	Appendix C2: House Developer Interview .....	412
	Appendix D: Publications .....	419

## List of Figures

Figure 2.1: Hierarchy of compliance documents (DBH, 2010). .....	22
Figure 2.2: Flow chart of the building consent process (Hasting District Council, 2013). .....	26
Figure 2.3: Residential Inspection process (Auckland Council, 2010).....	30
Figure 2.4: Residential Dwelling Consents (Statistics New Zealand, 2013). .....	44
Figure 2.5: Lodged building consents 2015 / 2016 (Auckland Council, 2016).....	45
Figure 2.6: Building inspections 2015 / 2016 (Auckland Council, 2016). .....	46
Figure 2.7: Auckland Council consent values 2015 vs 2016 (Auckland Council, 2016)	46
Figure 2.8: Construction value by Region (BRANZ, 2016). .....	47
Figure 2.9: Hypothesized Styles of enforcement (May & Winter, 2000).....	57
Figure 2.10: Four quality standard for good inspection (Jacobs and Cordova, 2005) ...	62
Figure 2.11: Eight-tiered IRCC performance-based building regulatory system hierarchy (Meacham, 2008) .....	70
Figure 2.12: Assessment flowchart for building certifiers (DHPW, 2012). .....	93
Figure 2.13: Overview of the balanced, risk-related building control system (DBH 2010) .....	100
Figure 2.14: New Zealand building-consent process (DBH, 2010).....	106
Figure 3.1: Overview of the simplified research process. Source (pg.115, Babbie, 2014) .....	113
Figure 3.2: The research process for this study.....	114
Figure 3.3: A Framework for Research – The Interconnection of Worldviews, Design and Research Methods – Adapted from: (Creswell, 2014). .....	123
Figure 3.4: Triangulation Design – Adapted from: (Creswell & Plano Clark, 2007 pg. 63). .....	135
Figure 3.5: Typologies of mixed-method research for this current study.....	143
Figure 4.1: Structure of the survey questionnaire .....	180
Figure 4.2: Experience in the construction Industry and as a professional.....	182
Figure 4.3: Building inspectors’ and designers’ familiarity with 2009 Government review .....	186
Figure 4.4: Familiarity of building inspectors with the 2009 review of building regulations .....	187
Figure 4.5: Familiarity of designers with the 2009 review of building regulations.....	187
Figure 4.6: Consent lodgement and processing .....	<b>Error! Bookmark not defined.</b>
Figure 4.7: Construction during the building consent process.....	<b>Error! Bookmark not defined.</b>
Figure 4.8: Inspections during the building consent process .....	<b>Error! Bookmark not defined.</b>

Figure 4.9: Code Compliance Certificate.....	<b>Error! Bookmark not defined.</b>
Figure 4.10: Participants’ understanding of risk-based building inspection.....	191
Figure 4.11: Building inspectors risk association at current notifiable inspection .....	192
Figure 4.12: Building inspectors’ regulatory inspection involvement.....	193
Figure 4.13: Designers’ risk association at current notifiable inspection .....	194
Figure 4.14: Designers’ regulatory inspection involvement.....	195
Figure 4.15: Participants’ thoughts about risk-based building inspection .....	196
Figure 4.16: Building inspectors’ inspection outcomes in the previous 24 months .....	199
Figure 4.17: Building inspectors’ reasons for failure .....	200
Figure 4.18: Building Code non-compliance actions by designers .....	201
Figure 4.19: Designers’ views on carrying out regulatory building inspections .....	202
Figure 4.20: Correlation table .....	209
Figure 4.21: Correlation table .....	210
Figure 4.22: Correlation table .....	210
Figure 4.23: Independent sample test on understanding risk-based inspection.....	211
Figure 4.24: Independent sample on the top four risk associations of notifiable inspection: scores of designers and building inspectors .....	213
Figure 4.25: The independent sample test on the top four notifiable inspections requiring regulatory involvement. Scores of the designers and building inspectors. ...	215
Figure 8.1: Accountability during building consent process .....	337

## List of Tables

Table 2.1: Structure of the Nordic Model (Horvat, 2005, Hattis & Becker, 2001; Foliente et al., 1998; Oleszkiewicz, 1994):.....	21
Table 2.2: Notifiable Building Inspections (WCC, 2013 & Auckland Council, 2014)..	28
Table 2.3: Estimate of the total housing stock for Greater Christchurch (MBIE, 2013).	48
Table 2.4: Causes and solution to problems of non-compliance (Baiche, et al., 2006)..	55
Table 2.5: Maximum tolerable impact based on performance groups and design event magnitudes (Meacham, 2008).....	71
Table 2.6: Comparison of regulatory regimes (May, 2007).....	75
Table 2.7: Comparison of regulatory regimes (Beller et al., 2003). ....	76
Table 2.8: Phases and evolutions of building control, Source: Hong Kong Government Gazette (Imported from Zou & Xue, 2015). ....	85
Table 2.9: Risk Matrix for establishing a sufficient schedule for class 2 to 9 buildings (DHPW, 2012). ....	92
Table 2.10: Statutory notification stages (DCLG, 2012). ....	96
Table 2.11: Summary of knowledge and knowledge gaps .....	108
Table 3.1: The research objectives and questions.....	121
Table 3.2: Philosophical Assumptions with Implications for Practice .....	125
Table 3.3: A comparison of positivist and interpretivist paradigms .....	127
Table 3.4: Common elements of worldviews and implications for practice.....	131
Table 3.5: Strengths and weaknesses of mixed-method Research.....	133
Table 3.6: Comparing Qualitative and Quantitative Research.....	139
Table 3.7: Data coverage area.....	149
Table 3.8: Survey sample for this current study .....	157
Table 3.9: Data collection: Survey and interview advantages and disadvantages.....	159
Table 3.10: Advantages and disadvantages of online surveys compared to postal questionnaire surveys .....	162
Table 3.11: NVivo key concepts and terms .....	175
Table 4.1: Research objectives and questions for the questionnaire survey .....	176
Table 4.2: Survey distribution and response rate .....	178
Table 4.3: Geographic location of research participants.....	181
Table 4.4: Participants' knowledge of building regulation documents.....	185
Table 4.5: Responsibility and accountability during the building consent process .....	189
Table 4.6: Building inspectors' and designers' thoughts on risk-based building concepts .....	197
Table 4.7: Building inspector inspections carried out in the previous 24 months .....	198
Table 4.8: Designers' overall opinions on the professionalism and competence of stakeholders.....	203

Table 4.9: Building inspectors’ overall impressions of the professionalism and competence of stakeholders .....	204
Table 4.10: Descriptive statistics – notifiable inspections in terms of risk rating .....	205
Table 4.11: Descriptive statistics: Notifiable inspections requiring regulatory intervention. ....	206
Table 4.12: T-test on understanding risk-based inspection.....	211
Table 4.13: T-test on the top four risk associations of notifiable inspection scores between designers and building inspectors .....	213
Table 4.14: T-test on the top four notifiable inspections requiring regulatory involvement: scores of designers and building inspectors.....	215
Table 4.15: Transcripts about skill levels in the housing construction process .....	219
Table 4.16: Transcripts of designers talking about risk-based models in the construction sector .....	221
Table 4.17: Transcripts by designers, regarding responsibility balance in the construction industry .....	223
Table 4.18: Transcripts about quality control in the construction industry .....	225
Table 4.19: Transcripts of licenced building inspectors .....	226
Table 4.20: Transcripts about education in the construction industry .....	227
Table 4.21: Transcripts about regulatory building inspectors.....	229
Table 5.1: Demographic information about the interviewees .....	234
Table 5.2: Key themes from interviews .....	235
Table 5.3: Theme 1 and sub themes .....	237
Table 5.4: Theme 3 and sub-themes .....	249
Table 5.5: Summary and key points that emerged from the housing developer interviews .....	267
Table 6.1: Demographic information of SMEs.....	271
Table 6.2: Building inspection risk-association ranking.....	276
Table 6.3: Building inspection regulatory intervention ranking .....	278
Table 6.4: Stakeholders’ professionalism and competence to Building Code compliance .....	279
Table 6.5: Construction stakeholders’ findings for SME validation .....	282
Table 6.6: Summary of SME verification and key inputs.....	298
Table 7.1: Notifiable inspection ranked in terms of risk.....	324
Table 7.2: Building inspection regulatory intervention ranking .....	325

## List of Abbreviations

AI	Approved Inspector
AP	Authorised Person
ABCB	Australian Building Codes Board
AUT	Auckland University of Technology
AUTEC	Auckland University of Technology Ethical Committee
BA	Building Act
BCA	Building Consent Authorities
BCPP	Building and Construction Productivity Partnership
BCSPP	Building and Construction Sector Productivity Partnership
BIA	Building Industry Authority
BOINZ	Building Officials Institute of New Zealand
BR	Building Regulation
BRANZ	Building Research Association of New Zealand
CAQDAS	Computer-Aided Qualitative Data Analysis Software
CCC	Code Compliance Certificate
CDM	Construction and Design Management
CIC	Construction Industry Council
CII	Construction Industry Institute
COW	Certificate of Work
DBH	Department of Building and Housing
DCLG	Department for Communities and Local Government
DRC	Design Review Committee
EQC	Earthquake Commission
GDP	Gross Domestic Product
IANZ	International Accreditation New Zealand
ICC	International Code Council
IPENZ	Institution of Professional Engineers New Zealand
IRCC	Inter-jurisdictional Regulatory Collaboration Committee
IT	Information Technology
LBP	Licensed Building Practitioners
M	Mean
MBIE	Ministry of Business, Innovation and Employment
MBF	Master Builders Federation
NSW	New South Wales
NT	Northern Territory

NTF	Notice To Fix
NZBC	New Zealand Building Code
NZCE	New Zealand Certificate in Engineering
NZCIC	New Zealand Construction Industry Council
NZD	New Zealand Dollar
NZEFO	New Zealand Economic and Financial Overview
NZIA	New Zealand Institute of Architects
NZPA	New Zealand Press Association
NZRAB	New Zealand Registered Architect Board
NZS	New Zealand Standard
OECD	Organisation for Economic Co-operation and Development
PhD	Doctor of Philosophy
PIM	Project Information Memorandum
PIS	Participant Information sheet
PWC	Price Waterhouse Coopers
QA	Quality Assurance
QLD	Queensland
QUAL	Qualitative
QUANT	Quantitative
RBI	Risk-based Inspection
RBW	Restricted Building Work
RFI	Request For Information
ROW	Records of Work
SD	Standard Deviation
SME	Subject Matter Expert
SPSS	Statistical Package for Social Sciences
T.A	Territorial Authority
TVNZ	Television New Zealand
UK	United Kingdom
URL	Uniform Resource Locator
US	United States
USA	United States of America
Vic	Victoria
WCC	Wellington City Council
WHRS	Weathertight Homes Resolution Service Act
WHT	Weathertight Homes Tribunal

## List of Publications

### Conferences (Peer-reviewed)

1. **Samasoni, J., & Rotimi, J. O. B.** (2014). An exploratory evaluation of the new risk-based inspection scheme in New Zealand. The Second Australasia and South-East Asia Structural Engineering and Construction Conference (ASEA-SEC-2) on Sustainable Solutions in Structural Engineering and Construction. Bangkok, Thailand. 3-7 November.
2. **Samasoni, J., & Rotimi, J. O. B.** (2014). An exploratory evaluation of the new national on-line consenting system in New Zealand. The 14<sup>th</sup> International Conference on Construction Applications of Virtual Reality (CONVR2014). Sharjah, UAE. 16 - 18 November 2014.
3. **Samasoni, J., & Rotimi, J. O. B.** (2016). Building Control and Regulatory Balance: Perspectives of building professionals in New Zealand. The Third ASEC-SEC-3 Conference, (ASEA-SEC-3), Kuching, Sarawak, Malaysia. 31 October – 4<sup>th</sup> November.
4. **Samasoni, J., & Rotimi, J. O. B.** (2016). Perceptions of Regulatory Building Inspectors and Designers on the Proposed Risk-based Inspection regime in New Zealand (ARCOM2016) Manchester, UK. 5-7 September.

## **Chapter 1 Introduction**

### **1.1 Background to the Study**

The construction industry is seen by causal observers as an indication of how one economy is progressing (Ramachandra, 2013a, Lewis, 2009). When the construction sector is booming, so too is the economy. When the economy takes a dip the construction sector usually follows suit (Saravanperumal, 2006). Therefore it can be said that construction is important to a country financially, and in terms of resource creation and development. Lewis (2009) suggests that the construction industry is normally narrowly defined to involve only those trades that are directly involved with the construction of building structures, but the industry should be seen to be part of a wider construction sector that includes other aspects of the business from obtaining raw materials through to the removal and demolition of the facility at the end of its lifecycle. Construction and its related sectors (including manufacturers of building products and systems, building manufacturer suppliers, designers and property managers) form one of the major economic sectors in every country. In some countries, these contributions could reach 14 -15 per cent of national gross domestic product (GDP) (Page, 2014, Seaden & Manseau, 2001).

The New Zealand construction industry is no different. The sector is the fifth largest, employing over 157,000 full-time equivalents (FTEs), which equates to 8 per cent of the total economy (PWC, 2011). This includes part of the wider construction- related services that employ a further 42,000 FTEs. In 2010, 14 per cent of all new employment was involved in the construction industry. A characteristic of the construction industry in New Zealand is that about 91 per cent of all housing and subcontractor firms have five employees or less (Page, 2014a). The Ministry of Business, Innovation and Employment (MBIE) has reported that the construction sector accounts for about 4 per cent of New

Zealand's GDP (about the same as agriculture), but employs 8 per cent of the country's workforce (MBIE, 2012). Comparatively, Australia's building and construction sector accounts for 7 per cent of GDP (PWC, 2011). Similarly, the contribution of the construction sector is significant in the United Kingdom (8 per cent) and in the United States of America (9 per cent) by PWC (2011) study. These reviews indicate that there is room for improvement in the New Zealand construction sector if the industry is to remain significant. According to the Building and Construction Sector Productivity Taskforce (Berry, 2011), productivity within the construction sector is comparatively lower than other sectors of the New Zealand economy.

The New Zealand construction sector has the nature of being extremely volatile in employment and GDP, in contrast to other sectors. In times of economic peaks, the sector suffers from resourcing constraints; in downturns, employment numbers dwindle rapidly in comparison to other sectors. This phenomenon plays out in the housing sector, as an increase in housing volume creates employment opportunities during the peak. As work slows down, employees are suddenly cut loose (OECD, 2009). The residential building sub-sector is the major driver for the volatility in the construction sector in New Zealand. In contrast to Australia, changes in GDP in construction fluctuate inconsistently from year to year, yet at the same time Australia's construction sector growth in labour productivity has been positive (PWC, 2011).

The Auckland housing demand pressures (Fallis, 2013, Auckland Council, 2013) and shortage of building stock experienced in Christchurch (exacerbated by the 2010 and 2011 earthquakes) have major implications for Building Control Authorities. There is evidence that inspection services already contribute bottlenecks in the building consenting process (McGee, 2011). The Auckland plan (2013) calls for 100,000 new dwellings units to be constructed between 2013 and 2021. A study by Page (2013a)

equates the numbers to 13,000 new units per year compared with the current 4800 annually. The demand for housing in Auckland has also resulted in soaring housing prices throughout the region. This has also pushed up demand in other cities (Page, 2013a). The situation in Auckland and Christchurch is consequently impacting on the rest of the nation through a construction skill shortage and low productivity in the sector (Piri & Wilkinson, 2015). Government is under pressure to deal with this crisis as Auckland homes have hit an all-time high with average house prices of \$828,502 (NZD) in 2015 rising to \$955,753 in 2016 (15.4 per cent increase) (Quotable Value New Zealand [QV], 2016).

Another contributory factor for low productivity is that the sector has had a high tolerance for rework during the construction phase. A survey by the New Zealand Centre for Advanced Engineering in 2006 found that 69 per cent of newly completed buildings had a defect at the time of handover to the client. Maurice Williamson, the Minister of Building and Housing at the time, commented as follows:

That's not good enough, and we are tackling the problem head-on through the Licensed Building Practitioner scheme, the recently introduced Restricted Building Work designation, the Building Act reforms and other initiatives such as the Productivity Partnership (Williamson, 2010)

Reports indicate that the building sector has become less productive over the last two decades. It was one of the main contributors to a 1.2 per cent fall in productivity across the economy between 2006 and 2009 (PWC, 2011). Further down the time horizon, the same Minister commented that the Building and Construction sector was a cog in government's agenda for growth and development.

But be assured, there is no slowing down or direction change; this is about taking what has been a poorer cousin of other parts of economic development and bringing it into the mainstream (Williamson, 14 May, 2012).

## **1.2 Justification for the Study**

The New Zealand residential construction industry is characterised by low productivity, growing building costs, complicated and long consenting processes and poor building quality (BCPP, 2013). As far back as August 2009, the Government announced a review of the Building Act 2004 to identify areas where the Act could be improved to minimise the cost of compliance without compromising the quality of building and construction. The Government focused on four key areas; (1) quality homes and buildings produced through a business-enabling and efficient regulatory framework, (2) ensuring consumers are able to make informed decisions carrying out transactions in the housing sector, (3) ensuring buildings are produced cost-effectively by a productive sector with the right skills and knowledge and finally (4) a regulatory system that is administered in an efficient and cost-effective manner (DBH, 2009). These concerns led to the formation of the New Zealand construction industry key stakeholders, to form a partnership known as the Building and Construction Sector Productivity Partnership (BCSPP) (BCPP, 2013). This initiative targets the perceived low productivity of the sector (DBH, 2009). Several studies have found that productivity within the construction industry is relatively lower than those in other sectors of the New Zealand economy (MBIE, 2013, BCSCP, 2009, DBH, 2010). A study carried out by BCSPP (2009) in improving productivity recommended developing quicker regulatory and consenting processes to reduce the barriers and roadblocks that urban developments face. Other key areas that were identified by the productivity partnership included the culture within the construction industry (in terms of attitudes, beliefs and the value of employees) (BCSPP, 2009), the sizes of firms, education and training (BCSPP, 2009). Consequently the attitudes and beliefs of stakeholders would require a culture shift from all key stakeholders that could assist in addressing the issues of low productivity in the sector according to the productivity partnership. Currently there is a lack of sufficient data for monitoring building regulatory

policies in New Zealand for productivity (Rotimi, 2010). The implementation of risk-based models is very limited by those stakeholders involved (Meacham, 2010). This realisation is the starting point for this research study and, effectively, its desired conclusion. Therefore the current study endeavours to investigate data that will contribute to the construction stakeholder's knowledge of risk-based inspection as a regulatory tool. Prolonging building timeframes can result in a number of unexpected costs. Delays in construction cause delays in progress payments, which can lead to late payment penalties and interest incurred on debt (Ramachandra, 2013). Labour costs may increase because inspections, and longer building timeframes result in the poor use of subcontractors' time. Ramachandra (2013) suggests delays can also expose developers to the risk of contract disputes due to late delivery. Streamlining building inspection processes could address these inspection bottlenecks.

Experience from overseas building control bodies that have experimented with risk-based modeling and Contractor Quality Assurance programmes that focus on inspectorate efforts where needed, or otherwise, suggests that gains of construction time are possible without diminishing built quality (Development for Communities and local government [DCLG] UK, 2012).

However, there is significant concern that an increased volume of building linked with a decrease in inspectorate hours on site would result in mistakes and errors (Rotimi, 2013, DBH, 2005) in built quality in New Zealand. For example, an increase in volume inevitably draws in less-skilled labour, hence the need for experienced and competent inspectors. The need increases in boom times (OECD, 2009). Following the repercussions of the relaxed legislation in New Zealand that led to the leaky-building (Mumford, 2010, Hunn, Bond & Kernohan, 2002) crisis in the early 2000s, there is a lack of trust from society towards the construction industry and central/local government. It is a recurring

issue with constant reminders by lengthy judiciary suits and the premature decaying of buildings.

Building regulations also have the potential to affect rehabilitation decisions by building owners, developers and investors, by increasing the financial strain of rehabilitation, increasing uncertainty and risk (Burby et al., 2006). Burby et al (2006) add that this creates an adverse business climate that repels developers and potential investors. Regulators may be tempted to manage their business risks by explicitly biasing decision-making and setting a higher compliance requirement than that would be normally expected. Examples of these are evident in New Zealand through the ‘determination’ process under the Building Act 2004, where regulatory rulings have been overturned in favour of applicants because authorities have requested information from owners/agents that were above that of the New Zealand Building Code (NZBC) (Rothstein et al. 2006). Similarly, York (1991) explains government processing procedures, regulations and building codes which are often seen as inhibiting the construction of low and moderate-income homes. Current regulations are increasingly seen as barriers to market liberalisation and, as a result, there is an international trend towards reducing government responsibility for building quality. Many countries are attempting to simplify their building control regimes, often through a combination of deregulation and the shifting of responsibility and, in some cases, balance to the private sector (Yau, 2009). According to May (2005), two barriers which have a regulatory implication on affordable housing are cumbersome regulatory decision-making processes which contribute to delays in construction and the rehabilitation of housing. The second barrier discourages housing development or rehabilitation in the first place and lessens the availability of housing in those areas, due to developers moving to more favourable locations. Consequently overall housing supply is reduced. A similar study by Burby et al., (2006) provides an insight

into building codes that hinder residential rehabilitation. The introduction of smart building regulations can significantly increase residential rehabilitation and enabling field inspectors to ease additional barriers further enhances results.

Sinclair (1997) suggests that other major barriers to the development of an ideal system of regulation is the context-specific nature of environmental issues. There is a plethora of possible variations, including differences in industry structures, costs and benefits, technological solutions, the prevailing business culture and assimilative capacities which collectively make up the wide variety of environmental issues confronting policymakers (Sinclair, 1997). Other constraints stem from the indirect control of homebuilders on construction quality. Modern home building is a collaborative effort in which general contractors employ a series of subcontractors specialising in different phases of the construction process (Rotimi, 2013). Miscommunication, misunderstandings and mistakes by subcontractors often result in more deficiencies than would be the case if homebuilders personally completed all phases of construction. The final constraint is inconsistency in what building inspectors look for and require (May & Winter, 2009). A number of excessive legal regulations and rules relating to building work exists, leading observers to note that they act, potentially, as a deterrent to good architecture and, in some instances, as an administrative burden that discourages development (May and Wood, 2003).

Regulators are finding that they have more to do, and more issues to respond to, than time or resources allow (Black and Baldwin, 2010). Many government regulators are now developing risk-based regulatory strategies as a framework for the management of their resources and their reputations (Rothstein et al., 2006, Black, 2005). These are collections of strategies that, at the very least, involve the targeting of enforcement resources on the basis of assessments of the risks that a regulated person or organisation poses to the

regulator's objective. The key components of such assessments are evaluations of risks of noncompliance and calculations regarding the impact that the noncompliance will have on the regulatory body's ability to achieve its objectives (Black and Baldwin, 2010). Burby et al., (2000) suggested that when enforcement programmes are understaffed or poorly managed, construction projects can be delayed, and the lack of enforcement provides the perception that favours are being given to those with good political connections. One response to staff resourcing issues, when carrying out technical functions, is to rely on third parties for these functions.

The selected experiences reviewed above provide some understanding of the issues involved when placing greater reliance on third parties for approvals. The involvement of third parties raises issues concerning certification, accountability and legal liability (May, 2005a). If government is to contract for services that are available in a private market, it should have the resources to manage, oversee, and enforce accountability (Van Slyke, 2003).

The current study investigates a preliminary review of the information on risk-based modelling systems. The UK risk-based inspection review suggests that by implementing risk-based models, these initiatives can be explored, understood, well designed and piloted as an alternative building control tool in New Zealand. Risk-based approaches are widely employed internationally, with examples found in the enforcement of food safety, (Hobbs, 2002) fire safety, (Ramachandran, 1999), and occupational health and safety, (Bennett, 2002) where they can be used to shape regulatory interventions and prioritise preventative controls, hopefully generating better outcomes. Gouldson et al (2009) suggested the risk-based regulation could provide a sound basis for identifying greater risks from lesser ones, and for investing resources in risk management proportionate to the risks posed. However, Gouldson et al., (2009) cautioned that whilst risk-based

approaches promise better regulation, if they prioritise efficiency over efficacy, they also risk contributing to regulatory failure with potentially significant impacts on human health and the environment. Therefore risk-based approaches should be explored, especially where reductions in the efficacy or reliability of regulation are not risked in the pursuit of efficiency gains (Gouldson et al., 2009).

This study intends to collect data that could be compared with trends in related construction industries such as Australia, United States and the United Kingdom. The advance study and knowledge obtained by the United Kingdom residential sector should provide a solid foundation for risk-based regulations in New Zealand. The implementation of such a tool may well be the solution to the construction sector being more productive and a resourcing solution for regulatory authorities during demanding times.

### **1.3 The research problems of this study**

Past literature shows that risk-based modelling could be a tool that could improve productivity and assist with regulatory resourcing issues in the New Zealand residential construction sector. Despite its benefits, there is no record to show stakeholders' understanding of risk-based building models and their implementation as regulatory tools. There is also a lack of information of risk-based models from the construction industry regarding cost, quality and time tools. There is a significant need to identify building consent authority red tape (bottleneck issues) which are contributing to construction sector productivity to establish if an alternative model is necessary. Finally, there is limited knowledge from the construction sector about the move towards accountability with the implementation of risk-based models as regulatory tools.

This research would also be a catalyst for risk-based models being implemented nationwide as a regulatory tool that fast-tracks building consents in anticipation of the

Auckland plan and the Christchurch rebuild, causing a national shortage of housing. Also Government, through the release of the Building Amendment Act 2012 alludes to risk needing to be aligned to those stakeholder best able to manage it. This study should therefore provide a blueprint for the feasibility of risk-based models in New Zealand and building increases worldwide, Betts et al. (2009). The aims and objectives to be addressed by the research follow.

#### **1.4 Research aim and objectives**

The primary aim of this research is to evaluate risk-based inspections for its effectiveness as a Building Consent Authorities tool, and seek challenges and opportunities for the implementation of the new system in New Zealand. The following objectives were formulated to help achieve the overarching aim of the study.

1. To determine the real position in New Zealand regarding risk-based building regulations.
2. To determine the current position of building inspection process.
3. To capture the extent of building consent authority inspection bottlenecks which are contributing to a lack of productivity in the construction sector.
4. To determine changes and seek suggestions from BCAs, designers and housing developers if risk-based inspections are a regulatory tool.

The set of objectives are key, in order to establish the main research questions and a subset of other questions designed to provide findings for initial research problems.

#### **1.5 Research Questions**

This study explores risk-based models as building control regulatory tools in New Zealand by enquiring into key stakeholders' opinions on the current regulatory inspection system, the proposed implementation of these new schemes as alternative means of

compliance, and tools for increasing the productivity of construction in the residential housing market. A preliminary literature review was conducted to explore the nature of regulatory building inspections in New Zealand and overseas to gain insights into development; in particular, the use of risk-based models. The main purpose of such a study is to describe what is prevalent with respect to the issue or problem of the study (Kumar, 2014).

### **1.5.1 Main Research Questions**

1. What are risk-based inspections and what impact will they have on the New Zealand construction industry?
2. How will the implementation of risk-based inspections affect building consent authorities and construction stakeholders?

### **1.5.2 Research Sub-questions**

- What is a risk-based building inspection?
- What alternative approaches to risk-based building regulation exist overseas?
- What risk-based building regulation concepts have been adopted in New Zealand, and are they effective?
- What is the construction stakeholders' understanding of risk-based inspection as a regulatory tool?
- What are the key stakeholders' experiences with risk-based building inspections?
- How does the New Zealand building consent process currently operate in specific building inspections?
- What would be a possible mechanism for implementing risk-based inspections as a BCA tool?

## **1.6 Methodology overview**

The focal point of the current study and methodology has been progressively developed in line with the research questions. The research essentially involves four phases: problem identification, data collection and analysis, validation and synthesis of research findings, and conclusions and recommendations. The research design for this current study adopted

a quantitative and qualitative method approach as per the philosophical position explained in section 3.2. A common way to approach mixed method research is through triangulation. This study employs methodological triangulation where it uses questionnaire survey to collect quantitative and qualitative data, and face-to-face interviews to collect qualitative data. According to Amaratunga et al., (2002), the combination of the strengths and weaknesses of both the qualitative and quantitative research approaches can be used mutually to strengthen the outcomes developed. The participants were purposively sampled, based on their experience in residential building. The study envisaged that the data-collection method would provide widespread coverage of housing construction in New Zealand so that the population would be truly representative. Ethical consideration was sought from the AUTECH committee prior to the commencement of data collection. An application (ethics application number 14/301) for the current research was granted by Auckland University of Technology AUTECH Ethics committee on 25 November 2014 (Appendix A1).

The first phase of the study involved the collection of data from housing designers and building inspectors through the administration of a semi-structured questionnaire. The objective of the questionnaire was to understand the current building consent bottlenecks and determine the stakeholders' understanding of risk-based inspections in residential construction. The same objectives were used when conducting the second phase of the research. This involved face-to-face interviews with housing developers. The research findings obtained from questionnaire surveys and face-to-face interviews were then validated using SMEs. The SME interviews provided their own views while validating both qualitative and quantitative research findings from the first two phases of the study. The final phase of the research process involved extracting conclusions and recommendations based on the synthesis of the research findings.

## **1.7 Scope of the research**

The focus of this research is limited to residential housing construction in New Zealand and, specifically the building pressure cities of Auckland (housing supply and demand) and Christchurch (post-earthquake rebuild). The purpose of the research was to increase the productivity in the building consent process without diminishing its quality, with the implementation of risk-based inspection model as a regulatory tool. The literature review and anecdotal evidence suggest that the building inspection process creates a bottleneck, and that the increase in building work is putting a huge strain on Building Consent Authority resourcing. Risk-based inspection is expected to align risk to those who are in the best position to assess it.

## **1.8 Thesis structure**

**Chapter one (Introduction)** provides an overview of the thesis. It commences with background to the research and justification of the study. This section then presents the research questions, followed by the aim and objectives of the research study. A brief summary of the adopted methodology and scope of the research is provided. The chapter concludes with an outline of the thesis chapters.

**Chapter two (Literature review)** provides definitions of risk-based regulations by several authors in the context of construction. It presents literature on the current building pressures of Auckland and Christchurch and the effect these pressures have on key construction stakeholders. The chapter demonstrates the government intention to proportion risk to those stakeholders that are in the best position to assess risk and, in turn, relinquish the undue reliance on building control authorities. In addition, the chapter presents the nature of the New Zealand building inspection process and the introduction of risk-based inspection as a Building Consent Authority tool. The chapter concludes by stating the need to examine other regulatory tools and provides initiatives from around

the world which address the current issues and challenges in the current building inspection process.

**Chapter three (Research methodology)** describes the research methodology. It commences with an explanation of the research process and the variety of research methods available. The importance and understanding of research methodology in the study is explained. Further, it presents the research design and the underlying epistemological and ontological paradigms, and perspectives from which this research is conducted. The chapter then describes research strategies and methods used for data collection and analysis. This is followed by information on the reliability, validity, and ethical issues of the study. The chapter concludes with a statement about the scope and limitations of the research methodology.

**Chapter four (Questionnaire surveys: report of findings)** presents the findings of the questionnaire survey with key construction sector stakeholders. It begins with demographic information about the survey participants, their knowledge of building regulation documentation, understanding of risk-based inspections and perception of risk. The final section of this chapter provides the stakeholders' perspectives on risk-based regulation which is presented in six themes.

**Chapter five (Semi-structured interviews: report of findings)** presents the analysis and findings from interviews conducted with housing developers. The data collection was in the form of face-to-face interviews where responses were recorded and transcribed into transcripts for analysis. The survey results are therefore presented in six themes and subthemes, based on the participants' responses.

**Chapter six (Validation of key research findings)** presents the views of the SMEs on the research findings from the questionnaire surveys and face-to-face interviews. SME

validation and extended knowledge are presented in five different themes identified as per the research questions.

**Chapter seven (Research findings and general discussion)** presents a synthesis and discussion of the research findings to answer the research questions and objectives that are presented in the final chapter of the thesis. The chapter presents key themes that emerged from the collation outputs from the questionnaire survey and interviews with housing developers and subject matter experts. This chapter also refers to the appropriate literature to support the current research findings where necessary.

**Chapter eight (Conclusion and recommendations)** integrates the key research findings in relation to the research questions. The chapter also presents the contributions to knowledge made by this study to the housing construction sector and key stakeholders. Finally, the chapter suggests opportunities for further research areas arising out of the study.

## **Chapter 2 Literature Review**

This chapter presents a review of building regulations in the construction industry, with a primary focus on risk-based building inspections as a regulatory tool. The literature review is in three key sections: an overview of building regulations, the building consenting process in New Zealand, and risk-based regulations. The chapter begins with an overview of building regulation processes in the construction industry. The section further provides a holistic picture of the New Zealand building consenting process and focuses on issues within the residential construction sector, in particular Building Consent Authorities (BCAs).

Finally, the chapter provides a definition of risk-based regulations, which is appropriate to the current research, and is consequently reinforced throughout the study. Also presented is an overview of risk-based regulations in the construction industry, focusing on implementation of such tools in different jurisdictions around the world. This is necessary for addressing gaps in the New Zealand housing sector by fully implementing risk-based regulations in the building consent process in order to boost productivity in the construction market.

### **2.1 Building regulations in the construction industry**

Building regulations are minimum standards for the design and construction of and alteration to most buildings (UK, 2013). They are developed by Government and approved by parliament. The building regulations also contain a list of requirements that are designed to ensure minimum standards for health, safety, accessibility and sustainability. These regulations set national standards for building work from barn sheds to complex commercial buildings. They cover all aspects of construction, including foundations, structure of buildings, insulation, fire protection and means of escape from fire. They also ensure that adequate provisions have been provided for people with

disabilities in certain types of buildings. However, building regulations are often regarded as a burden by designers and builders (Gant, 2002) who see their requirements as suffocating innovation and creativity in design (Yau, 2009). Historically, building regulations were not required because most structures were small and failures were unlikely to be catastrophic. Homeowners' either constructed the building themselves or entrusted the construction to someone that was known to them. The population was relatively static so a tradesperson could not afford to get a negative reputation. Buildings were also very simple in design and construction, and faults were obvious to most lay people. Larger buildings, on the other hand, were designed and built by masons who relied on their reputation; however, trial and error was often the only way to move forward. Buildings were designed and constructed without plumbing and electrical services, which minimised the risk of anything going wrong. Building owners commissioned or built buildings themselves so they had a personal and financial incentive for buildings to be safe and amendable. Building codes focused on protecting other properties against fire, and other aspects of safety and quality were left up to the building owner.

Why is there so much emphasis on having building regulations? At the lower end of the spectrum, building controls set out to provide a minimum standard of building requirements to ensure the safety of occupants. Some requirements ensure occupants remain safe and healthy where performance-based criteria and plumbing provisions are provided. Apart from the health and safety aspect, minimum standards for building also ensure that buildings purchased, particularly the family home, are fit for purpose and have a certain minimum level of quality. In the opinion of Vissher and Meijer (2007), building regulations are more suited to social than economic regulations as they predominantly serve to ensure environmental health and safety, as well as consumer protection.

One purpose that is overlooked by many in the building industry is that buildings are designed, constructed and able to be used in ways that promote sustainable development. This mindset is slowly changing as the green designer/builder emerges alongside global climate changes, and resources becoming scarce. Building controls are often seen as a source of frustration and red tape for many involved in the construction industry. For example, Goodchild and Furbey (1986) consider that controls do not benefit the built environment at all but simply prevent buildings with certain characteristics from being constructed. Owners seeking to develop new housing or rehabilitate existing housing are in disarray because of the regulatory gauntlet in obtaining necessary consents and approvals. Internationally, pressure is being exerted on governments and regulators to develop modern forms of regulation that deliver more for less, and in sophisticated ways.

The development of building controls is one example of the modernist conception of risk, whereby it states that directives set out minimum standards of building performance, based on a series of general criteria and formulae (Imrie & Street, 2009). The first known written building controls were written as part of the law of Babylon in the reign of Hammurabi between 1795 and 1750 BC. Dykes, D. Oswald (1904) describes this as the body of law which is also known as the “Code of Hammurabi” which contains the following clauses,

228 If a builder builds a house for someone and completes it, he shall give him a fee of two shekels in money for each scar of surface.

229 If a builder builds a house for someone, and does not construct it properly, and the house which he built falls in and kills its owner, then that builder shall be put to death.

230 If it kills the son of the owner, the son of that builder shall be put to death.

231 If it kills a slave of the owner, then he shall pay slave for slave to the owner.

232 If it ruins goods, he shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect the house from his own means.

It is no surprise that with these codes, builders had great incentives to build right the first time. It also brings to mind, at the present time, appropriate punishments for designers and builders of houses that leak. Building control regulations throughout the world have continued to evolve.

## **2.2 The construction industry in New Zealand**

New Zealand has a highly urbanised population with around 73 per cent of the residential population living in urban entities containing 30,000 or more people. As at June 2015, over half the population of New Zealand (52 per cent) lived in the four main urban areas of Auckland (1,454,300), Wellington (398,300), Christchurch (381,800) and Hamilton (224,000) (NZEFO, 2016). The construction industry accounted for 4.6 per cent of New Zealand GDP in the March 2013 year (Page & Norman, 2014). Yet the industry produces around 40 per cent of all capital formed in New Zealand, and is more closely aligned with the overall performance of the New Zealand economy than any other industry.

Over the 11 years since 2002, the percentage of small houses (under 150 square metres) has dropped from over 30 per cent of houses to around 20 per cent, while the proportion of large houses (larger than 250 square metres) has risen from around 20 per cent to 27 per cent. Medium-sized houses account for a little over 50 per cent of new houses, up from 48 per cent in 2002 (Page & Norman, 2014). The number of homes being built in 2016 is lower than those in the mid-1970s, but the current stock is much bigger in terms of total floor area (MacPherson, 2016). For comparison, in the year ended August 1974, 38,000 new homes were consented, with the average floor area of 110 square metres. This figure equated to a total floor area of 4.2 million square metres consented. In the year ended August 2016, 30,000 new homes were consented with an average floor area of 182 square metres; the total floor area consented was 5.4 million square metres (Goodyear & Fabian, 2014).

### **2.3 Building regulations in New Zealand**

The New Zealand Government passes laws both through statute and regulation to protect people. The Building Act stipulates that buildings are designed and constructed for safety, health and development, and people are safeguarded from possible injury (Massey, W., 1999). The New Zealand Building Code is contained in regulations under the Building Act 2004. This Act governs the building sector and sets out legislation for the construction, alteration, demolition and maintenance of new and existing buildings in New Zealand. It works in tandem with other legislation for health, safety, consumer protection and land use. Central and local government, through their building consent authorities, are the guardians of New Zealand's building regulations. Plans and specifications are assessed by building consent authorities (BCAs), usually the council, to ensure the proposed building work will comply with the building code. Once the BCA is satisfied on reasonable grounds, it will issue a building consent for construction to commence. The work is then required to be built to the consented plans and a code compliance certificate is obtained on completion. This certificate confirms the requirements of the building code have been met.

The design and construction of the built environment have always been focal points of discussion in relation to the risks that inadequately designed buildings can pose to human health, habitation and well-being (Imrie & Street, 2008). The construction process can usually be divided into three important phases: project conception, project design and project construction. Project conception is the recognition of a need, which can be satisfied by a physical structure. The project design stage translates the primary concept into an expression of a spatial form. The construction phase creates the physical form (Chan & Kumaraswamy, 1997). Completing projects on time is an indicator of an efficient construction industry. Chan and Kumaraswamy (1997) also state that a project

is considered ‘successful’ if it is completed on time, within budget and to the specified quality standards.

### 2.3.1 The Nordic Model

In 1963, The Nordic Committee on Building Regulations began a programme to harmonise the building regulations of Denmark, Finland, Iceland, Norway, and Sweden in logical, transparent and compatible structures (Oleszkiewicz, 1994). This hierarchical structure is commonly known as the ‘Nordic Model’ or the ‘Nordic five- level system’ as shown in Table 2.1.

Table 2.1: Structure of the Nordic Model (Horvat, 2005, Hattis & Becker, 2001; Foliente et al., 1998; Oleszkiewicz, 1994):

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<b>Level 1</b>	Goal (a broad statement addressing the essential interests of society and individuals).
<b>Level 2</b>	Functional requirements (this addresses one specific aspect of buildings and building sub-systems that are to meet Level 1 objectives).
<b>Level 3</b>	Operative or performance requirements (specific and detailed requirements necessary to achieve Level 2 requirements, expressed in terms of performance criteria or expanded functional description).
<b>Level 4</b>	Verification (instructions or guidelines for the verification of compliance / performance that enable the interpretation of the objectives and requirements in practice).
<b>Level 5</b>	Examples of acceptable solutions.

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Figure 2.1 provides the adopted Nordic model, which represents the hierarchy of the New Zealand regulatory compliance path. Building consent documentation must show how the functional and performance requirements of the building code are going to be satisfied. The building code does not stipulate how this can be achieved but the applicant must demonstrate compliance to the Building Consent Authority. Plans and specifications will usually need to be supplied with supporting information, such as whether particular compliance documents (acceptable solutions and verification methods) are to be used. Acceptable solutions and verification methods are relatively straightforward because additional documentation is usually required to demonstrate clearly how the solution or

method is to be specifically used in the proposed work. For example, the majority of acceptable solutions provide a number of options for achieving the same objective hence; building consent applicants need to specifically identify which part of the solutions are to be applied.

Alternative solutions provide another means of establishing compliance. The applicant must demonstrate how the solution will be applied and how the functional and performance requirements of the Building Code will be met. This could include an engineer’s report, manufacturer’s literature and any other relevant information reasonably required by the BCA.

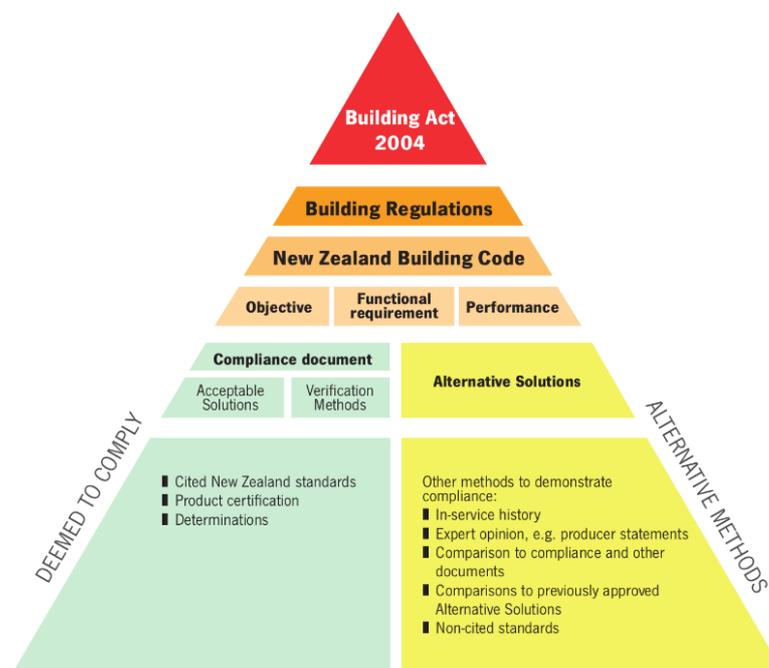


Figure 2.1: Hierarchy of compliance documents (DBH, 2010).

### 2.3.2 Performance based regulations

Performance reflects a focus on the intended function or outcome of a regulatory requirement rather than on how that function or outcome is to be achieved, which is described as ‘prescriptive’ or ‘descriptive’. Performance-based building regulations are also variously referred to as function-based or objective-based building standards, codes

or regulations that evolved in the early 1980s (Meacham, 2010). Commenting further on the risk-based performance approach, Meacham (2010) suggests the need to reduce the regulatory burden, reduce cost (to government, the market and consumers) and to facilitate innovation in building materials and systems, were the main drivers for the new regulatory approach.

Meacham (2005) suggested that the use of risk as a foundation for identifying tolerable building performance, gave rise to concepts which had already been incorporated into performance-based building codes (ICC, 2001 & ICC, 2003). The development of second-generation performance-based building regulations, using the concepts of identifying ‘tolerable levels of risk’ as a foundation for identifying ‘tolerable levels of building performance’ has become one of the common objectives (Meacham, 2010).

### **2.3.3 The New Zealand Building Code**

The performance-based New Zealand Building Code was introduced as part of a new building control system established by an Act of Parliament in New Zealand in 1991. The Building Code itself is part of the building regulations (MBIE, 2014) and represents the minimalist approach to performance-based regulation. The Building Code sets clear expectations of the standards buildings should meet. It covers aspects such as structural stability, fire safety, access, moisture control, durability, service and facilities, and energy efficiency (MBIE, 2014). The Building Code states how a building must perform in its intended use rather than describing how the building must be designed and constructed. It can be determined that the New Zealand Building Code is based on performance. Performance-based codes are in use or under development in many countries worldwide. The rationale for the implementation and transition to performance-based building regulations has varied by country, and has included the downsizing of government, deregulation, trade facilitation, increased design flexibility and the reduction of

unnecessary construction costs for achieving an appropriate level of building performance (Meacham, 2010c). Performance-based regulations in New Zealand focus on the outcomes that are envisaged for a building and less on specific materials, assemblies, construction and installations. These regulations include specific policy statements (goals and objectives) which reflect societal expectations of building performance, functional statements and performance criteria used to demonstrate that the goals and objectives are being met (Moore & Canler, 2011).

In New Zealand, all building work must comply with the Building Code, even if it does not require a building consent. This ensures that buildings are safe, healthy, durable, sustainable and fit for purpose. Before a Building Consent Authority can issue a building consent, it needs to be “satisfied on reasonable grounds” that the proposed building work will comply with the Building Code. This building work is to be described in documents (plans and specifications) that are defined in Section 7 of the Building Act (2004) as including:

- drawings, specifications and other documents which fully describe the proposed building work
- the proposed procedures for inspection during the building work
- the intended use(s) of the building
- the specified systems (if any) which should be included in a compliance schedule, and
- the proposed procedures for inspection and routine maintenance of those systems

#### **2.3.4 The building consent process**

The role of the Building Consent Authority (BCA) is to review and inspect processes to ensure that the proposed building work and completed building are satisfactory. There must be reasonable grounds regarding the performance requirements of the Building Code; these protect current and future owners (Bates & Kane, 2009; Pringle, 2009). The

BCA's powers are governed under the New Zealand Building Act 2004. The Department of Building and Housing (2014) suggests that there are five key steps in the successful processing of a building consent application:

- owner/designer prepares sketch plans
- owner obtains Project Information Memorandum (PIM) from the Territorial Authority
- owner/designer prepares detailed plans and specifications
- Building Consent Authority (BCA) checks plans and specifications for compliance with the Building Code
- Building Consent Authority issues the building consent

Figure 2.2 shows the current building consent process in New Zealand and provides a brief summary of each phase. The present model under the Building Act 2004 sets out a 20-day consent-processing time frame for building projects in which the clock can be stopped during this time. Requests for further information (RFI) prolong the issuing of the consent. It is not the role of the BCA to act as the designer and doing so could expose the BCA to liabilities. If the plans or specifications are deficient, they should be returned so the missing/incorrect information can be remedied (DBH, 2014).

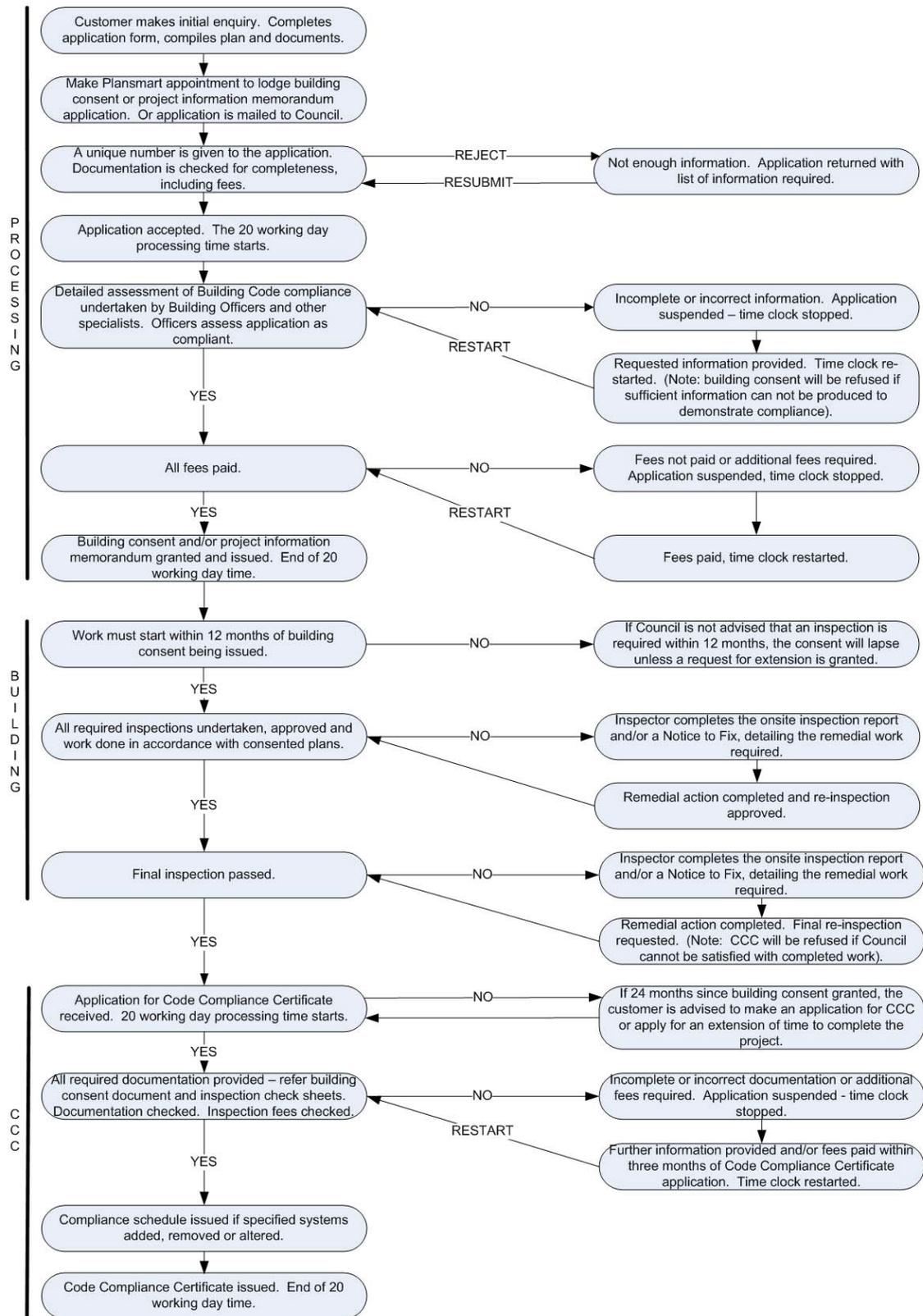


Figure 2.2: Flow chart of the building consent process (Hasting District Council, 2013).

## **2.4 The building inspection process**

Once the building consent is granted, the owner or agent (usually the lead builder) is required to notify the Building Consent Authority on predetermined inspections. On a new simple residential building, there could be up to 20 inspections. As there is no requirement in the Building Act or the building regulations for any particular inspection to be conducted, there can be no specific requirement for inspection procedures or the number of inspections to be made. Each authority has been left to develop its own procedures. Table 2.2 shows the different inspections that are required to be notified to the BCA for regulatory inspection. Once the notifiable inspection is booked, a building inspector is allocated to the project to carry out inspection. In 2014, a Ministry of Business, Innovation and Employment (MBIE) national survey showed that, nationwide, 97 per cent of inspections were booked by telephone.

A builders app is being developed to allow builders on-site to transmit requests for inspection that will be trialled as a building consent tool. In Auckland, each new residential building inspection consent application leads to an average of 12 inspections (Provost, 2015). The MBIE national survey stated that the average number of local authority inspections was eight for a simple residential building and 11.5 for a complex residential consent. The building inspection process requires a building inspector to carry out inspection with the relevant tools and would record the results either manually or, most commonly, on an electronic checklist. Any non-compliance would be dealt with by the inspector through a failed inspection notice in which a re-inspection was required and a compromised time given to rectify errors. Regulators are more likely to use business-friendly practices to resolve issues which include verbal notices of violations and negotiated schedules for their corrections (Burby, May, Maliza & Levine, 2000). In extreme cases, a stop notice can be issued, accompanied by a Notice To Fix (NTF) in

which prosecutions and fines could be in the vicinity of NZD \$200,000 under the Building Act 2004.

Historically, homebuilders are concerned, in particular, about the cost of delays that are imposed by stop-work orders or other inspection actions (May & Wood, 2003). Severe sanctions are automatic issuing of stop-work orders or injunctions when corrections are not completed by specified deadlines; severe fines are imposed when infractions are encountered and not corrected in a timely manner (Burby, May, Maliza & Levine, 2000). Building work on site is unable to continue to the next phase until the building inspector has passed the inspection. Most booked inspections, are carried out the next day although, in Auckland, final inspections need three days' advance booking (Provost, 2015). This whole process is becoming cumbersome for builders to down tools until inspection signoff. Building inspectors are also under pressure due to under-resourcing caused by the high demand for buildings in the main regions.

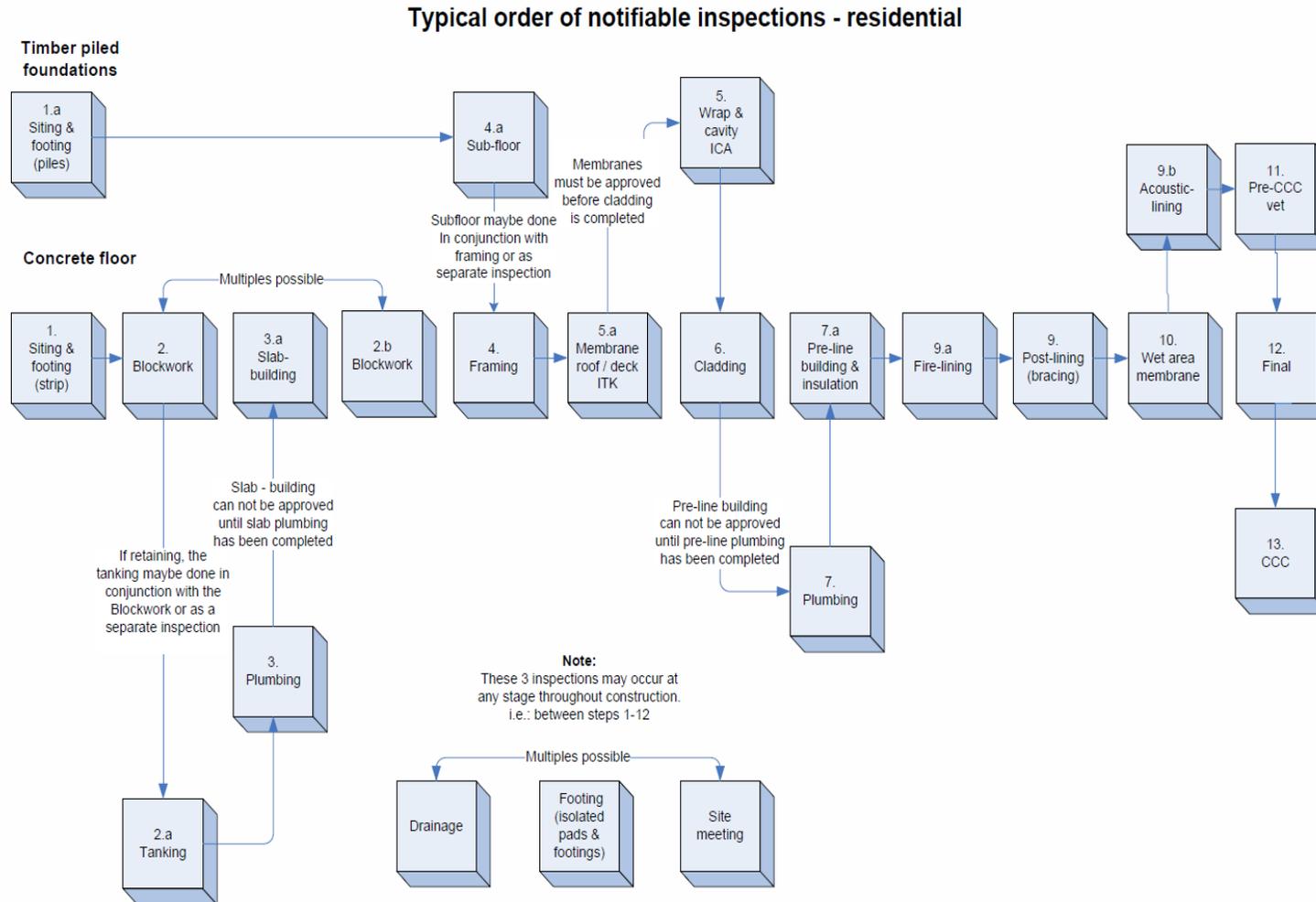
Table 2.2: Notifiable Building Inspections (WCC, 2013 & Auckland Council, 2014)

Siting	Drainage	Foundations	Blockwork	Framing	Membrane tanking
Cladding	Building Wrap	Fire lining	Wet Area Membrane	Site Meeting	Preline building
Isolated Footing	Subfloor	Cavity	Pool Fencing	Reclad	Postline building
Tilt slab reinforcing	Column and beam reinforcing	Precast fixing	Pre-Code Compliance Certificate	Code Compliance Certificate	Final Inspection

In the United Kingdom, the terminology used for site visit stages have varied slightly between local authority inspectors and approved inspectors (AI). There is no clear-cut list of stages when an inspector is required to go to a building site and inspect. A study conducted by Baiche et al (2006) showed that some building inspectors believed they

were carrying out more inspections than necessary, and doubted whether more inspections would achieve very much. On the other hand, others stated that more inspections are necessary, especially where site supervisors were seen to be shoddy, under-skilled, ignorant of requirements, or where site management was poor, but hinted that this was not usually easy to do, as there were not enough resources to carry out more frequent visits (Baiche, Walliman & Ogden, 2006).

Figure 2.3 shows a flowchart of typical order of notifiable inspection during a residential construction, and notes that any part of the inspection may occur more than once. An example could be blockwork construction that is required to be checked at certain heights to show compliance with the building code.



Any of the above inspections may occur more than once, for example there maybe 2 or more blockwork or slab inspections. When there is a slab plumbing, this should occur before slab building, similarly when there is a pre-line plumbing this should occur before the pre-line building it is also possible for some inspections to occur at the same time.

Figure 2.3: Residential Inspection process (Auckland Council, 2010).

### **2.4.1 Regulatory building inspectors in the construction industry**

Frontline workers are arguably the most important players in environmental protection. They generally work for state environmental protection agencies to monitor regulated facilities, ensuring those facilities are in compliance with regulations, and interacting with the people at those facilities (Pautz & Wamsley, 2012). They are responsible for ensuring that each facility complies with environmental regulations and for dealing with the regulators as needed. Hyun Jung (2009) provides an analogy of regulatory officials being perceived as public-spirited carpenters who enforce laws, providing a blueprint that shapes their persona and defines the tools they can use. Working within these parameters, the regulatory carpenters adapt the plans to the raw material with which they work, the hazard to be abated, the attitudes, capabilities, and economic resilience of regulated entities. They sort problems of detecting and preventing non-compliance and the unexpected disjunctions between the plans, and what seems feasible in a particular situation. Government inspectors are on the front line between the state and the market. Their performance has come under intense scrutiny as the high costs of poor inspection practices for economic performance, and the quality of governance in protecting vital public interest have become clearer (Jacobs & Cordova, 2005). May and Wood (2003) reported that many homebuilders had expressed negative comments about the inspection process. In response to an open-ended survey, negative comments outnumbered positive comments by two to one. The critical comments included: *“I don’t believe that most inspectors have much experience in the actual building of a home. They don’t seem to have very much common sense”* and *“The city views builders as the enemy”* and *“The seismic and energy code requirements far exceed what the Seattle area requires”*. Other stakeholders commented that building consent bodies and authorised inspectors needed better regulations. They believed there should be penalties for irresponsible actions.

Preventing perceived improper use of initial notices by some authorised inspectors is important (DCLG, 2012).

#### **2.4.2 Regulatory building inspector behaviour**

The balance of behaviours between regulator and regulatee is very difficult to comprehend; each party can be motivated by different objectives and goals. Heijden (2009) illustrates the difficulty of being a regulatory inspector in that one has to be flexible and lenient, interpreting regulations so compliance can be reached. The inspector should have a positive relationship with the regulatee, grant violators time to comply, and go as far to overlook non-compliance that poses no serious risk. On the other hand, the inspector has to enforce all regulatory requirements, deal to violations and treat all regulatees in the same manner. Similarly, Nielsen (2006) suggests that inspectors punish anti-social behaviour and cooperate; in other words, regulators are responsive leading to a cost-effective ‘positive spiral’ of actions and reactions between the regulator and regulatee. Promoting the positive aspects of consent process facilitation requires recognition of the fact that departments tend to avoid flexibility unless forced to by political powers. Reducing formality requires attention to the gap between demand and capacity that is reflected by heavy workloads (May & Burby, 1998). Flexibility refers to the scope firms are given to tailor regulatory responses to their individual circumstances (Sinclair, 1997). Affirmative motivations emanate from good intentions, and a sense of obligation to comply, whereas negative motivations arise from fears of the consequences of being found in violation of regulatory requirements (May, 2004). May (2003) further suggests that any regulatory regime must confront a fundamental issue of how stringent controls should be in promoting consistency versus how much discretion should be granted in promoting flexibility and innovation. May and Wood (2003) elaborated that inspectors do not ordinarily interpret code deficiencies as intentional acts of non-compliance, but rather as problems in need of a mutually acceptable solution. In this respect, inspectors

see themselves more often as educators than enforcers. They frequently choose the prospect of inducing future compliance through co-operation and knowledge enhancement over punitive modes of public action. However, the homebuilder's motivations for compliance with building regulations are shown to blueprint into distinct dimensions that reflect negative and positive motivations. Negative motivations are shown to be mostly influenced by attitudes and beliefs of regulatees and by their knowledge of the rules (May 2004a).

Prior studies of regulatory compliance reinforce the importance of inspections for compelling compliance (Burby & Paterson 1993; Gary & Scholz 1993; Helland 1998), but are contradictory to the level of sanctions once violation has been detected (May & Winter 1999, Kuperan & Sutinen 1998). As found by Winter and May (2001) when studying Danish farmers' compliance with agro-environmental regulations, and by May and Wood (2003) when studying home builders compliance with building regulations in the United States, regulatees seek predictability and consistency in regulatory requirements. The expectation is that more consistency in inspection practices across different inspectors and inspection experiences, contribute to both positive and negative motivations, while inconsistent practices undermine them (May, 2004a). May and Winter (2000) identified three patterns for Danish inspectors' that are (1) a rule-bound enforcement style compromising high degrees of formality and low to moderate degrees of coercion (2) an insistent enforcement style compromising moderate degrees of formality and moderate to high degrees of coercion, and (3) a token enforcement style compromising low degrees of formality and low to moderate degrees of coercion. On the other hand, inspectors with "conciliatory" or "accommodative" styles, are more interested in "compliance" than deterrence, as they are oriented towards finding results through co-operation rather than coercion, and as consultants rather than police agents (Kagan, 1989).

### **2.4.3 The New Zealand regulatory building inspector**

Building inspection in New Zealand is usually carried out by council inspectors or building consultants that are contracted to BCAs. The New Zealand Building Act 1991 created a new entity called a 'Building Certifier'. A building certifier was an individual or firm approved by the Building Industry Authority (BIA) to check plans and inspect work during and after construction. An owner or builder could engage a building certifier as an alternative to the territorial authority (TA) with which they also had the authority to work nationwide with no limitations on region. The Building Act 2004 removed the entity of building certifier, and all the rights and responsibilities of the role, in response to the leaky building aftermath. In New Zealand, a building control inspector is not referred to through the Building Act 2004. The Building Act 2004 states a series of legislative requirements, including the powers and duties of BCAs and TAs, but does not define the role of the building control inspector. Section 90 of the Building Act (2004), regarding inspections by building consent authorities, states that every building consent is subject to the condition that agents authorised by the Building Consent Authority (BCA) for the purposes of this section are entitled, at all times, to the TA as statutory regulator, administrator, keeper of records and service provider. As a representative of the BCA, the building control officer is required to represent both sides of the coin. Maintaining the legislative requirements is one aspect of the administrative/record-keeping process; the other is to represent the owner and the builder in providing them with a consent, inspection and approval service. However, the regulatory building inspector is not a clerk of work, and does not provide full inspection or quality control services (Pringle, 2009). The authorities have the right to inspect buildings during normal working hours, or while building work is being done. TA/BCA officers can inspect land, buildings and building work, whether on or off site, and can expect reasonable facilities to be available to make such inspections. They must produce a warrant if asked. The right to enter an occupied

household unit is restricted and may require a court order if entry is refused. Building inspection is not listed as a duty of a TA/BCA but section 222 (Building Act 2004) gives them wide powers of inspection to:

- inspect the land on which building work is proposed or is being carried out
- inspect building work that is being carried out on or off the building site
- inspect any building (for continuing compliance with the laws)
- inspect any building to determine whether it is earthquake-prone, dangerous or unsanitary

The Building Act (2004) defines “Inspection” as the taking of all reasonable steps to determine whether:

- building work is being carried out without a building consent
- building work is being carried out in accordance with a building consent
- a Notice To Fix has been complied with
- the inspection, maintenance and reporting procedures stated in the compliance schedule are being complied with
- the requirement for a compliance schedule is done if buildings have specified systems. This enables a TA to carry out its functions and duties in relation to buildings and to be satisfied that a Certificate of Acceptance should be issued

Typically, building inspectors have been retired builders, perhaps retired because of physical infirmity but very knowledgeable about building practices (Easton, 2010). In New Zealand, the persona of the building inspector is slowly changing as the ageing building inspector workforce nears retirement, and the introduction of new legislation states all technical BCA staff must hold or are working towards a recognised qualification to conduct BCA technical functions (Building Regulation 2006, Specific Regulations 18). The requirement of a recognised qualification has changed the face of building controls in New Zealand, as new recruits are likely to have a tertiary background with minimal practical experience. Previous applicants would have been straight off the tools with

plenty of experience but with few or minimal qualifications. A finding from Rotimi (2013) that some council building inspectors lacked the competency, skills and experience to carry out satisfactory building inspections indicated that the introduction of the qualification was well overdue.

## **2.5 Review of reports relating to building regulation improvements in New Zealand**

### **2.5.1 The Hunn Report and leaky buildings**

In 1996, five years after the introduction of the first nationally binding performance-based New Zealand Building Code, a change was made to the NZ Standard NZS3602 to allow the use of untreated kiln-dried *Pinus radiata* in timber house framing (Murphy, 2011). This change would be the catalyst for future building deficiencies in the housing sector. Weather-tightness problems were known in the late 1990s but the release of the Hunn Report heralded the start of the “Leaky Building Industry”. It was formally called the Weather Tightness Overview Group’s Report but is more often referred to as the Hunn Report (Hunn et al., 2002), as Don Hunn a former States Service Commissioner, was chair of the group. The report investigated the weather-tightness of buildings, and concerns about leaking and rotting houses, with particular reference to monolithic cladding which was directly fixed to framing. It concluded systemic failures in the building industry had led to inadequate building practices causing leaking. Consequently, the report called for extreme changes across the construction sector.

The Hunn Report was released in two parts; the first concentrated on the private sector, the role of private certifiers and territorial authorities, and the second part focused on the role of government, in particular the Building Industry Authority (BIA). In contrast to the first report, its release was delayed many times and the report that was finally released had clearly been carefully edited and provided no real guidance.

An outcome of the report, other than government distancing itself from any responsibility, was the repeal of the Building Act (1991). The Building Act (2004) that replaced the 1991 legislation clearly responded to “the plight being faced by homeowners”. For instance, the 1991 Act focused primarily on the health and safety of users and occupiers of all buildings (commercial and residential). In contrast, the 2004 Act includes homeowner consumer protection as a fundamental aim. Additionally, the tone of the 2004 Act includes homeowner consumer protection as a fundamental aim. Additionally, the tone of the 2004 Act has become overtly residential. This means that applying the Act to commercial construction has necessitated councils exercising their judgement.

Another outcome of the report was the decision by Government that funding of leaky building remedial work would come from identified “liable parties”. The public reaction to the Hunn Report was such that Government felt obligated to restore public confidence in the building sector, setting up the Weathertight Homes Resolution Service Act, 2002. This was later replaced by the Weathertight Homes Resolution Service Act 2006, creating in turn the Weathertight Homes Tribunal (WHT), a judicially independent tribunal providing adjudication on matters of weather-tightness (Murphy, 2011). Government-assisted homeowners could now pursue liable parties. The tribunal was established as an alternative to the District and High Courts with the aim that it would be less legalistic, less expensive and less gruelling for the homeowner. However, the court system and WHT use an adversarial approach which has added significantly to the homeowners’ stress. The leaky-building saga and the ongoing aftermath is a harsh reminder of the failure of regulatory intervention.

### **2.5.2 The Building Act 2004**

The Building Act 2004 was a reactive response to the criticisms inherent in the Hunn Report of 2002, and saw considerable tightening up of regulatory policies and procedures

surrounding the implementation of building controls (Murphy, 2011). On 31 March 2005, the Building Act 1991 was repealed. However, parts of the Building Act 2004 came into force on 30 November 2004. This means that for the period 30 November 2004 to 31 March 2005 the two Acts ran concurrently. This was managed in two ways: the Building Act 2004 was implemented in stages. It contains a number of ‘transitional’ provisions that determine how regulatory matters that were begun under the 1991 Act were to be managed under the new Act. The Building Regulations 1992, including the Building Code passed under the 1991 Act, continued in force under the 2004 Act. The Building Industry Authority (the Authority) was responsible for administering the Building Act 1991. On 30 November 2004, this responsibility passed to the Chief Executive of the Department of Building and Housing and the Authority was dissolved.

### **2.5.3 The review of the 2004 Building Act**

In August 2009, the New Zealand Government announced a review of the Building Act 2004, to find out how the Act could be updated to minimise the cost of compliance without compromising the quality of building and construction. The Government focused on four key areas; (1) quality homes and buildings produced through a business-enabling and efficient regulatory framework, (2) ensuring consumers are able to make informed decisions carrying out transactions in the housing sector, (3) ensuring buildings are produced cost-effectively by a productive sector with the right skills and knowledge and finally (4) a regulatory system that is administered in an efficient and cost-effective manner (DBH, 2009). The review found that the building regulatory system was not broken, and changes made by the Building Act 2004 had contributed much-needed improvements to the quality of the building work. However, problems were still evident.

#### **2.5.4 Problems with ensuring responsibility sits in the right place**

The Government suggested that responsibility and accountability for ensuring building quality and reducing the number of defects is not well aligned to the ability of each party to actually do anything about it. The roles of the different stakeholder and building consent authorities are not always clearly defined or understood. At present, there is a heavy reliance on the role of building consent authorities, in reviewing plans and construction, to protect consumers from defective building work, even when the risk and consequences of failure are low. Cooperation, communication and coordination are essential to enable good planning. The current fragmentation within the residential construction industry and adverse relationships with building consent authorities (BCAs) are a barrier to good planning. The leaky-home crisis (weather-tightness failure) liabilities have bred risk adversity and increased stringency amongst BCAs with regard to consent applications involving the use of non-traditional construction methodologies (Buckett, 2013). This has, understandably, translated into a risk-averse approach because of the duty of care imposed by the courts on local authorities in respect to residential homeowners (because of the statutory responsibility to issue building consents, carry out inspections and issue code compliance certificates). The use of risk-avoidance avenues (such as creating limited-life companies) by stakeholders in the building sector means they sometimes fail to stand behind their work. The fact that in negligence cases related to leaky buildings where liability is apportioned between several parties, the payment of damages (financial compensation) must be distributed by the parties. Where some of the parties cannot contribute their share, the cost of damages must be carried by those who can pay. In practice, this means that the ‘deep pockets’ of local authorities, as the parent organisations of building consent authorities, are covering much of the cost. The reliance on building consent authorities is out of balance with their ability to influence building quality through documentation and inspection, and their capacity to do so without

considerable cost. The consequence is the imposition of higher than necessary costs. Constant through the review were excessive requests by building consent authorities for documentation and plans, which contributed to the slow processing of consents. The New Zealand Minister of Housing Maurice Williamson reinforced the Government's intention,

We want competent building professionals and tradespeople to be able to get on with building without unnecessary costs and delays. We want the amount of council oversight to be related to the risk and complexity of the building work and the skills of the people doing the work. And we want consumers to be confident that the people building their home will do the job well and stand behind their work. That's where the Licensed Building Practitioner Scheme comes in, because it gives us a way of recognising the skilled people and holding them to account (Williamson, 2010).

Williamson (2010) also emphasised the unbalanced regulatory requirements:

The reliance on building consent authorities is out of balance with their ability to influence building quality through documentation and inspection, and their capacity to do so without considerable cost.

Another issue raised during the review included a large number of inspections during the course of construction which were excessive in the case of simple buildings (DBH, 2010). Prior to the implementation of the Building Act the environment traditionally saw inspectorate attention during construction focus on the structural aspects of the building framework, typically the structural integrity of the flooring, walls (including bracing) and roof. Cladding integrity and the inspection thereof were not considered as critical elements in the checking process (Murphy, 2010). On 23 November 2010, the Building Amendment Bill (No 3) was introduced to Parliament. This Bill proposed changes to the Building Act 2004 to make accountabilities clearer, and provided for a risk-based building consent system.

### **2.5.5 The Building Amendment Act 2012**

The Building Amendment Act 2012 was the result of a comprehensive review of the Building Act 2004. It was carried out in 2009/2010, and was aimed at lifting the overall performance of the building and construction sector. The amendment brought in changes that constituted that any Restricted Building Work (RBW) required a Certificate of Work (COW) from the designer at lodgement of the consent. At the end of the process, all licenced building practitioners (LBPs) that worked on the construction were required to be included in the Records of Work (ROW) documentation supplied to council for a completion certificate to be issued. For owner-builders, an exemption from RBW was amended in that if a homeowner met the prescribed requirements, they were able to carry out critical structural and weather-tight building work to their home. Another provision the Building Amendment Act 2012 immediately came into was the clarification of some aspects of the licensed building practitioner scheme, including some new grounds for discipline. A licensed building practitioner:

- must not misrepresent their competence
- must carry out or supervise building work only within their competence
- must not behave in a way that brings, or is likely to bring, the licensed building practitioner regime into disrepute
- must not breach the Code of Ethics (note that a Code of Ethics has not yet been prescribed)

The majority of the Amendment Act, creating the risk-based consenting system, has been put on hold. It will only be brought into force by Order in Council after regulations containing the details of the system are made.

### **2.5.6 Restricted building work and licensed building practitioners**

On 1 March 2012, the New Zealand Government, in response to the need for accountability in the construction sector, introduced restricted building work (RBW).

This is any work that is critical to the structural integrity or weather tightness of a house or small-to-medium-sized apartment. As a rule, RBW requires a building consent. The designation is underpinned by the licensed building practitioner scheme, a national building competency programme established to raise standards and accountability across the building and construction sector, and to give consumers greater confidence in the quality of building work done. LBPs are designers, carpenters, bricklayers and blocklayers, roofers, external plasterers, site and foundations specialists who have been assessed to be competent to carry out work essential to a residential building's structure or weather-tightness. By the end of April, a total of 20,222 people had applied for 26,334 licences (DBH, 2012).

The introduction of RBW also directly impacts on BCAs, because the BCAs are required to only accept LBPs registered in design to undertake certain work. On completion of RBW, LBPs are required to provide the owner and BCA with a Record of Work to confirm work was carried out or supervised by an LBP. The introduction of these schemes encourages the housing sector actors to be more accountable for work they have done and provides the government with an avenue to crack down on repeat offenders. The measures underpin an efficient and accountable building sector focused on quality.

## **2.6 Issues in New Zealand Building Control Authorities (BCAs)**

### **2.6.1 The Auckland Plan 2012**

New Zealand's resident population at 30 June 2015 was estimated at 4,596,700, with an estimated 34 out of every 100 (1,570,500 people) New Zealanders living within the greater Auckland region. It remains one of the fastest growing regions in the country (NZEFO, 2016). According to projections of demand in Auckland, there is a need to build more houses per year in New Zealand than industry and systems can currently sustain (Statistics NZ, 2010). Auckland's population is projected to increase to between 2.2 and

2.5 million over the next three decades (Auckland Plan, 2012). The Auckland plan calls for 100,000 new dwelling units to be constructed between April 2013 and March 2021. It equates to 13,000 new units per year compared with the current 4,800 annually (Page, 2013a). The challenge is great; as of 2012, there was a shortfall of about 10,000 homes, and levels of house building were less than half the volume required. In 2012, only 5,000 consents for new homes were issued in Auckland and not all these projects were completed (Statistics NZ, 2012). Further, in New Zealand as a whole, only about 24,000 houses are built each year. The rebuilding of Christchurch is taking up a large part of national construction capacity.

The Auckland Plan provides greater certainty for developers about when and where development will occur over the next 30 years. Auckland has a large shortfall in housing and a depressed development sector; it is a major task to achieve at least 13,000 new dwellings annually, on average, over the 30-year life of the plan, without urgent, bold, multi-sector action.

Auckland Council influences housing supply through its planning, regulatory and consenting processes. For developers, the loss of equity and profit caused through delays can be more costly than the fees themselves. Time and costs across the entire development process need to be reviewed. Processes can be streamlined to increase certainty around cost and timing. Auckland Council could move to outcome-based consenting and bring in other incentives for development in existing urban areas, and zone land for development in new growth areas. Building and delivering on a multi-sector Housing Strategic Action Plan to achieve the required increase in housing supply, includes options to increase affordable housing supply for first-home buyers.

New Zealand's building industry is small-scale and fragmented, with a lot of silo design, construction skill shortages, and low productivity (Page, 2008). All these factors

influence supply and demand. Also, the value of house prices, combined with the situation after the Christchurch earthquakes, has put pressure on housing nationally. Figure 2.4 shows that by September 2013 residential dwelling consents had increased nationally 22.3 per cent (1860 consents), with Greater Christchurch noting an annual increase of 53 per cent (544 consents) and Auckland 6.6 per cent (489 consents) (Statistics New Zealand, 2013).

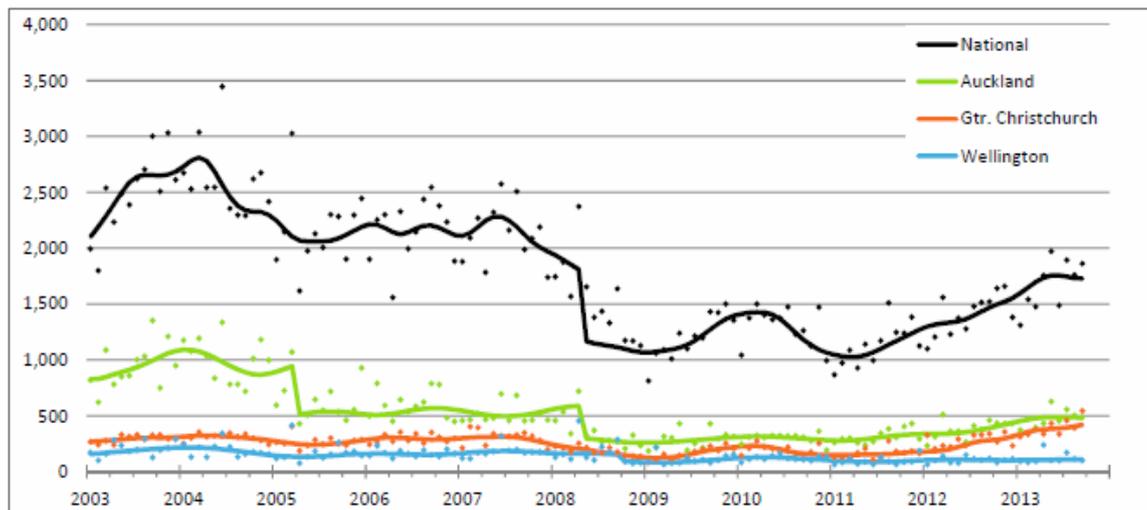


Figure 2.4: Residential Dwelling Consents (Statistics New Zealand, 2013).

### 2.6.2 Auckland Council building control challenges

As of 1 November 2010, Auckland Council became a unitary authority through the amalgamation of one regional council and seven territorial authorities. Auckland Council is the largest accredited BCA in New Zealand. The building control department has about 550 staff who are responsible for processing more than 17,000 building consent applications, and carries out about 148,000 inspections a year (Provost, 2015). This compares with 137,000 inspections in 2012/13, an increase of 8 per cent. The BCA experienced increased volumes of building work between 2011 and 2016. An audit conducted under the Local Government (Auckland Council) Act 2009 in 2015 recommended that Auckland Council bring forward the introduction of an electronic lodgement system for building consent applications because the extensive handling of

paper was too time-consuming (Provost, 2015). Figure 2.4 shows that at the end of the 2015 financial year, 21,603 building consents had been lodged with Council, an increase of 11.8 per cent from the previous year.



Figure 2.5: Lodged building consents 2015 / 2016 (Auckland Council, 2016).

Building inspections at the end of the 2015 financial year had increased by 10.8 per cent from the previous year indicating that work in the sector was on the rise as shown in Figure 2.6.



Figure 2.6: Building inspections 2015 / 2016 (Auckland Council, 2016).

Figure 2.7 shows that at the end of the 2015 financial year, Auckland building consent values of \$6.37 billion had increased 18.9 per cent from the previous year.

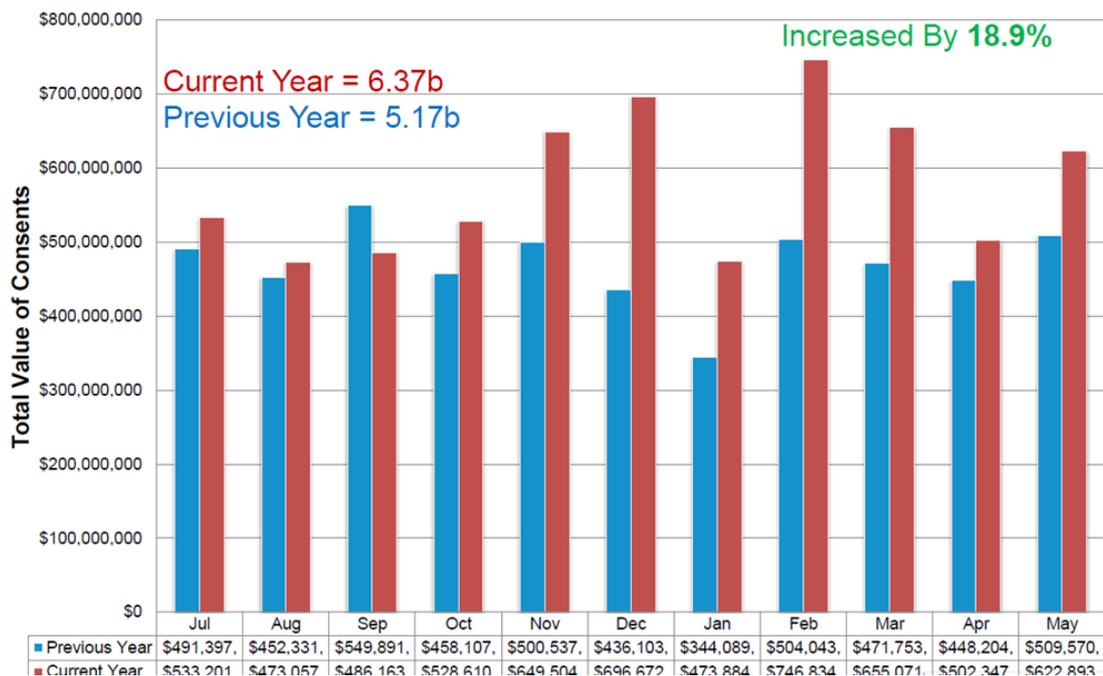


Figure 2.7: Auckland Council consent values 2015 vs 2016 (Auckland Council, 2016)

Figure 2.8 provides an overview of the construction work by value for Auckland, in comparison with the rest of the country. Auckland construction value is averaging \$4

billion. The other major cities and the rest of the regions are averaging just under \$2 billion.

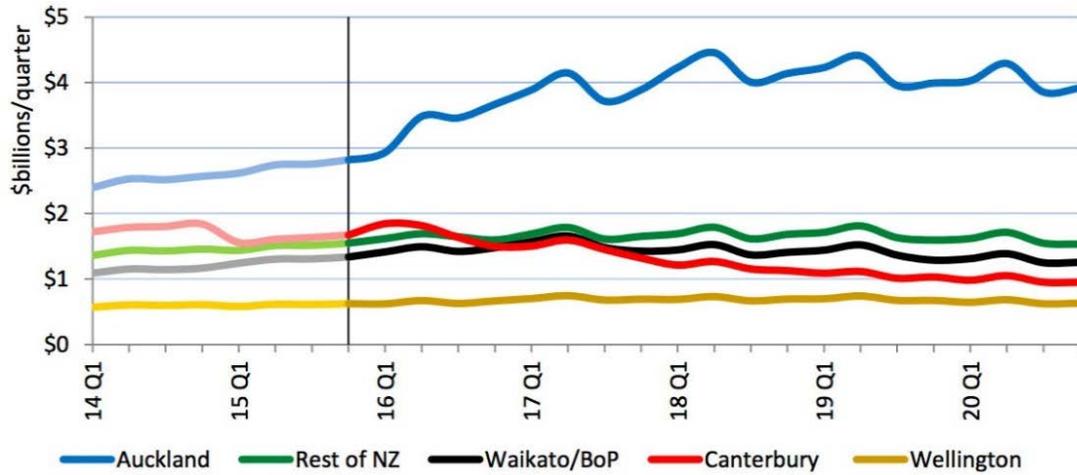


Figure 2.8: Construction value by Region (BRANZ, 2016).

### 2.6.3 Christchurch earthquakes

On Saturday 4 September 2010, a magnitude 7.1 earthquake occurred near Christchurch. It was the largest earthquake to affect a major urban area since the 1932 Hawkes Bay earthquake. The quake occurred at a time when the majority of people were asleep in their homes and the streets were largely deserted. The lack of casualties was also due to strict building regulations and partial strengthening of older buildings.

The worst damage was suffered by mainly pre-1940s buildings constructed of brick and masonry which lacked adequate reinforcement. An early Treasury estimate of the cost of the earthquake was \$4 billion. The event had left a question mark regarding the stability of older buildings.

On Tuesday 22 February 2011 at 12.51 pm, Christchurch was struck by a magnitude 6.3 earthquake which took the lives of 185 people and injured several thousand others. The collapse of two multi-storey office buildings – the Canterbury Television and Pyne Gould Corporation buildings accounted for 110 fatalities. The earthquake brought down many buildings previously damaged in the September 2010 earthquake, especially older brick

and mortar buildings. Many historic buildings were heavily damaged. Over half the buildings in the central business district were demolished.

House foundations cracked and warped, wrecking many homes; several thousand homes would need to be demolished. The catastrophic event has put a lot of strain on central and local government, particularly with regard to replacement homes and historic / building assessment (MBIE, 2013).

Since the February 2011 earthquake, the greater Christchurch region has suffered a loss of 7,860 houses due to properties being deemed uninhabitable; these houses were classified as “red zoned” (MBIE, 2013). A report by MBIE (2013) estimated that the housing stock had been reduced by a net 11,500, or 6.2 per cent of the previous housing stock, between the fourth quarter of 2010 when the earthquake sequence started and the fourth quarter of 2012. Table 2.3 provides an estimate of the housing stock for the Greater Christchurch Region between 2011 and 2012. The New Zealand Treasury estimated the total cost of the rebuild at around \$40 billion (about 20 per cent of annual nominal GDP), much of which is covered by private insurance (reinsured through overseas insurance companies) and the government- owned Earthquake Commission (EQC) (NZEFO, 2016).

Table 2.3: Estimate of the total housing stock for Greater Christchurch (MBIE, 2013).

<b>Quarter</b>	<b>Housing Stock*</b>	<b>Annual Change</b>
Q4 2006	176,300	
Q4 2007	179,900	3,600
Q4 2008	182,400	2,500
Q4 2009	183,900	1,500
Q4 2010	186,200	2,300
Q4 2011	176,200	-10,000
Q4 2012	174,700	-1,500

\* Includes dwellings which are private and non-private: occupied, unoccupied and under construction

#### **2.6.4 Christchurch building control challenges**

The Christchurch earthquakes have put a lot of stress on housing in the Christchurch area and there is pressure on the Government to rebuild faster (MBIE, 2013). Another devastating blow was to hit the country in the form of the local building control authority losing their accreditation. At 11.10am on Monday 1 July 2013, TVNZ's One News reported that Christchurch City Council's Building Control Department had been stripped of its building consent accreditation. International Accreditation New Zealand (IANZ) had issued a decision revoking the Council's capacity as a building consent authority (Hutching, 2013). IANZ had been engaged to provide a report on the Council's consenting process as property developers were claiming that consent department delaying tactics were costing the developers thousands of dollars a day. This decision was effected immediately from 8 July 2013. The council was made aware of the intention to revoke its accreditation as a consent authority the previous month. The Government had also threatened to intervene, stating that taking into account the enormous pressure caused by the earthquakes, the council was still moving too slowly. Prime Minister John Key stated,

There is a huge amount of stress on the organisation because of the rebuild, but this is slowing things down.

The New Zealand Herald also reported, in an article headed "Council consents: 'critically important' that process is sped up", that the Government wanted to develop a longer-term solution that ensured Christchurch City Council would deliver timely, quality consents, and that they were once again IANZ accredited (Bennett, 2013). IANZ chief executive Llew Richards said in a statement that a high level of responsibility was expected of any accreditation body:

The critical issue is ensuring all issued building consents fully comply with the technical requirements of the Building Code and Building Act.

Dr Richards provided an example of buildings meeting structural engineering standards, fire protection requirements and being weathertight. It was also important that any accredited building consent authorities ensured all staff members understood the specific standards required when approving consents.

The people issuing consents must be technically competent to do so – and any limitations on their competence clearly understood. The BCA's (Building Consent Authority's) competence review of its staff and on-going audit of allocating work to competent people all need to be recorded and established as effective.

Richards added that records were kept as evidence that compliance with the Building Act had been adhered to and, without such evidence, neither IANZ nor the building owners could be assured the consenting process was sound. An average of 35 building applications were received each day in March and April, according to the agenda from a planning committee meeting. The workload led to one council officer reporting:

We have seen backlogs develop across all process steps - from pre-processing initial data entry through processing and into typing. The sheer volume exceeds capacity, and applicants are expressing a significant level of concern at this.

Bennett (2013) reported that MP Gerry Brownlee had previously hit out at the council's slow response, saying:

The council knew this workload was coming and hasn't adequately addressed it.

The pressure and demand put on the Christchurch BCA post-2011 earthquakes provide evidence that the BCA were not coping with the volumes of building work that required regulatory intervention. The lack of resourcing due to Auckland's building boom, and a shortage of skilled workers, requires BCAs around the country to provide alternative solutions in which risk-based inspections may be the key. The loss of the second-largest

BCA accreditation in New Zealand was a harsh reminder that no matter how large the organisation, no BCA was immune to losing its accreditation.

## **2.7 The characteristics of building regulations**

### **2.7.1 Lack of accountability**

Buildings must be compliant with the laws and regulations while providing end-users with products that conform to what is established within contractual agreements (Almeida, Sousa, Dias & Branco, 2010). Accountability is a fundamental and thorny issue for performance-based regulations and, as such, is the Achilles heel of this form of regulation (May, 2003). Prescriptive-based regulatory regimes attempt to achieve accountability by mandating adherence to the rules. Regulatory inspectors are biased towards monitoring adherence to rules that are easy to observe and, as a consequence, accountability under such systems can be haphazard and misplaced with little attention to the final outcome (Bardach & Kagan 1982, Sparrow 2000).

The case of performance-based regulation of buildings in New Zealand illustrates a leaky regulatory regime. The regime allowed for flexibility without adequate accountability (May, 2003). The leaky-home saga, through the Hunn Report (Hunn et al.,2002), provided the New Zealand Government with 25 recommendations which included guidelines being provided to building inspectors as part of the code of compliance certificate process and clarity of roles and responsibilities of stakeholders responsible for procuring, designing and constructing a building to ensure regulatory code compliance. This is to improve the accountability of all stakeholders in the house-building sector.

Therefore, it is very important that the roles and responsibilities of those involved in the building process are clearly defined, and it is vital to clearly identify key decision makers (Chan & Kumaraswamy, 1997). Mulgan (2000) extends the scope and meaning of ‘accountability’ to internal aspects of official behaviour, beyond the external focus

implied by being called to account; to institutions that control official behaviour other than through calling officials to account; and to democratic dialogue between citizens where no one is being called to account. In each case, the extension is readily intelligible because it is in an area of activity closely related to the analysis and assessment of accountability. Meacham, Bowen, Traw and Moore (2005) suggested that accountability is a fundamental and challenging issue for performance-based regulations, and that more understanding of the responsibility and accountability of all stakeholders is required to help ensure that regulatory safeguards are established.

Only in time of crisis, when an abuse or tragedy has occurred, do elected and agency officials question why a public agency was unable to manage and monitor its providers, while repeated requests from public managers to their superiors to employ further staff for auditing and oversight functions are continually met with resistance. This resistance is mainly based on the competing incentives and goal divergence that exists among various stakeholders involved in the contracting relationship (Van Slyke, 2003). Mulgan (1997) argues that contracting out does not reduce government accountability for public services. Contracting out inevitably involves some reduction in accountability, through the removal of direct departmental control over day-to-day actions of contractors and their staff. At the same time accountability may, on occasion, be increased through improved organisational control following greater clarification of objectives and the specification of standards. An integral step that could elevate the responsibility and accountability of building practitioners is through raising competency, training, licencing and certification to establish minimum requirements in the market (Meacham, 2010). Providers may also become more responsive to public needs through the forces of market competition (Mulgan, 1997).

Mulgan (2000) expresses that structures of accountability appear to be generally more stringent in the public than the private sector, particularly in contrast to the accountability of organisations for the processes by which they determine their general directions and policies. A study carried out by DCLG (2012) supports this, in that staff in local authorities thought they were carrying more burdens than approved inspectors (maintaining public registers, undertaking enforcement work etc.). One inspector commented that whilst competition had sharpened local authorities, it would be beneficial if the regulations protected the local authority as much as the approved inspector (AI) when it came to gaining work. The consequences of this leniency alluded to the fact that several respondents referred to the practice of AI's franchising out their work to individuals who were receiving no scrutiny, and were able to undercut both local authorities and other AI's (DCLG, 2012). The key accountability considerations for the system-based and performance-based regimes researched by May (2007) are professional judgement and the exercise of professional responsibility. Each reduces the role of traditional regulators in favour of increased reliance on the professional expertise of industry personnel and third-party experts. When such expertise is lacking, as in the case of New Zealand's performance-based building safety regime, there is a clear mismatch in regulatory design. The discouraging news for advocates of newer regulatory regimes is that the experiences reviewed show potential shortfalls in different aspects of accountability and a potential for subtle forms of regulatory capture. These problems reinforce the dilemma of allowing for increased regulatory flexibility without sufficient accountability structures (May, 2007).

### **2.7.2 Regulatory building non-compliance**

May (2004) explains constraints on homebuilders' compliance with Building Code provisions due to the complexity of codes; some are hundreds of pages long and are often specified in technical terms that are not easily understood. This is evident in the New

Zealand regulation system where there are 39 code clauses (of which 37 are technical) in which certain codes contain clauses whose pages number into the hundreds with specific acceptable and verification methods for compliance. One technical clause in particular is “C Documents: The protection from Fire” comprises seven parts for the acceptable solution (NZBC 1991).

The United States has a plethora of legal regulations and rules relating to building work. These regulations can lead to a deterrent to good architecture and, in some instances, as an administrative burden that contributes directly to discouraging development (Imrie & Street, 2009). Similarly, in England and Wales, the level of compliance with building regulations was not always sufficient, though there was no evidence of systematic and purposeful non-compliance with building regulations. However, faults were largely due to lack of skills and knowledge about the required standards on the part of the builders, shortcomings in site management and tolerance of sub-standard workmanship (Baiche, Walliman & Ogden, 2006).

A study compiled by Baiche, Walliman and Ogden (2006), as a result of interviews with building control inspectors on building regulations in England and Wales, provided an overview of the causes of building regulation non-compliance during building inspections. All inspectors, both local authority and approved others, agreed that overall none of the building regulations were too impractical or difficult to put into practice, and that there were no particular difficulties in enforcing them. The causes of non-compliance are shown in Table 2.4.

Table 2.4: Causes and solution to problems of non-compliance (Baiche, et al., 2006)

<b>Causes of non-compliance</b>	<b>Solutions to problems of non-compliance</b>
Poor workmanship	Better training in building skills
Ignorance of details of regulations	Better training in changes to building regulations and standards for tradespersons.
Use of incorrect or non-certified materials	More adoption of simplified building details
Poor management	Consistent and competent site management
Conflict / confusion between trades	Monitoring
Changes to standard approved designs	
Unfamiliarity with design	
Complicated labour-intensive details requiring work from several trades	
Lack of detailed calculation of ultimate site levels around buildings.	

### **2.7.3 Inconsistency in regulatory building enforcement**

Unnecessary building code requirements and strict enforcement practices, however, have been widely criticised for increasing the cost of new construction and rehabilitation, particularly within central cities (Burby, May, Maliza & Levine, 2000). These burdens reduce the ability of central cities to compete successfully with surrounding suburban areas for population and economic development. The technical, economic, and legal problems encountered in implementing regulations mould the regulators' enforcement style (Kagan, 1989). Regulators should not settle enforcement matters with "for the purposes of proceeding" admissions. If business offenders settle a matter with admissions and later renege on those admissions by stating that they believe they were not legally or morally liable for the conduct, then the regulator should confront them about their denials, making the conflict explicit and able to be resolved one way or another. Regulators should only settle where offenders show remorse, apologise, and make a commitment to repair

the harm caused by their misconduct (Parker, 2006). Irrespective of the type of case involved, the traditional means of obtaining compliance through strategies of deterrent threat. The argument driving this perspective is threefold: fear of possible future punishment leads to compliance with the law; risk calculations are partly shaped by both the anticipated likelihood of punishment and by judgements about severity; and the focus is (and should be) on the power of legal authorities and institutions to shape behaviour by threatening to deliver (or by actually delivering) negative sanctions for non-compliance (Jackson, Bradford, Hough, Myhill, Quinton & Tyler, 2012). Regulatees value clarity in expectations, consistency in procedures, and the benefit of the doubt when deficiencies are found. However, inspectors must be able to strike a proper balance to encourage cooperation without allowing them to be manipulated into ignoring substantial violations (May & Wood, 2005).

Conversely, Ayres and Braithwaite (1992) and Sparrow (2000) have endorsed variants of flexible approaches that involve situational monitoring of compliance, results-orientated enforcement of code requirements, and the use of sanctions only when required (May, 2005a). One study on code enforcement that relates to issues surrounding compliance has identified two philosophies of enforcement: a strict, systematic philosophy and a more business-friendly, facilitative philosophy (Burby, May, 2000; May & Burby 1998; Kagan 1994). Regulatory enforcement departments employ a mix of deterrent enforcement practices, discretionary enforcement practices, incentive practices, technical assistance practices, and standardisation of enforcement. Three enforcement strategies are identified by May and Burby (1998): strict enforcement, creative enforcement and accommodative strategy. Strict enforcement and creative enforcement correspond to previous conceptualisations, although the details differ from stylised versions of these. The accommodative strategy is found where enforcement philosophies are highly

unsystematic, are only moderately facilitative, and require little overall departmental effort. This is similar to a retreatist approach in which regulatory officials avoid making difficult decisions and create an illusion of enforcement. Aggressive regulatory departments or officials are called “legalistic”, or “sanction” oriented, devotees of a “deterrence” model or “coercive” style of regulation. May and Winter (2000) show that inspectors’ enforcement styles are best depicted as having two dimensions, the degree of formalism and the degree of coercion that they exercise when carrying out inspections. Figure 2.9 shows hypothetical enforcement styles displayed in two dimensions. The ideal-type categories that fall along the diagonal line are shown in bold text.

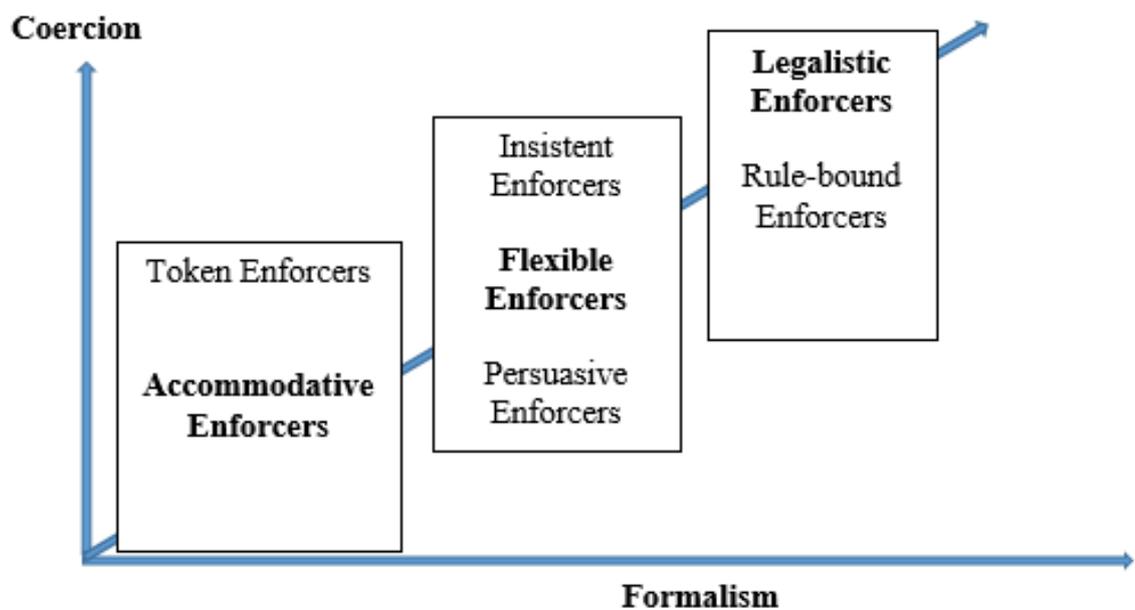


Figure 2.9: Hypothesized Styles of enforcement (May & Winter, 2000)

## 2.8 Suggestions for improving regulatory building inspection

The building inspection regime can be an emotional roller coaster. It has many components which include regulatory rule, financial commitment, mobile construction sites and human behaviour all entwined to produce a fit-for-purpose product, in this case, a family home. Governments and academics have spent time and money researching these behaviours to make sense of some of the issues. Homebuilders and inspectors clearly

view building inspection as a critical element in bringing about compliance. Indeed, the inspection process is typically viewed by inspectors and homebuilders as a form of quality control (May & Wood, 2005).

However, Burby et al (2000) suggest practices that deserve careful scrutiny and possible change include rigid application of rules, use of severe sanctions, and supervisory practices that prevent field personnel from developing satisfactory working relationships with contractors. The rigid application of rules includes the automatic issuing of written notices of violations, when non-compliance is detected, and the specification of strict schedules for their correction (Burby, May, Maliza & Levine, 2000). Similarly, May (2004a) suggested that the expectation of more frequent inspections, more thorough inspections, and the inspector's willingness to issue sanctions when violations are not corrected when ordered contribute to a stronger negative motivation (May, 2004a) about the inspection process. Building inspectors are expected to be more vigilant when non-compliance issues arise; harsher penalties should be applied to repeat violators. The intention of this hard line is for non-compliance to be dealt with fairly rather than with leniency. May and Wood (2005) suggested that inspectors appeared to get tough only when they felt that homebuilders were far off the mark in compliance levels. More often, this was when homebuilders were not present.

May and Wood (2005) further suggest that inspectors know they are likely to interact with the same builders again, and they know that builders can make life for inspectors difficult by escalating issues to inspector's manager to be resolved. Under such circumstances, it is far better to get along than to get tough, especially given that inspectors are concerned about their reputations with homebuilders. Similarly, Kagan (1989) supports this argument in that regardless of the laws and regulators' notions of what would be best, it assumes that regulators work within a charged political atmosphere

in which interest groups attempt to persuade department leadership. In these circumstances the inspector's decision may be over-ruled by a superior who has been influenced by a regulatee with whom he or she has formed a better relationship. Other academics provide examples of the over-strict supervision of inspectors, which includes rotating inspection territories frequently to prevent inspectors from becoming too friendly with contractors. This requires inspectors to adhere, without deviation, to formal inspection routines, and forces supervisors to review inspector compliance with building department policy. Business-friendly supervisory practices emphasise the attainment of enforcement goals while giving inspectors a considerable degree of freedom in how they interact with contractors and developers (Burby, May, Maliza & Levine, 2000).

The logistics for homebuilders has dramatically changed in the last decade, with modern homebuilding becoming more of a collaborative effort in which general contractors employ a range of subcontractors specialising in different phases of the construction process (Rotimi, 2013). A typical three-bedroomed, brick-and-tile single level dwelling would probably have six or more subcontractors providing services to complete its construction (May, 2004). The relationship between success on site and strong management teams underpins the need for effective site management and supervision by contractors and consultants (Chan & Kumaraswamy, 1997). The same relationship is encouraged by building inspectors in the UK. They believe that having the same person as site manager for the duration of the job not only helps build up a good relationship between the two stakeholders but also benefits the quality of the end product (Baiche, Walliman & Ogden, 2006). Furthermore, May and Wood (2003) comment that one of the key constraints that frustrates homebuilders is inconsistencies with the requirements of building inspectors.

### **2.8.1 Competencies and training**

Competencies and training play a major role in technical decision-making outcomes. Many professional institutes and organisations require that for registration membership to be valid, members are required to show competency in the field of their profession. This is the case for architects and building officials in New Zealand. The New Zealand Registered Architects Board (NZRAB) is required, by law, to confirm every five years that all member architects are still competent. This is ascertained by a review procedure known as a Competence Review. One of the competence review requirements states that architects must demonstrate that reasonable steps have been made to maintain the currency of architectural knowledge and skill since their last assessment (Registered Architects Rules 2006, Rule 21 (1) (b)). Building officials also have similar legislation in Building Regulation 2006 (specifically, Regulations 9, 10 and 11) where technical BCA staff require a competency level before making any technical decision. Yau (2009) recommends that for the professional competence of technical personnel undertaking the work-certifying exercise, the government should set stringent minimum-experience thresholds for use in assessing eligible personnel for the registration process. It is also vital that continuous training or professional development is stipulated as a mandatory requirement for qualification renewal. Meacham (2010c) provides a summary of approaches that will help to achieve better building performances in the construction sector, helping to raise the quality and competence of professionals in the process:

- at all levels across the construction sector, raising the competency, licensing and certification of practitioners
- putting more responsibility and accountability on practitioners to maintain high standards of care
- introducing a mandatory third-party review of calculations, in particular in high-risk buildings and complex analyses
- increase the verification and validation of computational tools

- develop better performance-oriented testing; the more the testing can be modified to produce data over a range of conditions indicative of assessing performance in use, the more robust the performance regime will become

It is necessary to boost the confidence of the general public in the proposed regime. As public confidence is a matter of public education and understanding of the new regime, the government should launch extensive promotion campaigns, including organising public seminars and workshops. It should also provide material capable of being understood by non-professional readers, and set up advisory centres and hotlines to answer public enquiries (Yau, 2009). Stakeholders at both the technical and managerial levels should have their own knowledge updated by continuous professional development schemes in forms of short training programmes or day-release courses in an educational establishment (Chan & Kumaraswamy, 1997). Tradespeople are believed by the inspectors not to know building regulations. There has been concern about this serious lack of knowledge of building regulations. However, the inspectors agree that tradespeople who are well-trained and educated make a lot of difference to compliance with building regulations; inspectors encourage ongoing building-regulation training (Baiche, Walliman & Ogden, 2006). To be an effective scheme aimed at demonstrating minimum competency requirements, there should be some mandatory requirements for minimum levels of competency and for continued professional development, as well as a clear and effective system for disciplinary action to remove unethical professionals from practice. In a performance-based system, there may be benefits in licencing a wide range of practitioners, from trades to professionals, and even specialists such as risk analysts and computational modellers (Meacham, 2010c). Page (2010) believes that by improving skills through training and re-training of the workforce, it might be possible to reduce rework and waiting times in construction activities. Small firms have acknowledged that

having the appropriate level of trade skills, and managing projects effectively, are the two most important factors for productivity and performance (Page, 2014a).

### 2.8.2 Quality Assurance

Construction industry stakeholders (regulatory bodies, standardisation bodies, owners, designers, contractors, subcontractors and end users etc.) have developed specific parameters in their requirements, according to their motivations and outcome goals. The fact that multiple construction stakeholders aim simultaneously, at the fulfilment of different sets of requirements, thus using different references to support their own perception of quality, is one of the reasons for diverging perspectives that define construction quality (Almeida, Sousa, Dias & Branco, 2010). Defining ‘quality’ for an inspection is very difficult because an inspection is only one component of a larger and complex legal system. At the least, inspections are meant to improve compliance with clear rules, in order to achieve policy results. However, compliance on its own does not meet sufficient standards of quality. Jacobs and Cordova, (2005) proposed four quality criteria for a good inspection system as shown in Figure 2.10.

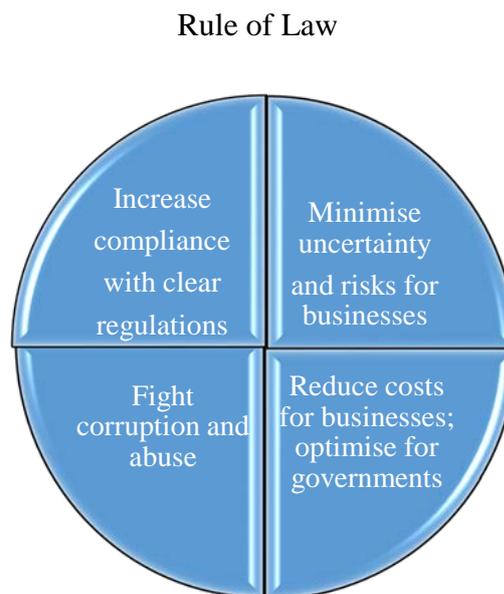


Figure 2.10: Four quality standard for good inspection (Jacobs and Cordova, 2005)

The use of quality control systems in which all major service stakeholders are required to have a full quality system in place for their organisation, includes architects, design engineers and contractors. Such quality systems describe such factors as the scope of the firm, the competencies of the key personnel in technical or project management areas, the design methodology, methods, and generally how the analyses or constructed systems are to be verified for compliance (Meacham, 2010).

Imrie and Street's (2009) study of risk, regulation and the practices of architects provided evidence that architects increasingly negotiate the use of auditable items, calculative operations, techniques and instruments to ensure the minimisation of risk. An example in that study showed that the project team had a series of meetings whereby the risks were delegated to different members who took responsibility for managing those risks. Also, setting up auditing systems, to ensure that project team members were covering themselves, was a priority. Participants in the research also stated that the auditing process, due to the number of personnel involved, had become a burden.

On the other hand, others felt that a paper trail was important as a means to demonstrating to stakeholders that decisions had been resolved collectively. The key objective was to avoid 'individual blame', should things go astray (Imrie & Street, 2009). Another form of quality assurance was to contract work out, thus buying in specialist help. For some architects, part of the risk culture relates to fear of blame, underpinned by lack of trust in other players, and systems to check or control elements of practice. As one architect noted, the lack of trust is reflected in the assemblage of legal teams in projects (Imrie & Street, 2009). Page (2010) believes that having a proper quality management system within a construction organisation is positive and relates to productivity.

### **2.8.3 Third-party review**

When instituting mandatory third-party review of critical calculations, the purpose is to ensure that certain designs, prepared by qualified practitioners (licenced registered professional engineers), are independently checked to minimise the risk of design errors due to complacency by the designer. A review of this nature also provides a peer review for building consent authorities (Meacham, 2010). If private sector companies come to accept a greater degree of accountability when providing public services (for instance, exposure to an ombudsman or an administrative tribunal) they may be under pressure to provide similar redress and scrutiny in their other activities. Thus, contracting out, which is often seen as implying a watering down of public accountability, could also be a means of strengthening accountability in the private sector by nudging it more closely to public sector practices (Mulgan, 2000). Gouldson (2009) argues that a challenge with risk-based regulations is understanding the potential role of the private sector, and identifying whether and under what conditions regulators might transfer their responsibilities to the private sector.

There are major concerns about the accountability of private sector organisations and their capacity to regulate firms they have a commercial relationship with. The uncertainty about transaction costs and risk makes it clear that basing aspects of the regulatory process on complex relationships between regulators and a potentially wide range of private players would not be any cheaper or more reliable than continuing to rely on the agency to deliver risk-based approaches. In confronting these issues, the agency would better understand when and under what circumstances it may be appropriate to delegate some of its powers to the private sector (Gouldson, A.Morton, & S.J.T Pollar, 2009). Competition between local authority building control and approved inspectors leading to lower standards was a recurring theme, linked to the perceived conflict of interest between the local authority's commercial activities and its enforcement roles. However,

stakeholders have offered various solutions: the local authority could undertake enforcement only, building control could be run as a centralised organisation, and the approved inspectors system could be abolished (DCLG, 2012).

#### **2.8.4 Self-certification**

A proposed self-certification approach must be backed up by a comprehensive monitoring, inspection and audit regime that coincides with strong enforcement powers (Yau, 2009). Self-certification without any post-monitoring and spot-checking could result in a decline of standards over time (UK, Department for Communities & Local Government, 2008). It is necessary for Government to provide a clear definitions and guidelines for application processes, and clearly specify these changes in revised building regulations. In the vast majority of circumstances, neither pure self-regulation nor strict command and control will be the preferred policy solution; rather, some combination of the two will be necessary to deliver optimal regulatory outcomes (Sinclair, 1997).

Architecture can be risky; it can be regulated in a number of ways. Foremost is the legal aspect: local government rules and regulations are broadening the scope of what constitutes risky objects (to be regulated) in the design and development process. This contributes, potentially, to task enlargement, related to the development of new systems of regulation in which there is greater legal risk and litigation, and more reliance on self-regulation, or the individualisation of responses to possibilities of ‘blame displacement’ for elements of project failure (Imrie & Street, 2008).

In October 1997, the then Department of the Environment, Transport and the Regions in the UK issued proposals for reducing the administrative burden of the building regulations by allowing self-certification of compliance by enterprises and individuals judged as competent. The consultations with key building industry stakeholders showed general support for the proposals for schemes in sectors where the health and safety risks

to people were low (Planning & Building UK, 2010). The schemes offered benefits to both consumers and industry. Consumers would benefit from lower prices as building control fees were not payable and firms that joined these schemes would avoid the time and expense of notifying a Building Control Body (BCB). Such measures increasingly required organisations to demonstrate competence in risk management (and regulation) in which architectural firms' involvement in risk-based regulation, such as self-certification of parts of the building control process, the appointment of 'risk auditors' and auditing of compliance with health and safety directives, provided opportunities to demonstrate capacities as 'self-reflective and self-improving' organisations that could be trusted (Imrie & Street, 2008). The scheme encouraged local building control departments to concentrate their resources on areas of highest risk. The powers used to set up the schemes are in Schedule 1, para 4(a) of the Building Act 1984. The schemes have been set up under the Building Regulations 2000(SI 2531/2000) as amended by the Building (Amendment) Regulations 2009 (SI 2009/466), using powers in Schedule 1, para 4(a) of the Building Act 1984 (Planning and Building UK, 2010).

In a performance-based system, there may be benefit in licencing a wide range of practitioners from trades to professionals and even specialists as in the field of risk analysis and computational modellers (Meacham, 2010).

## **2.9 Risk-based regulations**

It is important to begin with an understanding of how risk-based regulations have been variously defined by many authors and, in particular, within the construction industry. According to Rockett (1999), the terms risk, crisis and disaster have as many definitions as there are people capable of defining them. There is no single accepted or correct definition of risk. Risk-based regulation seeks to make laws more efficient as well as more transparent. It aims to replace prescriptive, deterministic regulations by goal-oriented,

probabilistic regulations, based on the criteria of cost- effectiveness and limitation of individual risk (Flueler & Seiler, 2003). Hutter (2005) refers to risk-based regulation as an ad hoc scenario involving the piecemeal adoption of risk-based tools and an uneven use of the language and rhetoric of risk. In some cases, regulatory agencies describe risk-based regulation as if it represents an entire perspective or framework of governance. Risk-based approaches provide a new direction that can be used across different mediums and help forge a common purpose, language and approach (Hutter, 2005). While a variety of definitions of the term risk-based regulations have been suggested, this current research project has used the definition suggested by Rothstein et al. (2006), at its simplest:

Risk-based regulation, allocating resources in proportion to risks to society (such as health, safety or environmental risks), in which the consequences of it happening and the overall impact are considered, in order to establish appropriate levels of control.

Black and Baldwin (2010) have argued that risk-based regulation has achieved broad acceptance within many governments and regulatory organisations. Hutter (2005) suggests one criterion for why super agencies are created: a response to changing working practices and environments. Changing social and economic conditions contributing to the move to risk-based regulation is a normal response.

Hutter (2005) further suggests that an important role of risk-based approaches may be to serve as an integrative template for new regulatory organisations. These are large, centralised agencies which are responsible for the domain of risk management across all relevant sectors. These agencies represent a move from sector-related regulation to domain-related regulation that takes on a broader, more integrated view of risk management, which co-ordinates sectors where knowledge is shared (Hutter, 2005). Internationally, pressure is being exerted on governments and regulators to develop modern forms of regulation that deliver more for less, and in better ways.

One large regulator, the environmental agency for England and Wales, has responded to such pressures by implementing risk-based approaches to regulations (Gouldson, 2009). Risk-based regulations are an established practice in a number of areas of UK health, safety and environmental enforcement, with examples found in the enforcement of food safety (Hobbs, 2002), fire safety (Ramachandran, 1999), and occupational health and safety (Bennett, 2002). Also, the UK Health and Safety Executive in 1995 introduced construction and design management regulations (CDM) to identify hazards, reduce risk, save lives and eliminate injury (Imrie & Street, 2009).

An extension to CDM regulations in April 2007 required architects to consider the safety of buildings, end users, and make clients responsible for appointing a dedicated CDM coordinator. In each case, the frequency of inspection and associated enforcement actions are now based on a combination of the risk(s) posed by the activity and the standard of management.

Rothstein et al. (2006) argues that risk-based regulations can encounter at least three kinds of challenges. First, the epistemic challenges which happen when regulation asks questions of science, and science is not in a sufficiently advanced state to answer. Secondly, risk-based decision-making might also be expected to pose institutional challenges. The pressure on resources and expertise can be considerable. Conflicts can arise with decision-making methodologies embodied within regulatory frameworks and accumulated regulatory mandates. Thirdly, risk-based regulations can be constrained by normative conflicts.

Bureaucratically rational decision-making procedures may not find favour with stakeholders, for example, if stakeholders measure and weigh the costs of benefits of regulatory decisions in different ways. Risk-based regulation, therefore, has the potential to improve the management of risks to society but it may also have the unintended

consequence of focusing policy attention on problems that carry high institutional risks for the regulator, at the expense of those that carry high risks to society (Rothestein et al., 2006). Similarly, Flueler and Seiler (2003) suggest risk-based regulation is not a substitute for political value judgement, nor is it a substitute for politics and policy but a methodical tool into which political judgements may be explicitly incorporated. It makes transparent which risks exist and which risks are implicitly or explicitly accepted. Therefore, it forces politicians (and the public) to make or consider value judgements on the tolerability or non-tolerability of risks (Flueler & Seiler, 2003).

### **2.9.1 Risk-informed building regulations**

Performance-based building's regulatory and design environment provides opportunities for engineers and designers to innovate and to apply analytical tools and methods to design safe, efficient, cost-effective, and aesthetically pleasing buildings (Meacham, 2010). However, for regulators and enforcement officials, performance-based approaches are often met with scepticism and concern, as the desired performance is not always understood or agreed upon. To address these concerns, risk-informed, performance-based approaches are being explored, with the aim of better identifying and connecting tolerable levels of risk, performance expectations, and design criteria for different aspects of building design. Meacham (2005) considered a risk-informed, performance-based approach as one that considers threat, risk and hazard data in contrast to stakeholders' and societal risk perceptions and performance expectations, agreed-upon building performance parameters for hazards, and understanding agreed performance objectives in the construction of a building. Meacham (2010) explains a risk-informed approach as measuring quantitative risk information; it is but one component of tolerable risk decision-making and not the sole basis for the decision. This must be balanced by societal costs and benefits, equity issues, cultural and political systems, and other influences on the regulatory environment to help inform decisions about building performance targets.

### **IRCC hierarchy**

Until recently, the basic structure behind many of the performance-based building regulations currently in use has followed the five-tiered hierarchy used by the Nordic Committee on Building Regulations in 1976 (NKB, 1976, 1978). However, since the introduction of the NKB model, it has been recognised that for performance-based regulations and design methods to be effective, there must be a logical and transparent relationship between top-level societal goals and objectives, more information to describe the level of performance and risk which a building is to achieve over a wide range of hazard events (Meacham, 2010).

As a result, the Inter-jurisdictional Regulatory Collaboration Committee (IRCC), a group comprising lead building regulatory agencies of more than 13 countries (see [www.irccbldingregulations.org](http://www.irccbldingregulations.org)), developed an eight-tiered performance-based hierarchy as shown in Figure 2.11 (Meacham, 1999, 2004a, 2010).

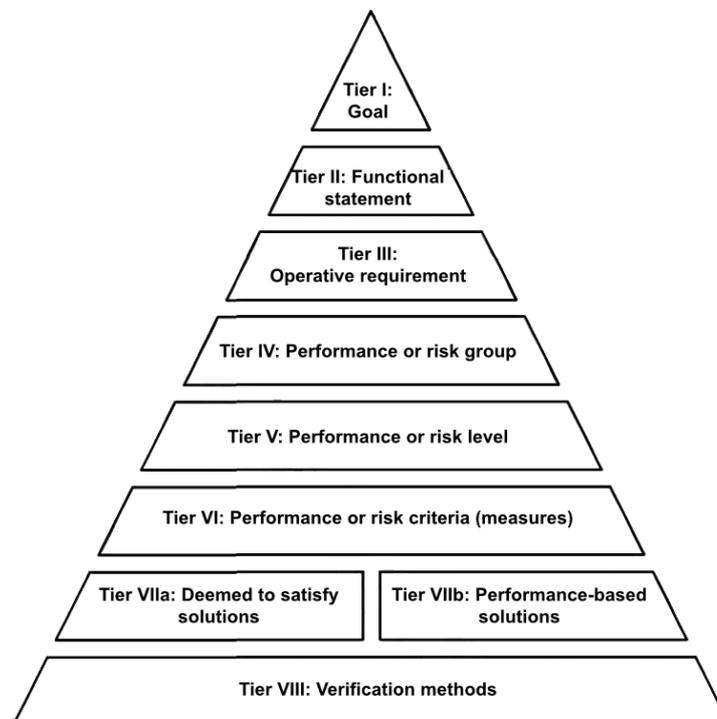


Figure 2.11: Eight-tiered IRCC performance-based building regulatory system hierarchy (Meacham, 2008)

The fundamental difference between the IRCC performance hierarchy and the NKB model is the inclusion of tiers for performance or risk groups, performance or risk levels, and performance or risk criteria (measures) within the IRCC model. These tiers were added to the hierarchy to illustrate how factors such as levels of tolerable building performance or risk, and importance of a building category to the community, are reflected in goals, functional requirements, and operative (performance) requirements (Meacham, 2010).

Meacham (2010) conceptualised the matrix of performance groups, hazard events and levels of tolerable impacts, as illustrated in Table 2.5, as the central feature. In brief Meacham explains, buildings with common risk characteristics, importance factors, and expected performance are categorised by performance groups. For any given event, magnitude such as “large”, the expected impact on the facility changes by performance group (PG); “Severe” impact is given for PG I (low risk to life/ importance), “High” for PGII, “Moderate” for PG III, and mild for PG IV (important buildings).

Table 2.5: Maximum tolerable impact based on performance groups and design event magnitudes (Meacham, 2008).

		Performance groups			
		Performance groups I	Performance groups II	Performance groups III	Performance groups IV
Magnitude of design event	Very large (very rare)	<b>Severe</b>	<b>Severe</b>	<b>High</b>	<b>Moderate</b>
	Large (rare)	<b>Severe</b>	<b>High</b>	<b>Moderate</b>	<b>Mild</b>
	Medium (less frequent)	<b>High</b>	<b>Moderate</b>	<b>Mild</b>	<b>Mild</b>
	Small (frequent)	<b>Moderate</b>	<b>Mild</b>	<b>Mild</b>	<b>Mild</b>

### **2.9.2 Risk-based building inspections**

In general, the risk-based approaches define the risk as a combination of the consequences derived from the range of possible failure, and the likelihood of these failures (Magnusson et al., 1995). Risk-based inspections (RBI) offer an evidence-based means of targeting the use of resources and of prioritising attention to the highest risks, in accordance with a transparent, systematic and defensible framework (Black & Baldwin, 2010). Similarly, Tan, Jianfeng, Zongzhi, Jianhu and Weifeng (2011) explain that risk-based inspection is an approach to prioritising and planning inspections, predominantly in the oil and gas industries. This type of inspection planning, analyses the likelihood of failure and the consequences of the same in order to develop an inspection plan (Bertolinia et al, 2009). RBI will assist an organisation to select cost-effective inspection tasks and techniques, to optimise such efforts and cost, to produce an auditable system, to give an agreed “operating window” to promote team work and to implement a risk- management tool (Tan et al., 2011). Black and Baldwin (2010) also add that risk-based regulation should not be seen as a free-standing and technical guide to regulatory intervention. Rather, it should be seen as a particular way to construct the regulatory agenda and as a control strategy that has to be combined with other control strategies in different ways across different contexts and regulatory tasks. Zhaoyang et al (2011) provides five purposes of risk-based inspections:

1. To move away from time-based (allocation of time slots) inspection often governed by minimum compliance with rules, regulations and standards for inspections.
2. To introduce a strategy of doing what is required for safeguarding integrity and improving reliability and availability of the asset by planning and targeting those inspections that are needed.

3. To provide economic benefits such as fewer inspections by adjusting inspections based on recent generations of inspections.
4. To safeguard integrity using a classic definition of risk, both the probability and consequence of failure under the support of a risk-specific code.
5. To reduce the risk of failure by considering operational conditions, failure records and inspection results.

The development of risk-based frameworks follows the pattern of many innovations (Black 2005b). Regulators have shared the detail of their frameworks and their experiences to other regulators through transnational networks such as the European Union Network for the implementation and Enforcement of Environmental Law, in the environmental context, or bilateral interchanges (Black, 2006). Models of risk-based systems are thus spread across regulators and modified each time. Black and Baldwin (2010) provide examples of the risk-based model of the Australian Prudential Regulation Authority (APRA) which was based on that of the Canadian banking regulator, the Office of the Superintendent of Financial Institutions (OSFI), and the UK financial regulator, the FSA. The UK's risk-based model of financial regulation has been adopted in countries as diverse as France and Columbia.

The frameworks vary considerably in their complexity. However, all have a common starting point which focuses on risks not rules. Risk-based frameworks require regulators to begin by identifying the risks they are seeking to manage, not the rules they have to enforce. The frameworks themselves have five common core elements, as described by Black and Baldwin (2010). Firstly, they require a determination by the organisation of its objectives – of the risks to what that the framework is desired to control. Secondly, they require a determination of the regulators' own risk appetite. For example, what type of risk is the organisation prepared to tolerate and at what level. Thirdly, risk-based

frameworks involve an assessment of the hazard or adverse event and the likelihood of it occurring. In general, two broad categories of risk are identified: (1) inherent risks arising from the nature of the business's activities and, in environmental regulation, its location; and (2) management and control risks, including a compliance record. Fourthly, regulators assign scores and/or ranks to firms or activities on the basis of assessments. These scores may be broadly framed into categories or traffic lights (high, medium, or low) indicating severity of risk. Lastly, risk-based frameworks provide a means of linking the organisation and supervisor(s), inspector(s), and often enforcement resources to risk scores assigned to individual firms or system-wide issues. In practice, resources do not always follow the risks in the way that the framework would suggest, but resource allocation remains a critical rationale for their development (Black & Baldwin, 2010).

## **2.10 Regulatory regimes**

One can think of a regulatory regime as a means for achieving regulatory goals (Hood et al. 2001; May 2002; Lodge 2004). A regime comprises an institutional structure and assignment of responsibilities for carrying out regulatory actions. The institutional structure is made up of rules that prescribe expected behaviours or outcomes, standards that are benchmarks against which compliance can be measured, a mechanism for determining the degree of regulatory compliance, and sanctions for failure to comply with the rules (May, 2007). Table 2.6 draws a contrast between traditional emphases on prescriptive regulations with newer forms of system-based and performance-based regulations. Each of these regimes entails a government role in setting forth regulations and enforcing them. They differ, however, with respect to the nature of the rules and standards and the means for gauging adherence to them.

Table 2.6: Comparison of regulatory regimes (May, 2007).

	Regulatory regime		
	Prescriptive regulation	System-based regulation	Performance-based regulation
<b>Regulatory foci</b>	Prescribed actions	Process or system	Results or outcomes
<b>Compliance determination</b>	Adherence to prescribed actions	Acceptable production system	Achieved of desired results
<b>Nature of rules and standards</b>	Particularistic and detailed specifications	Process-oriented specification	Goal-oriented outcome specifications
<b>Basis for achieving regulatory goals</b>	Adherence to prescriptions presumed to meet goals	Appropriate system controls are designed to meet goals	Regulatory goals are embedded in the results orientation
<b>Examples</b>	Dominant regulatory approach in the USA for environmental and social regulation	Aspects of food safety, industrial health and safety, nuclear power plant safety	Aspects of air and water quality, building and fire safety, energy efficiency, forest practices, pipeline safety

Table 2.7 summarises the qualitative and quantitative aspects of building regulatory regimes of some countries around the world. The hierarchy columns provide a cross reference among the regulations considered regarding how the upper levels of the NKB / IRCC hierarchy are defined. The “Quantitative values in Regs?” column is used to indicate whether quantitative values are within the regulations and are therefore enforceable. Structure indicates how the various regulations have been structured.

Table 2.7: Comparison of regulatory regimes (Beller et al., 2003).

Country	Hierarchy			Quantitative values in regs?	Structure
	1 <sup>st</sup> Level	2 <sup>nd</sup> Level	3 <sup>rd</sup> Level		
<b>Australia</b>	Objectives	Functional statements	Performance requirements	By reference	Objectives and functional statements are guidance level provisions and the performance requirements are compliance level provisions
<b>Canada</b>	Objective (and sub-objectives)	Functional requirements	Performance criteria	Yes	Two divisions: A contains objectives and functional requirements; B contains quantitative performance criteria and mandatory links. Connect A to B and B to A.
<b>Japan</b>	Objectives	Functional requirements	Performance requirements	Yes	Objectives, functional requirements and quantitative performance requirements are all included in the regulations. The regulations also include prescriptive solutions and procedural options for unique solutions.
<b>Netherlands</b>	Performance requirements and functional description together in a clause; performance requirements refer to a standardised determination method			By reference	All elements (objectives, functional requirements, performance level, determination method and links between elements of the regulation) are stated together in a Decree divided into chapters (usage functions: to be built and existing), divisions, paragraphs, sections, and clauses. Codes of practice are placed outside the regulations.
<b>New Zealand</b>	Objectives	Functional requirements	Performance requirements	Few	Objectives, functional requirements and performance requirements are the only provisions of the regulations.
<b>United Kingdom</b>	Objectives (in Building Act)	Functional or goal-based requirements	Performance statements (sometimes in guidance documents)	None in regulations but are in Approved (guidance) Documents	Objectives and functional requirements are mandatory, supported by detailed minimum standards in Approved Documents, with some performance standards for guidance.

Country	Hierarchy			Quantitative values in regs?	Structure
	1 <sup>st</sup> Level	2 <sup>nd</sup> Level	3 <sup>rd</sup> Level		
<b>United States: ICC</b>	Objectives	Functional statements	Performance requirements	Few	Objectives and functional statements and performance requirements contained in the regulations. Administrative provisions and design performance levels provided as guidance.
<b>United States: NFPA</b>	Goals	Objectives	Performance criteria	Indirect	Includes prescriptive and performance-based options. Body of document contains mandatory language including goals, objectives and qualitative performance criteria. Annexes contain explanatory material regarding several ways to determine if the criteria have been met.

### **2.11 Implementing risk-based regulatory policies**

The implementation of a new regulatory tool may be a difficult and long process, as the mould and holistic approach of established regulatory rule can be entrenched into people's behaviour. Rothstein et al (2006) explained that enforcement officers in the field may not fully comprehend new regulation approaches because new methods may conflict with existing policies and procedures. The full implementation of risk-based regulation as a government tool requires the buy-in from all key stakeholders. Some researchers have suggested that Government itself needs to take the lead role in writing these tools into legislation so that they become mandatory requirements. A study by Spence (2004) on regulations for construction of new buildings and code enforcement suggested that in middle-income countries (such as Pakistan and India), modern codes were not being implemented because they had not been made mandatory or because there was a lack of project supervision and building control.

The introduction of new legislation is backed by improving existing capacities (in the number of trained professionals able to implement the codes in design and to provide supervision) and the number of trained builders able to adopt the techniques involved. A ripple effect of these changes at the top level provides regulatory enforcers of these regulations greater confidence to implement change and trust in the system. Trust enables cooperation and is a productive approach to environmental regulation (Pautz & Wamsley, 2012). May (2004) suggested that higher-level influences shape the behaviour of caseworkers in implementing national policy reforms. Caseworkers are more willing to take on board national goals when it is clear that their immediate political principles endorse the change in legislation. From this perspective, regulatees comply because they fear the consequences of being found in violation of regulatory requirements (May, 2004). Kagan (1989) also suggested that this can be the case for officials who offend politically

significant government officials or influential high-profile private organisations; officials can face public criticism, financial implications and even replacement.

The caseworker must also fully understand the new policy being introduced so that regulatees are provided with the same information consistently around the region. May and Wood (2003) found that one major constraint that frustrates homebuilders is inconsistencies in what building inspectors require. Policy emphasis by caseworkers means they are influenced by their understanding of policy goals, professional knowledge, and policy evaluations (May & Winter, 2007).

When designed well, and piloted and implemented with feedback, risk-based regulation can provide a sound basis for distinguishing greater risks from lesser ones, and for investing resources in risk-management proportionate to the risks posed (Gouldson, Morton & Pollard, 2009). However, these regulatory processes may also incur risk, unless the consequences of resource trade-offs are fully understood and, for certain consequences, guarded against. In other words, whilst risk-based approaches promise better regulation, if they prioritise efficiency over efficacy they also risk contributing to regulatory failure with potentially significant impacts on human health and the environment. Risk-based approaches should be explored but in a precautionary way, where reductions in the efficacy or reliability of regulation are not risked in the pursuit of efficiency gains (Gouldson, Morton & Pollard, 2009). Yau (2009) and Spence (2004) recommended that to encourage people to use the new system, fees for the submission process for the regime should be considerably lower than those incurred in the conventional approach. However, Rothstein *et al.* (2006) found that implementing risk-based logic for decision-making purposes might impart a false sense of security, covering up uncertainties that may then be overlooked, which, in the long run, may have considerable negative consequences for stakeholders.

Pautz and Wamsley (2012) suggested a simple measure with a behavioural approach regarding trust. Many benefits stem from the presence of trust in regulatory relationships. Trust is likely to reduce resistance to regulation. A regulatee who is approached with distrust and hostility by a regulator may be less likely to comply voluntarily with regulations because the official will be predisposed to respond defensively. Without trust, expectations are low and neither party can rely on the other for support and flexibility in accomplishing the common goal. Therefore, regulatory requirements become more onerous and difficult to realise (Pautz & Wamsley, 2012). The willingness to comply is insufficient unless regulated entities are also aware of what is desired and are able to carry out the requisite steps: knowledge of rules, capacity to comply and potential complexities (Winter & May, 2001). The following section provides examples of regulatory policy initiatives implemented in overseas countries.

## **2.12 Implementation of risk-based building regulations abroad**

The introduction of new building incentives has provided many benefits and rewards to countries that are fully committed to their implementation. These incentives have resulted in the reduction of time, hassle and the cost of building projects. For the building regulation policy to be effective, building code enforcers must understand how it works and they must use it in combination with a facilitative philosophy of code enforcement. This will require on-going training and educational programmes for code officials as well as architects, structural engineers and other key stakeholders. Effectiveness may also require increasing pay scales to attract more highly trained staff who are capable of applying building regulatory rules in a facilitative, business-friendly manner (Burby, Salvesen & Creed, 2008). The following sub-sections provide examples of building policy models in different jurisdictions. The way the models are implemented are detailed in the different sections to show that countries are being smarter with their policy, and

targeting their resources in areas that require their full attention; these are key attributes of risk-based regulations.

### **2.12.1 Risk-based building regulations in the USA**

The International Code Council (ICC) has published a “Performance Code for Buildings and Facilities”. This document contains three parts: administrative, building and fire. The key element is, instead of providing specific references to building codes and standards or other applicable methods, criteria are provided to assist in the selection of an appropriate method for design (Beller et al., 2003).

Chapters within the ICC’s Performance Code contain specific objectives, functional statements and performance requirements. With the exception of some of the expected loads discussed in the performance requirements of stability chapter, there are no qualitative values. The ICC Performance Code has similarities to the New Zealand Building Code in that acceptable solutions and other means of verification are not contained within the regulations. Beller et al. (2003) suggested that the main difference is found in chapter 3 where further qualitative detail is provided in the form of levels of acceptable damage as they relate to different types and magnitudes of events.

The city of Orlando, in the United States of America, is most famous as the “home of the mouse”. The tourism and service economy spawned a large minimum-waged labour force which created a demand for low- to moderate-income housing. In 1988, Orange County estimated that 41 per cent of its households fit within the low- to very low-income range, and, faced with a housing shortage for this income group, Orlando created a task force in which the goal was to lower housing costs through decreased government regulations and delay (York, 1991). The Orlando programme protects public interests, yet expedites the review process.

York (1991) further suggested that, essential to the success of the Orlando affordable housing model, the streamlined review process provided by the Design Review Committee (DRC), has the authority to grant development approvals. The DRC, established through a developer's agreement, is accountable to the city council. The DRC provides a single forum for those city departments that have a role in the development approval process, thus avoiding conflicts that arise when different entities review the applications separately. The DRC can allow modifications of specific construction standards as identified in a developer's agreement. Its role is to optimise savings in certain design standards, streamline the development approval process, and coordinate development requirements. Both the private and public sectors are represented on the DRC which addresses the four areas of land development. The DRC is in charge of the inspection process. The development agreement grants the villages the right of inspection within four hours of notification but if the city cannot comply, the DRC can approve private inspections. The city retains the right of final approval over private inspections. Initially, the city inspectors had difficulty realising that this project was not business as usual and that exceptions were to be made.

In another part of the United States of America, Baltimore County (a neighbour of Howard County), one can hire a consultant whose sole function is to navigate the bureaucracy so people can avoid dealing personally with the often intimidating and confusing consenting process (Loesch & Hammerman, 1998). Together the Applied Physics Laboratory (Regulatee) and Howard County (Regulator) have worked out an alternative to the traditional process. Without forming this partnership, the Laboratory would need to obtain permits on a daily basis. This would be costly and time consuming for Applied Physics Laboratory (APL); issuing and inspecting such a volume would stretch the County's limited resources for checking building construction. Loesch and

Hammerman (1998) explained that the partnering system allowed APL the flexibility required for the continual in-house work to continue but at the same time, it assured the County that building regulation work had been carried out that was incorporated through a Master Building Permit. This permit relies on documented quality assurance systems that include procedures for design review, a system for verifying code compliance in construction documents, and an in-house inspection process with written certifications proving that completed work had been carried out in accordance with the approved plans and specifications.

The Department of Inspections, Licences and Permits of Howard County conducts occasional unannounced inspections and audits for which the quality assurance system provides the framework for the Master Plan. The Laboratory benefits from permission to make numerous alterations, modifications and repairs under a built-in quality-assurance process without the delay inherent in the traditional building permit review and approval process. The County benefits from the assurance that refurbishment and construction work is completed in compliance with building regulations and minimal expenditure of County resources (Loesch & Hammerman, 1998).

### **2.12.2 Risk-based building regulations in Hong Kong**

To promote a healthy and safe built environment, Hong Kong's Government enacts statutory standards in the form of ordinances, regulations and guidelines. After World War II, the Building Control System, a set of prescriptive or performance-based requirements of planning, design and construction, was established and gradually improved over time. The Building Control System controlled the registration authority personnel and contractors, the vetting and approval of building plans, issuance of occupation permits, monitoring of site works, and authority to cease, demolish or alter work. The Building Ordinance and the Building Regulations (Administration, Planning

and Construction) were statutory parts. The Code of Practice issued by Building Authority was a lesser grade of control and non-statutory (Zou & Xue, 2015).

Zou and Xue (2015) explain that the building control mechanism has been frequently reviewed and amended to meet changing needs for the purpose of social and economic leverage. Zou and Xue (2015) suggest the evolutionary history of building control in Hong Kong and the experiences of legislation and its implementation may be useful in other jurisdictions. The history of Hong Kong's Building Control System, that spans nearly 200 years, is presented in Table 2.8.

Table 2.8: Phases and evolutions of building control, Source: Hong Kong Government Gazette (Imported from Zou & Xue, 2015).

Phases	Enacted time	Name of ordinance
I. Building control closely relate to public health	1856 No. 8*	Building and Nuisance Ordinance
	1883 No. 7	Order and Cleanliness Amendment Ordinance
	1887 No. 24	Amendment of Public Health Ordinance
	1889 No. 15	Building Ordinance
	1891 No. 25	Building (Amendment) Ordinance
	1894 No. 15	The Closed Houses and Insanitary Dwellings Ordinance
	1895 No. 7	Buildings (Amendment) Ordinance
	1899 No. 34	Insanitary Properties Ordinance
	1901 No. 30	Buildings Amendment Ordinance
	1903 No. 1a	Public Health and Building Ordinance
	1908 No. 14	Public Health and Building Amendment Ordinance
	1927 No. 6	Public Health and Building Amendment Ordinance
	II. Building control basically self-contained	1935 No. 18*
1936 No. 2		Building Amendment Ordinance
1941 No. 12		Building Amendment Ordinance
III. Building control overhaul and supplement	1955 No. 68 (operated 1956 G.N.A 45)*	Building Ordinance (3 Regulations: Administration, Planning, Construction)
	1959 No. 44	Building Amendment Ordinance
	1962 G.N.A.97*	Building (Planning) (Amendment) Regulations
	1967 L.N. 91	Building Ordinance (Application to the New Territories)
IV. Building control system mainly finalised	1969 L.N. 54	Building Amendment Ordinance
	1972	No. 71 Building Amendment Ordinance
		L.N. 235 Building (Amendment) Ordinance (Application to the New Territories)
	1979 No. 24	Building Amendment Ordinance
	1980 No. 72	Building Amendment Ordinance
	1982 No. 41	Building Amendment Ordinance
	1987	No. 57 Building (Amendment) Ordinance
		No. 60 Building Amendment Ordinance (Application to the New Territories)
V. Building control system gradually amended	1990 No. 91	Building Amendment Ordinance
	1992 No. 42	Building Amendment Ordinance
	1994 No. 77	Building Amendment Ordinance
	1996 No. 54	Building Amendment Ordinance
	1997 No. 36	Building Amendment Ordinance

\*Important points of buildings control system evolution

In most jurisdictions, central or local government was traditionally the key regulatory figure with regard to building control (Johnston, 1992). These public authorities were responsible for various processes, including the vetting of building proposals, issuance of work permits, monitoring of building and demolition works and the final check of completed building work. In spite of this long-standing government-centred, command-and-control tradition, the government started deregulating building control in response to the new public management doctrines such as deregulation and wider private-sector involvement in the late 1970s and throughout the 1980s (Yau, 2009). In the early 2000s, as noted by Visscher and Meijer (2007), there was an increasing trend in European countries to extend the category of exempted or permit-free building works.

It is further suggested by Visscher and Meijer (2007) that the certification of building works by the private sector had been instigated by governments in some countries (such as Australia and the UK) as part of their increasing commitment to the decentralisation of building control. A statutory framework relating to private certification was therefore installed in the Building Act 1984 in Hong Kong. Under this new arrangement, a property owner could appoint an approved inspector to take responsibility for plan checking and inspection of the work. To initiate the process of private certification, the property owner and approved inspector were required to jointly notify the local authority of the intended work. Once the initial notice had been accepted by the local authority, the approved inspector then undertook responsibility for it (Pitt, 1984; Office of the Deputy Prime Minister, 2005) to:

- give the property owner advice on how the building regulations apply to the proposed building work
- check the plans of the proposed building work

- issue a plans certificate to the property owner to attest that the plans of the proposed building work complies with the requirements laid down in the building regulations
- inspect the work in progress
- issue a final certificate to the local authority to confirm that the work referred to in the corresponding initial notice is completed in accordance with the prevailing building regulations

Yau's (2009) study into the effectiveness of the proposed private certification of building works in Hong Kong provided responses from building professionals generally supporting the new system. Concerns were expressed by professional institutions (for example, architects, building surveyors and structural engineers) and trade associations in Hong Kong on clarification about the definition of work, the competence of technical stakeholders and the delineation of responsibility (Yau & Chan, 2008). In 2003, the Hong Kong Government proposed a new control regime to streamline the process of building proposal approval by allowing private-sector practitioners to certify certain types of minor building work.

Yau (2009) suggested that the proposed regime was generally perceived as having the capacity to speed up the process of building proposal approval whilst also improving overall standards of building performance in Hong Kong. Concerns were, however, expressed by professional institutes about the clarity of the definition of minor works, and about the level of competence on the part of the private certifiers. Respondents also expressed concerns over the adequacy of government support offered to private certifiers or property owners under the proposed system. Under section 14 of the Building Ordinance (Chapter 123 of the laws of Hong Kong) a building proposal had to be approved, and consent to commence work obtained prior to starting any building work. A property owner had to obtain an authorised person (AP), for example an architect,

structural engineer or building surveyor registered under the building ordinance, to coordinate any building.

At that time, private certification was simply one of many possible measures for streamlining the property development process. In February 2006, the task force commissioned Babtie Asia Limited to undertake a consultancy study on the private certification of building submissions. Their final study report highlighted a number of issues that would have to be properly addressed (Yau, 2009). These included the independence of private certifiers, consistency in applying building standards by private certifiers, the commercial viability of private certification, availability of professional indemnity insurance to private certifiers, and public confidence in private certification (Construction Industry Council, 2007). The task force recommended that private certification of building submissions should not be continued.

The Provisional Construction Industry Co-ordination Board (PCICB) suggested that the definition of “minor works” within the new system could be more clearly defined as there was currently a lack of guidance as to what kinds of building work should be classified in this way. Yau (2009) suggested that it was necessary for the government to provide a clear definition of “minor works” with allowable dimensions and locations of the works clearly specified in the revised building regulations. The proposed self-certification approach should be backed up by rigorous: monitoring, inspection and strong enforcement powers. A rigorous audit regime is also required. (Yau, 2009)

Self-certification without any post-monitoring and spot-checking was thought to result in the slippage of standards over time (Department for Communities and Local Government, 2008). Yau (2009) further suggested encouraging more people to use the new system, and that the municipal fees for the submission process for minor works should be lower than the conventional approach. Regarding the professional competency of technical personnel,

the government should set stringent minimum-experience thresholds during the registration process. In addition, the continued training or professional development should be a mandatory requirement for qualification renewal. Building information kept in building departments should be easily accessible to prescribed professional and contractors.

To boost the confidence of the general public, education about the new application process requires an extensive promotion campaign, including organising public seminars and workshops, and publishing guidance capable of being understood by non-professional readers. Advisory centres and hotlines could be set up to answer public enquires. As with the situation in England and Wales, the Hong Kong Government's original aim of making the private sector responsible for the certification of building submissions for all types of development did not initially receive wide acceptance from industry. The Government has introduced reforms that restrict the scope of private certification to minor works; the relevant bill was passed in late 2007.

### **2.12.3 Risk-based building regulations in Australia**

The present building control system in Australia is one in which the individual six state and two territorial authorities administer a set of generally uniform technical provisions through individual state and territorial legislation. The individual authorities are represented on the Australian Building Codes Board (ABCB). The ABCB is responsible for the development of the Building Code of Australia (BCA). The Building Code of Australia, published in 1990 (BCA, 1990), was a prescriptive code up to October 1996 when the ABCB launched the new performance-based Building Code of Australia 1996 (BCA, 1996).

In the Australian state of Victoria, consumers have the choice between engaging a municipal building control officer and seeking the same service from a private building

control surveyor known as a private certifier. All private certifiers have the same responsibilities and are allowed to carry out the same tasks. Private certifiers have to meet criteria set by the Building Practitioners Board, an independent regulatory agency whose stakeholders represent private-sector organisations (van der Heijden et al., 2009). A private certifier is responsible for managing the building consenting or approval process with all relevant practitioners, with all building work complying with the building assessment provisions of the Building Act 1975 (BA75). Building Certifiers are required to undertake sufficient inspections of buildings at intervals at which the building development approval states the work must be inspected. The Building Regulations 2006 (BR) require mandatory inspections for more simple buildings and structures, such as houses (Class 1a buildings), sheds and garages (Class 10 buildings and structures). The BR do not currently provide a similar inspection schedule for class 2 to 9 buildings (which include multi-storey residential buildings, office buildings, shops, public halls and commercial and industrial buildings).

### **A risk-based approach to inspection of class 2 to 9 buildings**

In 2012, the Queensland Government, through their Department of Housing and Public works, released guidelines for a risk-based approach to the inspection of class 2 to 9 buildings. The guidelines objective is to provide practical and effective methods for private building certifiers to meet their statutory duties and obligations. A risk matrix, with examples of suggested applications to particular buildings, forms part of the guidelines and complements the risk-based approach. The size, complexity and nature of some class 2 to 9 buildings means it is not practical for a building certifier to inspect every element of the building for compliance with the building assessment provisions of the BA. An inspection schedule that relies on prescriptive, itemised checklists may not sufficiently address the varying complexities that exist between class 2 to 9 buildings. This could lead to instances where low-risk buildings are over-inspected (significantly

adding to costs and delays) and high-risk buildings are under-inspected (increasing the risk).

A best practice process of inspections of class 2 to 9 buildings should directly address the risk of the building. A risk-based approach allows private building certifiers to assess the overall view of the safety requirements of a building, and establish an inspection schedule.

**Risk matrix: a tool for establishing a sufficient inspection schedule for class 2 to 9 buildings**

The use of a risk-based approach to developing and implementing a sufficient inspection schedule can be achieved through a risk matrix that assigns buildings a rating based on certain criteria. The risk rating assists the building certifier to determine an inspection schedule, including the type and frequency of inspection required. The risk matrix identifies three risk categories: low, medium and high. To establish the risk level, a building is assessed against five risk factors. Each risk factor contains broad criteria against which to compare buildings. The risk matrix is provided in Table 2.9. An assessment flow chart for building certifiers is provided in Figure 2.12.

Table 2.9: Risk Matrix for establishing a sufficient schedule for class 2 to 9 buildings (DHPW, 2012).

Risk factor	Risk level		
	Low risk	Medium risk	High risk
<b>Building classification</b>	Building is a class 2, 3 or 4 (part of a building), 5, 6, 7 or 8 and is less than three storeys high.	Building is class 2, 3 or 4 (part of a building), 5, 6, 7 or 8 and is more than three storeys high.	Building is class 9 or of any class determined to be of importance level 3 or 4 in accordance with the BCA.
<b>Height / floor area</b>	Not greater than three storeys above the ground.  Fire compartments do not exceed the provisions of BCA Table C2.2.	More than three storeys above ground but not more than 25 metres in height.	Contains fire compartments exceeding the provisions of BCA Table C2.2. More than 25 metres in height.
<b>Alternative solutions</b>	No alternative solution. Proposal meets deemed-to-satisfy provisions of BCA.	Incorporates alternative solution not involving fire-safety systems.	Incorporates alternative solution involving fire- safety systems.
<b>Experience of the design and building team</b>	Practitioners designing and constructing the building have been involved with more than three buildings of the same classification.	Practitioners designing and constructing the building have been involved with, and completed, fewer than three buildings of the same classification.	Practitioners designing and constructing the building have no previous experience relating to the proposed classification or building type.
<b>Climate conditions</b>	Area is not impacted upon by known risk e.g. flood, bushfire, earthquake, cyclone, landslip.	Area has known risks e.g. flood, bushfire, earthquake, landslip, contaminated land.  Building is not class 9.	Area has known risks e.g. flood, bushfire, earthquake, landslip, contaminated land.  Building is not class 9.

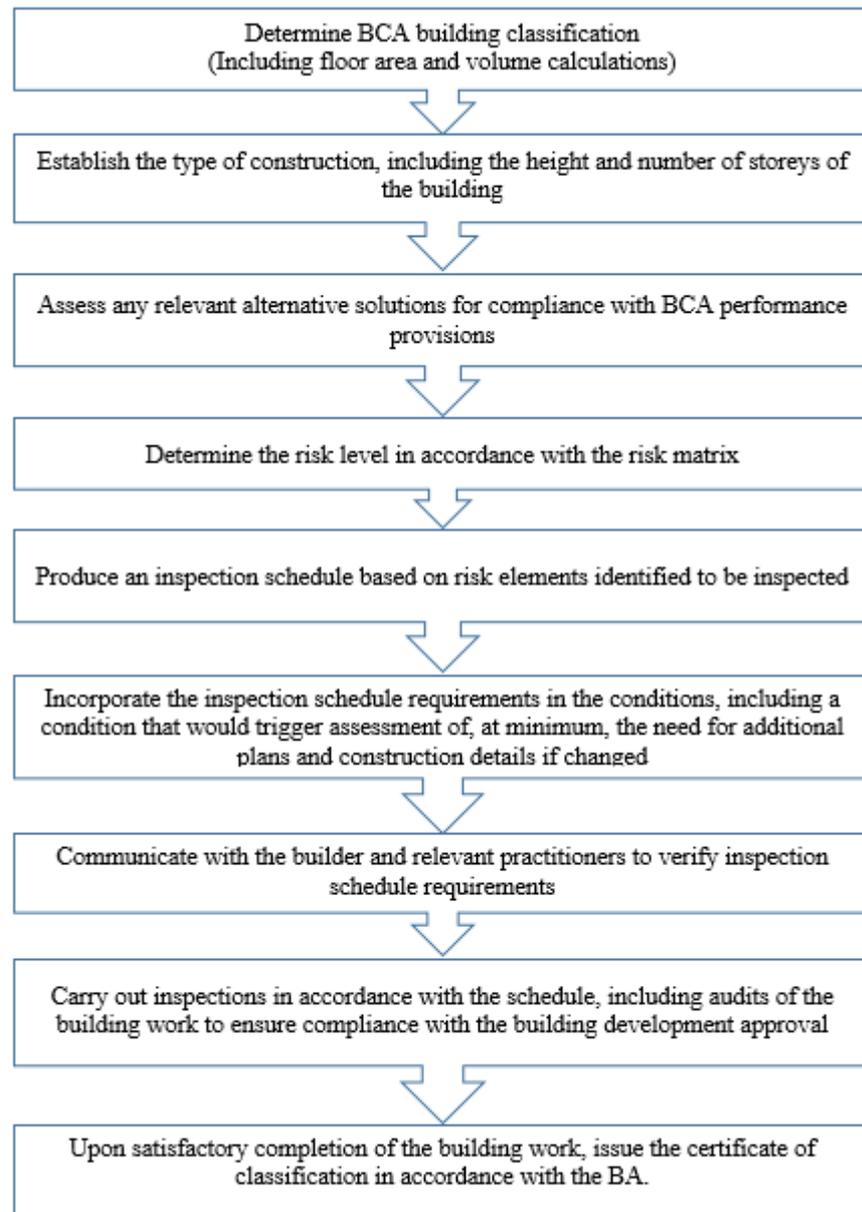


Figure 2.12: Assessment flowchart for building certifiers (DHPW, 2012).

#### 2.12.4 Risk-based building regulations in the United Kingdom

The building industry in the UK bears striking similarity to New Zealand's in structure and state. The UK has been experiencing a severe housing shortage for many years. The number of households has increased as demographics have changed. This exacerbated the shortages when production dropped to its lowest levels since World War II (Buckett, 2013). Some 225,000 houses a year were forecasted to be required in the UK in the lead up to 2016; however, in 2001, only 173,100 homes were constructed (Goodier & Pan, 2013, Buckett, 2013).

In England and Wales, building regulations are based on functional, or goal-based, requirements. The Building Regulations 2010 are made under powers contained in The Building Act 1984, as amended. They set out what is controlled building work, typically the erection, extension or alteration of a building, or controlled service or fitting as well as certain changes of use. Like many international building regulations, they set minimum standards for design and construction of buildings, primarily for the purposes of people's health and safety, energy efficiency and accessibility. The building codes are performance based, in terms of what is reasonable, adequate or appropriate. The building control system helps to ensure that the required level of performance has been achieved. The role of building control, either in the form of the local authority or a private sector Approved Inspector (AI), is to perform as an independent third party check to encourage regulatory compliance which is usually conducted through plan checking and/or onsite inspections. The introduction of building control competition in 1985 was primarily to encourage efficiency but also to enable building contractors who operated across different local authority areas, to be able to deal with a single building control provider if they wished to do so. A statutory framework relating to private certification was therefore installed in The Building Act 1984.

The main difference between the two building control providers is that only local authorities can take formal legal enforcement action. The Building Act places a statutory duty on local authorities to provide a building control service in which they must approve or reject a full plan application within a specified time limit. For AIs, there is no statutory duty to provide a building control service so the relationship between AI and the person carrying out the work is governed by their contract. In addition to third party checking by building control, certain types of construction (where the volume is high and the risk associated with non-compliance is low) may be deemed compliant by the installer where

a member of a competent person self-certification scheme is and has been assessed as competent to do so. Since its introduction in 2002 this voluntary “self-regulation” approach has proved a successful alternative, and the range of work covered has expanded significantly (DCLG, 2012). In England and Wales, a competent person scheme for the installation of electrical, plumbing, heating and hot-water services are all self-certified by a competent person as an alternative to submitting a building notice or using an AI (DCLG, 2012).

In 2010 the Department for Communities and Local Government invited external partners to submit ideas and evidence on possible changes to the building regulations and the building control system that supports the regulations. The emphasis was on areas where deregulation and/or a reduction was burdensome, whilst delivering high levels of compliance. The proposals were grouped and considered in detail under five sections in the impact assessments that each set out the costs, benefits and preferred options. They were:

- improving local authority building control processes
- improving private sector Approved Inspector arrangements, including removing the Warranty Link
- augmenting the range of enforcement options
- extending the competent person self-certification scheme’s framework and introducing specialist third party certification schemes
- introducing the option for developers to use “Appointed Persons” to act as compliance co-ordinators on construction sites

### **United Kingdom statutory notifications**

In the UK, owners and agents are required to notify their local authority on certain notifiable inspections. The local authority provides the building control function. Owners/agents are required to notify the local authority that work has reached a certain

stage in the building process. “Statutory notifications” alert the local authority to decide whether it needs to inspect the work; the builder needs to wait up to two days for the inspection. The UK system has nine statutory notification stages, as shown in Table 2.10.

Table 2.10: Statutory notification stages (DCLG, 2012).

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<b>Stages</b>	<b>Statutory notification</b>
1.	Intention to start to work
2.	Intention to commence work which will cover up any excavation for a foundation
3.	Intention to commence work which will cover up any foundation
4.	Intention to commence work which will cover up any damp-proof course
5.	Intention to commence work which will cover up any concrete or other material laid over a site
6.	Intention to commence work that will cover up any drain or sewer to which the regulations apply
7.	Completion of work which involves laying, haunching or covering any drain or sewer in relation to where a requirement is imposed by the drainage and waste disposal requirement of the regulations
8.	Intention to occupy a building or part of a building before completion
9.	Completion of the work

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Notification would only be required where it applied to work being carried out. In relation to the New Zealand building consent model, the statutory notification stages are mandatory for all building work, whether large or small, but the UK model has a provision that if there was no response from the authority within two days of the notification, work could continue.

### **UK inspection service plan: for dwelling houses and low-rise flats**

In January 2012, the Department for Communities and Local Government (DCLG) issued a consultation seeking views on proposals for changes to technical and procedural aspects of the building regulations to ensure they were fit for purpose. The proposal had a

particular focus on reducing the regulatory burden and delivering even better levels of compliance (DCLG, 2012). Inspection service plans were introduced because of changes to building regulations that came into effect on 6 April 2013 (UK, The Building Act 1984, Building (Amendment) Regulations 2012). The requirement to notify the local authority at prescribed stages of the building process has been changed. It is still a requirement to notify the local authority two days before commencement of work on site and not more than five days after work has been completed. Regulation 16 of the amended building regulations now states the local authorities can specify notices of any other stages of construction when it considers a site inspection is necessary. The approach adopted is based on the DCLG document, 'A risk-assessment tool for building control bodies: final risk- assessment guidance', January 2012 (DCLG, 2012). This DCLG document sets out the process local authorities should follow when developing inspection service plans for any building project. The inspection service plan takes into account:

- the type of building work proposed
- the size and complexity of the work
- risks to compliance with building regulations
- the builder's experience
- ground conditions

The local authority may vary the inspection service plan if unforeseen circumstances arise that could affect compliance with the building regulations. The type of building and the experience of the builder will contribute to how many site inspections will be required to be carried out on projects. The inspection service plan identifies the stages that the local authority will need to inspect before work commences. The owner is therefore responsible for notifying the local authority for inspections at each stage to ensure that the building project complies with the building regulations (LABC, 2014).

### **2.12.5 Risk-based building regulations in New Zealand**

Risk-based concepts in New Zealand have been brought into the construction sector as government initiatives to improve affordability and productivity in the housing sector. The following sub-sections provide a background of existing risk-based concepts applicable in the New Zealand residential environment.

#### **DBH Simple House (Acceptable solution)**

One government initiative to improve the affordability, and present the residential housing sector in a straightforward, deemed-to-comply route for the building consent process was the implementation of the ‘Simple House’ design (Joiner, 2009). In 2010, the Department of Building and Housing introduced the ‘Simple House (Acceptable Solution)’ which is a compliance document containing acceptable solutions for single-storeyed, stand-alone household units. The new compliance document is intended to encourage market-based solutions for simple houses and to provide opportunities for cost savings for designers and owners, through a simplified design and consent process. Joiner (2009) suggests that the simple house design will minimise risks to health and safety, and sets appropriate standards of building quality, without inhibiting creative design. It meets industry preferences and government priorities for streamlined and simple house solutions under the New Zealand Building Code (Joiner, 2009).

#### **National multi-use approval (Known as a MultiProof)**

The national multi-use approval is a statement by the Ministry of Business, Innovation and Employment (MBIE) that a set of plans and specifications for a building complies with the New Zealand Building Code (MBIE, 2013). The approved plans and specifications may include the proposed procedure for inspections. Under the Building Act 2004, BCAs must accept multi-use as evidence of Building Code compliance. Multi-use allow builders who replicate the same or substantially similar buildings several times

to benefit from a streamlined building consent process. This avoids the need for BCAs to assess and re-approve the design proposed to be built on different sites. Multi-use approval should lead to a faster processing time, reduce duplication for builders and lower consenting costs. However, because the BCA only needs to assess the building code compliance of site-specific features excluded from the multi-use consent, there is a statutory timeframe of 10 working days instead of the usual 20 for BCA to issue consent.

### **Review of the Building Act: risk-based consenting**

In August 2009, the Government announced a review of the Building Act 2004 to investigate how the Act could be updated to minimise the cost of compliance without compromising the quality of building and construction. The review found that there were weaknesses such as consumer protection in certain parts of the system, and the system was out of balance. The regulatory setting resulted in an unduly low tolerance for risk, with a strong emphasis on central and local government protecting homeowners from the risks of building defects and failures (Department of Building and Housing, 2010).

The proposed risk-based (“stepped” or “streamlined”) building consenting process which forms part of the Building Amendment Act 2012, in contrast to other legislation in this Act, has not been implemented as the Government has emphasised that it will not come into effect until the construction industry is ready. The Licensed Building Practitioner scheme is in its ninth year. Indications are that risk-based building consents are on the horizon. The legislation will introduce four types of building consents in which applicants will be able to align their project, according to the criteria and parameters of building work involved. The four types of building consents are: 1) low-risk residential, 2) simple residential, 3) standard, and 4) commercial. Applicants will also be required to provide the BCA with risk profiles and quality assurance systems for projects whose criteria the government has yet to specify. The implementation of this scheme will relax the number

of notifiable inspections by the BCA and provides for review and inspection by third parties.

The principle of less BCA involvement (and more but limited private sector involvement) in minor work and “low-risk” housing is seen as desirable if it meant ratepayers are less burdened, from a resource and liability perspective, and if resources could be freed up for the more complex, high-risk projects requiring the full weight of BCA scrutiny and attention (Murphy, 2012). At the time of the current study, the definitions and regulations of this scheme had not yet been released. Figure 2.13 provides an overview of the balanced, risk-related building control system (DBH 2010).

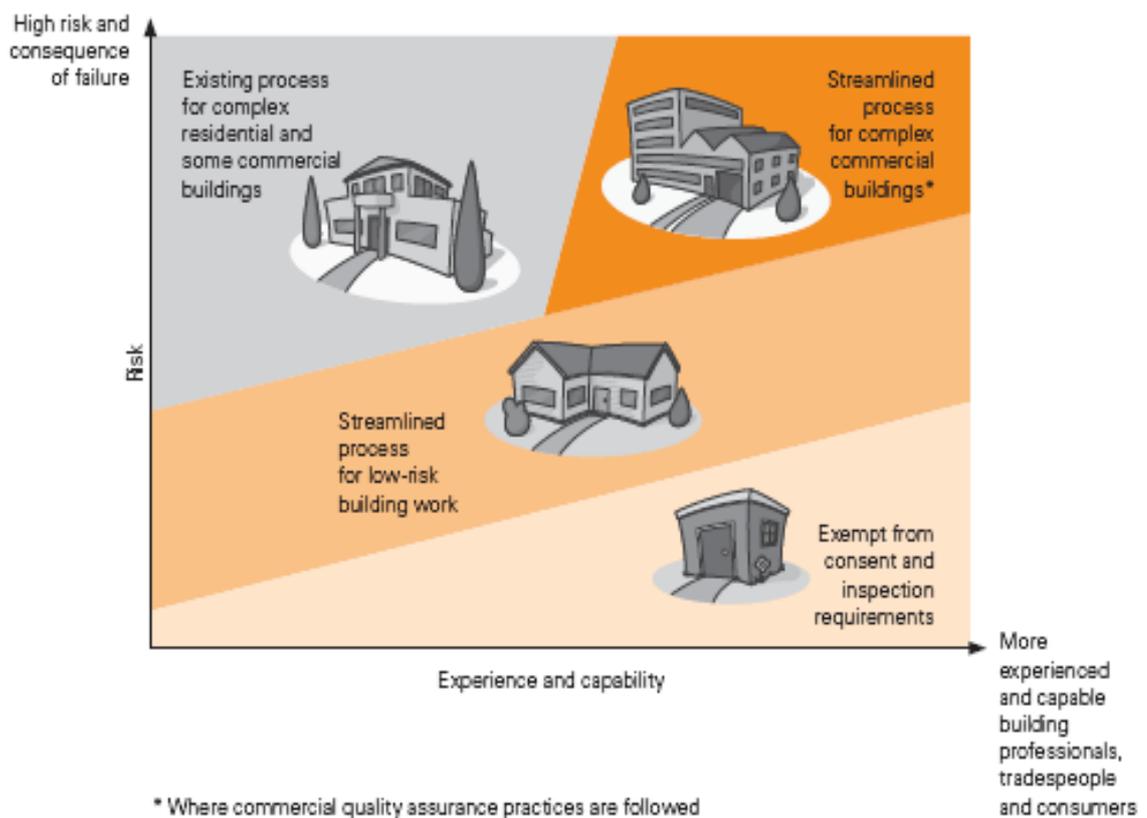


Figure 2.13: Overview of the balanced, risk-related building control system (DBH 2010)

It appears from these different types of consents that the scope of the BCA’s duty of care will become user pays. For lower-risk building projects, a person could make use of the

cheaper low-risk application process but would not be able to hold the BCA liable if the building project goes awry due to an unperceived fault in the plans.

This scheme has a major impact on the roles of construction stakeholders in New Zealand. The different types of consents provide applicants with two options: to take the risk of paying a lower fee for no regulatory input, and taking on more liability or standing than with the status quo. If issues arise in the future, the "duty of care" (Invercargill City Council v Hamlin, 1994) placed on councils would come into play during the disbursement of costs for repairs if negligent inspection was part of the cause.

In New Zealand, the transition of building-consent authorities adapting to risk-based inspection is sporadic, with Auckland and Christchurch utilising this tool to cope with demand on the consenting regime. In 2013, the Christchurch City Council implemented a pilot scheme of a risk-based (stepped or streamlined) building-consent process in lieu of the Building Amendment Act 2012 and, despite other parts of the Act coming into force, the risk-based process still remains inactive. The Council would determine what buildings would qualify and set prescriptive parameters for applications. Applications that did not meet the standard were reverted back to the status quo of the 20-day consenting process from the Building Act 2004. Those that were successful were able to fast-track their building projects and, where a request for further information was required and the issue was minor, a phone call was made instead of a formal letter for further information.

A review of the process showed that the average processing time for applications for low-risk building consents was four hours; all consents were processed within 24 hours of lodgement. During the piloting of this scheme in Christchurch, the BCA lost its accreditation to issue building consents and has had to endure multiple restructures of the

organisation. At the time of this study, no official records could be produced on the monitoring of the scheme.

Auckland Council's Building Controls have a similar process. They have now introduced it to their customers. Under a memorandum of understanding (MOU) the criteria and expectations that both parties would be privileged to be agreed upon. This is supported by Imrie & Street's (2009) findings in that the use of the MOU is seen as an important instrument in establishing communication between project team members. The practice of using an MOU is important when working with consultants whose lines of communication between different members of the team are often unclear.

The individualisation of risk is also occurring through the adoption of 'risk-sharing behaviour', more commonly known as risk-spreading, whereby risk is allocated to different members of a project team (Imrie & Street, 2009). The objective is to achieve partnership in providing a fit-for-purpose product, on time, and without compromising quality. Organisations are pre-approved by the Council and are able to participate but are monitored on their performance in order to remain on the scheme. The building consents were either granted or refused within a timeframe of usually two to five working days. At the time of the current study, Auckland Council was transitioning to a follow-up process, "Consenting made easy (CME)" which combines further regulatory departments involved in the process, most notably resource consenting and water care services. The objective of Consenting Made Easy was "*An easy, efficient, and consistent integrated consenting experience for our customers*" (Auckland Council, 2016).

### **2.13 Establishing the knowledge gap**

This section brings together all the knowledge accumulated from the existing literature on risk-based regulations in residential building construction. The section summarises the key issues that have been raised in chapter one and the present chapter from background

readings, a review of the literature, and document analyses. The summary of the two chapters joins the two main questions outlined in section 1.4, chapter one. The questions began with a review of the existing situation and concluded with the identification of the research problem and knowledge gaps.

Firstly, a significant search of the literature has shown that there is an absence of New Zealand-related research on risk-based inspections as a regulatory tool. There are no records to show what impact the risk-based model will have on the New Zealand construction industry or any other significant details which might provide insight into the ways and means of ensuring that responsibility sits in the right place (DBH, 2010). Thus, allocating risk to those who are in the best position to deal with potential problems and failures (Williamson, 2010), while encouraging productivity in the construction of new homes. The inevitable result of such an incomplete record of accountability makes it difficult to allocate risk for New Zealand's construction industry stakeholders. The availability of such industry-wide standards could encourage construction organisations to share best-practice processes, systems and initiatives, and learn from the experience of others (Fayek, et al., 2003).

Secondly, very little or no research has been undertaken to determine the level of understanding of key stakeholders of the building-consent process. Through the review of the residential construction environment, it is evident that Building Consent Authorities are under pressure and this holds up productivity (MBIE, 2013). The need to address this industry-wide issue is important to all parties in the building construction field. The review of the current building-consent system, and gauging stakeholders' opinions, would enable tools and processes to be put in place that could encourage not only best practice but identify opportunities where improvements could be made to the

house building process. Therefore, engaging the construction industry's stakeholders to improve productivity is one of the key reasons for embarking on the current study.

Finally, risk-based inspection models as a building production tool have not been as widely adopted within the new residential house-building sector in New Zealand. Even though risk-based inspection pilot schemes were conducted in Christchurch and Auckland. Both pilots have not provided substantial evidence or documentation of its operations due to Christchurch pilot being dis-continue and the Auckland pilot still in its infancy. The discontinuation of the Christchurch risk-based pilot scheme due to the pressure and issues post the 2010 and 2011 earthquakes and Auckland's steady progress provides a need to ascertain the feasibility for a risk-based system. Literature analysis shows that there is a lot of research on using risk-based processes as a regulatory tool that have been implemented around the world. The USA created a task force in which the goal was to lower housing costs through decreased government regulation and delay (York, 1991). The result was a streamlined building-consent review process under the "Orlando affordable housing model".

Hong Kong and Australia delved into the private certification model in which building control surveyors known as "private certifiers" have the same responsibilities and are allowed to carry out the same tasks as government building inspectors (Yau, 2009 & Van der Heijen et al, 2007). Visscher and Meijer (2007) support this view by explaining that the certification of building works by the private sector has been instigated by governments as part of their increasing commitment to the decentralisation of building control.

More recent developments in the study of risk-based regulations in residential housing construction include the United Kingdom's Building Act 1984. Building (Amendment) Regulations 2012 (implemented in 2013) removed the statutory requirement to notify a

local authority at specific stages during construction, instead enabling local authorities to set out what they requires of those undertaking building work. The UK regulations also require that building stages are based on the intention to inspect and the assessed risk of non-compliance with building regulations. All these overseas studies show the implementation of risk-based regulatory tools as a viable solution to reducing government intervention, while increasing construction sector productivity. The similarities within the UK and New Zealand building-consent processes heighten the need for countries like New Zealand to examine how they could improve their building production processes through the introduction of risk-based tools. As feasible as the risk-based tool may appear, it is required that the implementation of the tool be encouraged across all levels. Every stakeholder in the building consent process must be on-board with the tool so that the real benefits can be realised. As was indicated in previous literature, the implementation of legislation requires the following attributes to be successful;

- 1) attitudinal changes throughout (Rothstein, et al., 2006)
  - 2) trust and cooperation within and between stakeholders (Pautz & Wamsley, 2012)
  - 3) management influence (May, 2004)
  - 4) training and awareness of regulatory tool (Chan & Kumaraswamy, 1997)
  - 5) enforcement of regulatory tool (Spence, 2004)
  - 6) consistency in decision making (Wood, 2003)
  - 7) resourcing and supporting of tool ( Gouldson, Morton & Pollard, 2009)
- A particular benefit of adapting risk-based regulations would be a regulatory system that is administered in an efficient and cost effective manner and the allocating of government resources to those areas subject to a high risk of failure. This, in turn, would allow good



The primary aim of this research is to evaluate risk-based inspections for their effectiveness as a Building Consent Authorities' tool in New Zealand, and to seek challenges and opportunities for the implementation of a new system. The following questions were formulated to help achieve the overarching aim of the study:

1. What are risk-based inspections and what impact will they have on the New Zealand construction industry?
2. How will the implementation of risk-based inspection affect building consent authorities and construction stakeholders?

The key research questions presuppose that there are problems with the existing building inspection process, and the uncertainty of the implementation of a new building regulatory policy to address this issue. The research study has identified some of these problems and provides some possible solutions to the problems specific to building regulations, the current building inspection process and risk-based regulations that are the focus of the current study. It is envisaged that this research will set the foundation for future studies and also contribute to the current body of knowledge.

Some of the key issues that were studied are presented in the left-hand column, Table 2.11. The knowledge gaps which the current study desires to address are presented in the right-hand column.

Table 2.11: Summary of knowledge and knowledge gaps

	<b>Knowledge Contribution</b>	<b>Knowledge Gap</b>
<b>Building regulations</b>	Promote a regulatory system that is administered in an efficient and cost-effective manner. Existing legislation use and understanding. Risk-based models.	Articulation of the nature of legislative problems. Limited suggestions re solutions, especially from stakeholders' perspective. Limited knowledge on stakeholders' uptake of existing legislation documents Applicability of the UK model in New Zealand.
<b>Building consent process</b>	To ascertain problems with ensuring responsibility sits in the right place throughout the building consent process. Building inspection process and statutory requirements. BCA resources. BCA improvements.	Limited knowledge of the building inspection process's bottlenecks. Implication of inspection delays on construction projects. Limited knowledge on consequences of BCA resource shortages. Limited suggestion of solutions, especially from stakeholders' perspective.
<b>Risk-based regulations</b>	Understanding risk-based inspections. Risk-based inspection as BCA's permanent tool. Risk-based inspection implementation. International risk-based regulations.	Clarity in responsibilities and arrangements to deal with the transition to risk-based inspections. Lack of information for risk-based regulation to stakeholders. Operation and coordination of the full implementation of risk-based regulations. Limited knowledge of risk-based regulations from stakeholders' perspective. Lack of information of international jurisdiction practising risk-based regulations.
<b>Other Issues</b>	NZ construction stakeholders. Demand of housing in the largest cities in New Zealand.	Limited knowledge of stakeholders' opinions on legislative changes.

## **2.14 Summary**

This chapter has reviewed the literature on the subject of risk-based regulations and risk-based inspections in the construction industry. It has provided examples of regulatory intervention from abroad and how they have impacted the productivity of residential construction in those countries.

In addition, the chapter presented the challenges and pressures on the New Zealand residential construction sector, focusing on BCA in high supply-and-demand areas. The literature has highlighted that the BCA bottleneck during the building inspection stage hinders the construction sectors' productivity. While some Building Consent Authorities, both within and outside New Zealand, have actively pursued risk-based regulation as an alternative tool, New Zealand has not fully committed to the idea. It would appear that one of the key reasons for the full implementation of risk-based inspection not being implemented is due to the leaky-home saga and its aftermath for all key stakeholders. However the current review suggests that careful consideration and transparency of these new tools need to be a priority to gain the confidence and trust of all stakeholders.

A question raised in the current study is, "Could the adoption of the risk-based approach improve New Zealand construction productivity challenges and address the resourcing issues of BCA during peak periods?"

The literature does not show any integrated and holistic approach to understanding risk-based building regulation issues in New Zealand. There are also other issues regarding homeowners, home builders, architects, building inspectors and other residential sector key stakeholders in understanding the effects of risk-based regulations as having a BCA tool. These reinforce the need for a study which integrates current building regulation processes, the challenges and pressures on the BCAs and the implementation of risk-based regulations as a BCA tool.

These gaps must be addressed in order for the New Zealand housing sector to become more productive, and so that the BCAs can be more efficient in the allocation of resources during peak times. This study attempts to address these gaps by investigating the effectiveness and implementability of alternative regulatory tools that can be implemented nationally through government BCAs. Therefore the study employs quantitative and qualitative methods comprising a questionnaire survey, and semi-structured interviews to collect information from designers, regulatory building inspectors and homebuilders on their understanding and thoughts on risk-based inspections as a regulatory tool. It is anticipated that this will enable the study to identify the perceptions of key stakeholders on the implementation of this or other new tools in the construction sector.

The study will also collect data on other issues within the building-consent process and will obtain suggestions from key players that could improve the current system. The next chapter covers the methodological framework and research paradigm employed in this research.

## **Chapter 3 Research Methodology**

It is evident from the previous literature review chapter that minimal research has been conducted on the effects of risk-based building inspection as a regulatory tool in the New Zealand construction industry. The literature review also reveals that there is no established understanding from the construction sector stakeholders regarding risk-based inspection as a regulatory tool. Given the preceding information, a knowledge gap exists in the current research. The researcher will determine the level of understanding of risk-based inspections amongst building control authorities and construction stakeholders in New Zealand. The aim is to evaluate risk-based inspection for its effectiveness as a regulatory tool in New Zealand.

The research methodology discussed in this chapter provides the development process of the research from conception to completion. The chapter begins by defining the research, the research approach, the justification for the research methodology and methods selected by the researcher for this study. To ensure that the primary understanding of the research problem and strategy follow established research criteria, this chapter discusses the research problem, objectives, questions and philosophical position.

This section also lays out the theoretical dimensions of the research, and further defines the research design and the perspectives from which the research is conducted, utilising the epistemological and ontological paradigms. The discussion also provides justification for the methodological options of quantitative and qualitative methods used in this study. The chapter presents an overview of primary data sources, the management of data, coding of data, data analysis techniques, issues with reliability and the validity of the research findings. The chapter concludes with an insight about the ethical issues and methodological limitations of the study.

### **3.1 What is research?**

The word research has multiple meanings and its precise definition varies as authors try to define it. Basically, research is a systematic and methodical process of inquiry and investigation with a view to increasing knowledge. It is not only a set of skills but also a way of thinking (Collis & Hussey, 2009, Kumar, 2014). According to Woodwell (2014) research is the process of intentionally seeking out knowledge for the specific purpose of understanding what and why things have happened or are happening. A researcher sets out on a quest to accumulate knowledge and then understand what the knowledge represents. At times the research subject can be a narrow one: it could be about a certain location, thing, or event. At other times, the study involves the effort to understand how things behave in general. Similarly, Cough and Nutbrown (2012) consider research as being about asking questions, exploring problems and reflecting on what emerges in order to make meaning from the data and tell the research story.

While a plethora of definitions of the term research can be suggested, this study will use the definition suggested by Woodwell (pg.188, 2014) simply as, “*a systematic and intentional effort to answer questions and learn more about a specific subject*”. The current study will determine the understanding of risk-based inspection and the implications it will have on the construction industry in New Zealand.

### **3.2 The Process of Conducting Research**

When conducting or planning research projects, researchers need to identify which research method they will employ, as this approach is based on bringing together a world view or assumptions about research, a specific design and research methods (Creswell, 2014). Figure 3.1 provides an overview of what a typical research process plan would involve.

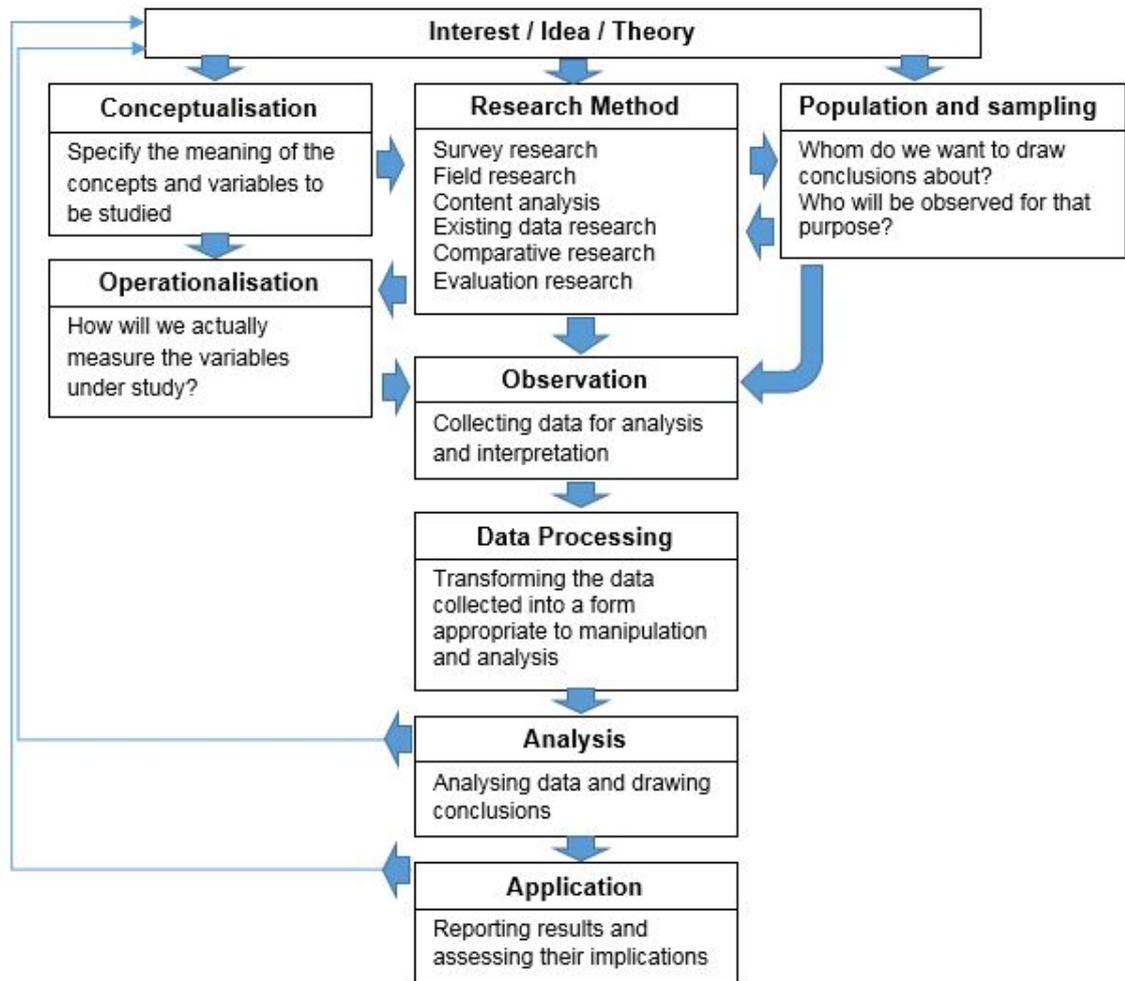


Figure 3.1: Overview of the simplified research process. Source (pg.115, Babbie, 2014)

The research process involves a set of decisions regarding what topic is to be researched, among what population, with what research methods and for what purpose (Babbie, 2014). Therefore, defining the nature of the problem is important because it is one of the main factors which drives the selection of the appropriate research methodology or methods (Babbie, 2012). Similarly, Punch (2009), provides three basic questions that should guide a researcher when developing a research process.

- *What?* What is the purpose of the study? What are we trying to find out?
- *How?* How will the proposed study answer these questions?
- *Why?* Why is this research being conducted? What will we learn, and why is it worth knowing?

The research provided in this study followed a systematic research procedure similar to that shown in Figure 3.1. The study began with an interest and ideal formed from the literature review in which problems and questions emerged. This provided a basis from which the researcher was able to plan the overall research. Once the researcher was able to explore the literature review around the subject area, and questions and objectives formulated, a target population was identified and a sampled group was used to extract qualitative and quantitative data for analysis and findings. The research findings were then validated through Subject Matter Experts and a final application of conclusions and recommendations finalised the thesis. Figure 3.2 summarises the research process for this study.

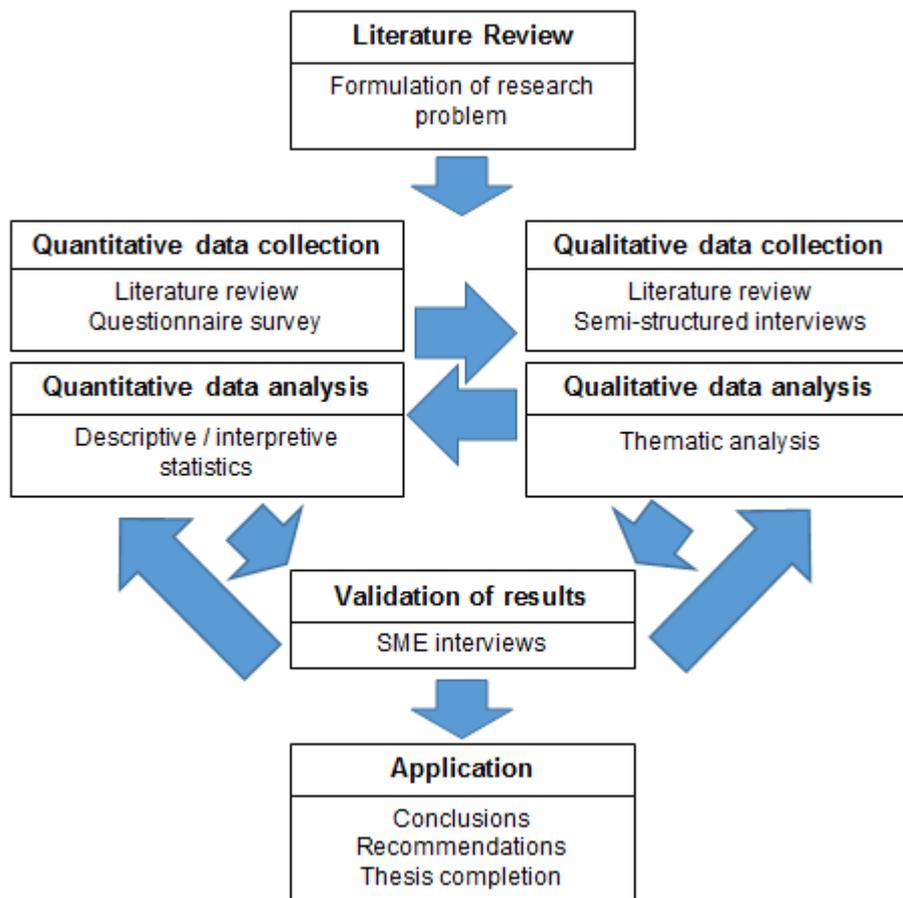


Figure 3.2: The research process for this study

### 3.3 Types of research

Research can serve many purposes. The three most common and useful purposes can be found in exploration, description and explanation (Bernard, 2013). Exploratory research explores an initial feasible understanding of some phenomenon where nothing or very little is known; explanatory research discovers and reports relationships amongst different aspects of the phenomenon under study, and descriptive research describes the exact measurement and reporting of the characteristics of some population or phenomenon, situation, problem or issue under study (Babbie, 2013, Kumar, 2014).

This particular study intended to explore risk-based models as building control regulatory tools in New Zealand. It was an enquiry into the key stakeholders' opinions on the current regulatory inspection system, the proposed implementation of new schemes as an alternative means of compliance, and a tool for increasing the productivity of construction in the residential housing market. A literature review was conducted to explore the nature of regulatory building inspections in New Zealand and overseas, to gain insights into development, in particular, the use of risk-based models. The main purpose of such a study is to describe what is prevalent with respect to the issue or problem of the study (Kumar, 2014). In the current study the main research questions are:

1. *What are risk-based inspections and what impact will they have on the New Zealand construction industry?*
2. *How will the implementation of risk-based inspections affect building consent authorities and construction stakeholders?*

Once the main purpose and questions were developed, the second phase of the research was a set of semi-structured interviews conducted with ten housing developers using a semi-structured survey questionnaire which was distributed to designers and building inspectors. The methods used were qualitative data collection which was associated with

exploratory research, and quantitative data collection which is usually associated with explanatory research (Punch, 2009). The final phase of the study was providing the research findings from the first two phases to Subject Matter Experts to validate.

This suggests that the current study can be categorised as a combination of exploratory, explanatory and descriptive research. The research began as descriptive research and the latter stages of research adapted exploratory and explanatory identities. Although, theoretically, a research study can be classified in one of the above objective-perspective categories, in practice, most research is a combination of all three in that they contain elements of exploratory, explanatory and descriptive purposes (Babbie, 2014, Kumar, 2014). The philosophy of knowledge for this study, according to Creswell (2014), required the use of inductive reasoning for accumulating data, establishing themes, consistencies and meanings in order to understand the effect of risk-based building inspection in New Zealand and the implication on BCAs and construction stakeholders.

### **3.3.1 Exploratory research**

Exploratory research is employed when a new interest, or when the subject of study itself, is relatively new and also appropriate for more persistent phenomena (Babbie, 2013). Similarly Nardi (2014) explains that people use exploratory research to provide a feasibility opportunity to take on a study, to try out different methods for collecting data for a proposed larger research project in the future, or to learn the language and concepts used by those who will be studied. Babbie 2013, provides three purposes in the use of exploratory studies: firstly to satisfy the curiosity of the researcher in providing a better understanding of the phenomena; secondly, to test the feasibility of taking on a more comprehensive study, and thirdly, to develop the methods to be employed in any subsequent study. Its general logic is that quantitative investigation is inappropriate until exploratory qualitative methods have built a comprehensive foundation of understanding

(Punch, 2009). Creswell and Clark (2007) give examples where the research needs to develop a measuring tool, but requires a more in-depth understanding of the phenomenon in question; or where it is important to explore some phenomenon in depth before measuring its distribution and prevalence.

### **3.3.2 Explanatory research**

Explanatory studies explain things and why they have occurred. Descriptive research answers questions of what, where, when and how (Babbie, 2013, Kumar, 2014). Explanatory research is designed to answer the “why” questions, for example, why there is a range of behaviours or opinions held among people surveyed. Ideally, the object is to explain or, perhaps, predict these opinions and behaviours with efficient, less complex reasons or causes (Nardi, 2014). Punch (2009) explains that this is a two-phased mixed-method approach, where the research uses qualitative data to help explain, or to build upon, initial quantitative results in which the first phase is quantitative and the second qualitative. This research may be used where qualitative data is required to explain significant (or non-significant) findings or surprising results (Creswell & Clark, 2007).

A semi-structured survey was conducted to establish exploratory findings at the commencement of the study in which the data from the survey described construction stakeholders’ perceptions of risk-based regulations. Therefore, it can be established that during this particular process an explanatory type of research exists.

### **3.3.3 Descriptive research**

Descriptive research is often the first step in the majority of research projects and is the primary objective, in that it presents basic information profiling respondents and describing the issues under study (Nardi, 2014). A key criterion in research is for the researcher to observe situations and events and then describe what was observed (Babbie, 2013). Similarly, Woodwell (2014) adds that descriptive research involves both the

outlining and shape of data as well as the search for further information based on pre-existing data and, since it answers factual questions such as ‘what’ or ‘how’, all original research involves some degree of description. These facts can be tangible and perceptible. The following section will provide the research methodology considered for the current study.

### **3.4 Research methodology**

The research methodology section is an important part of any research project as it shows how research questions are articulated with questions asked in the field. In effect, it is a claim about significance. Methodology takes its place in the middle of a hierarchy of considerations when carrying out research. At the top of this hierarchy lie ontological and epistemological assumptions about social research and the particular research questions being posed. At the bottom end of the scale are the research methods, the tools for collecting data. Methodology sits in between. Methodological considerations frame the use of particular methods but methodologies themselves are consequences of particular research questions (Hammond & Wellington, 2013).

For new researchers, a common issue that arises is the confusion between the difference of methods and methodology. According to Clough and Nutbrown (2012), at its simplest, this distinction can be seen in terms of methods as being some of the ingredients of research, while methodology provides the reasons for using a particular research recipe. Similarly, Woodwell (2014), explains that research methodology refers to a broader idea than the more specific term research method. Methodologies act as the overarching blueprint for the innumerable types of specific methods that research employs, in specific disciplines, to uncover new information. In military terms, methods are like tactics, and methodologies are like strategies (Woodwell, 2014).

The selection of research methodology should consider a number of criteria such as research objectives, resource availability and funding, as well as historical, political, ethical and personal factors (Bryman, 2009). Therefore, the next section describes the research problem and research questions undertaken for this research project to show that the selection of research methodology and paradigm is appropriate.

### **3.5 Analysis of the research problem**

A research problem is an issue or concern that needs to be addressed. The problem comes from a gap in knowledge identified through a literature review. Conflict in research results in the literature topics that have been neglected, and the need to elevate the voice of marginalised participants and real life problems (Punch, 2009). The formulation of a research problem is the first and most important step of research processes (Kumar, 2014).

The problems being addressed by the current research include:

- There is no record to show stakeholders' understanding of risk-based building models and their implementation as regulatory tools.
- Lack of information about risk-based models in the construction industry as cost, quality and time tools.
- There is a significant need to identify building consent authority red tape (bottleneck issues) which contribute to the construction sector's lack of productivity.
- There is limited knowledge from the construction sector about accountability with the implementation of risk-based models as regulatory tools.

As with most research, it is fundamental to specify the research questions precisely, as these will guide both the selection of the content to be analysed and the coding schedule. If the research questions are not clearly articulated, there is a risk that inappropriate media will be analysed or that the coding schedule will miss out key criteria (Bryman, 2016). A research question is one that guides the project, and which the research is designed to answer and investigate (Collis & Hussey, 2009). Research questions are central. Kumar

(2002) implies that undertaking research is to find answers to a question, and the process being applied: (a) is being undertaken within a framework of a set of philosophies; (b) uses procedures, methods and techniques that have been tested for their validity and reliability; (c) is designed to be unbiased and objective. Punch (p.64, 2009) identifies five main objectives of the role of research questions:

- They organise the project, and give it direction and coherence;
- They delineate the project, showing its boundaries;
- They keep the researcher focused during the project;
- They provide a framework for writing up the project;
- They point to the data that will be needed.

The current research addresses two central research questions and six sub-research questions. This is in line with Creswell, (2014) who suggested not asking more than five to seven sub-questions in addition to one to two central questions. These research questions enable the objectives of the main focus areas to be achieved. The first objective to capture the real position in New Zealand regarding actual demand including regional prioritisation housing requirements and current state of regulatory building inspections. The second is to provide a level of understanding of risk-based inspection amongst construction sector stakeholders, and, if this could be a Building Consent Authority regulatory tool, to accelerate productivity during consent processing. This study will assist in achieving government's goals of:

- quality homes and buildings produced through a business-enabling and efficient regulatory framework
- ensuring consumers are able to make informed decisions when carrying out transactions in the housing sector
- ensuring buildings are produced cost-effectively by a productive sector with the right skills and knowledge

- implementing a regulatory system that is administered in an efficient and cost-effective manner

Therefore the central questions this research was designed to investigate and answer are listed in Table 3.1.

Table 3.1: The research objectives and questions

<b>Main Research Questions</b>	
1. What are risk-based inspections and what impact will it have on the New Zealand construction industry?	
2. How will the implementation of risk-based inspection affect building consent authorities and construction stakeholders?	
<b>Research objectives</b>	<b>Research questions</b>
O1. To establish an understanding of risk-based inspection in the context of building regulations.	Q1. What is a risk-based building inspection?
O2. To investigate risk-based models used in building regulations overseas.	Q2. What alternative approaches of the risk-based building regulation exist overseas?
O3. To review existing risk-based models and their effectiveness in New Zealand building consent process.	Q3. What risk-based building regulation concepts have been adopted in New Zealand, and are they affective?
O4. To determine the real position in New Zealand regarding risk-based building regulations.	Q4. What is the construction stakeholders' understanding of risk-based inspection as a regulatory tool?
O5. To investigate from construction stakeholders experiences of risk in the building inspection process.	Q5. What are the key stakeholders' experiences with risk-based building inspections?
O6. To determine the current position of building inspections in New Zealand building consent process.	Q6. How does the New Zealand building consent process currently operate in specific building inspections?
O7. To capture the extent of building consent authority inspections bottlenecks which are contributing to the construction sector's lack of productivity.	Q7. What would be the possible mechanism to implement risk-based inspection as a BCA tool?
O8. To determine changes and seek suggestions from construction stakeholders if risk-based inspections could be a regulatory tool in New Zealand.	

### **3.6 Philosophical assumptions**

It is essential that before undertaking any research the researcher needs to consider the philosophical worldview assumptions that he/she brings to the study, the research design that is related to this worldview, and specific methods or procedures of research that translate the approach to practice (Easterby-Smith, et al.,2008, Creswell, 2014). Crotty (1998) suggests as a starting point that in developing a research proposal four main questions would need to be addressed:

- What methods do we propose to use?
- What methodology governs our choice and use of methods?
- What theoretical perspective lies behind the methodology in question?
- What epistemology or ontology informs this theoretical perspective?

Therefore, to establish the philosophical position of this research, its epistemological and ontological background is examined. Creswell (2014) further suggests that individuals preparing a research proposal or plan make explicit the larger philosophical ideas they espouse, as this information will help explain why particular research approaches have been selected for their study. Subsequently it is essential to establish the research background in the relevant research paradigm. Figure 5.3 provides a framework of research and the interconnection of worldviews, design and research methods.

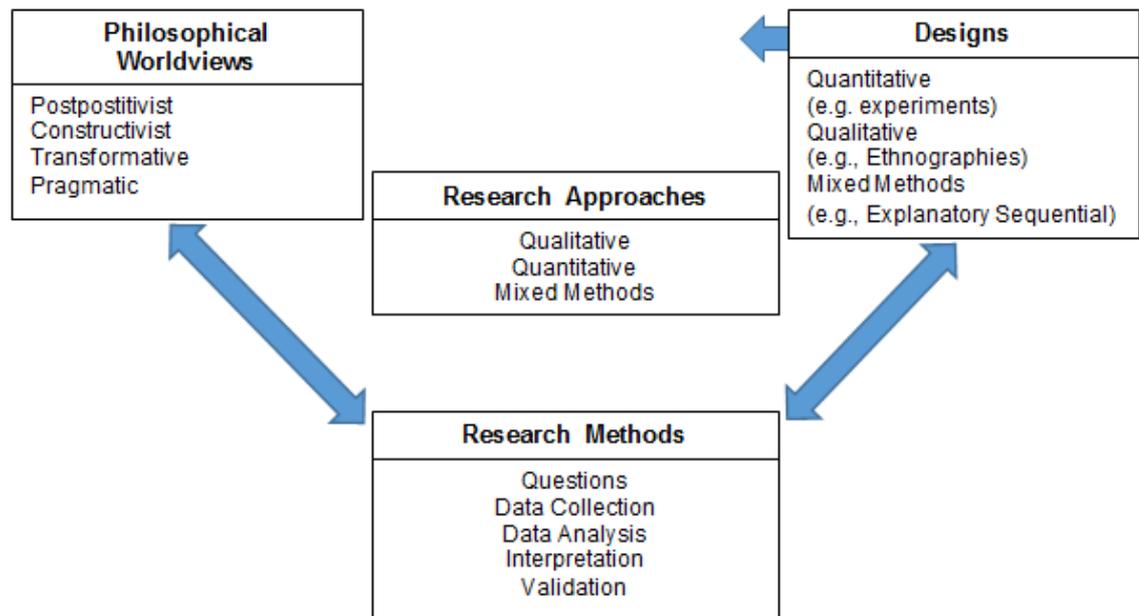


Figure 3.3: A Framework for Research – The Interconnection of Worldviews, Design and Research Methods – Adapted from: (Creswell, 2014).

### 3.6.1 Ontological background

Creswell (2013) relates ontology to the nature of reality and its characteristics. Reality, seen as evidence of multiple realities, includes the use of multiple forms of evidence in themes using the verbatim words of different individuals and presenting different perspectives (Creswell, 2013). Similarly Hammond and Wellington (2013) describe ontology as beliefs about the fundamental nature of reality, in particular social reality. These beliefs have often been discussed in terms of the dichotomy (Bryman, 2004) between an objective reality which exists independently of the observer and reality as it appears subjectively and, more commonly, as negotiated within groups. The former typically comes under the banner of objectivist, realist or foundationalist ontology; the latter an anti-positivist or anti-foundationalist ontology, informed by constructivism or interpretivism (Bryman, 2004).

### 3.6.2 Epistemological background

In simpler terms, Crotty (1998) defines epistemology as the theory of knowledge which is embedded in theoretical perspective and thereby in the methodology. Similarly,

Hammond and Wellington (2013) explains that epistemology refers to what we believe about how we come to know and understand the world in which social researches have invariably presented a dichotomy of positivist and interpretive / anti-positivist epistemologies. Positivism suggests that social researchers come to know the world by following the procedures established in natural science, while interpretivism sees social researchers as having a special concern for uncovering the meaning associated with social activity (Hammond & Wellington, 2013).

### **3.6.3 Ontological and epistemological position of the research**

Hammond and Wellington (2013), explains the close entwined relationship between epistemology and ontology, the claims about nature, of being and existence, in that it is difficult to imagine the world without imagining our claims about the world. Therefore, epistemology and ontology take, or should take, a place together at the top of the hierarchy when it comes to moulding a research project. The understanding of knowledge and how it is acquired defines the nature of the questions that will be asked during the study entailing, as well, the methodology and methods that will also assist in addressing these questions.

To understand the regulatory balance in residential construction in New Zealand, the entwined ontological and epistemological position endeavours to prove that there is a social reality regarding risk-based inspection being implemented as a regulatory tool and the productivity of the New Zealand construction sector. The research investigated whether or not this reality can be observed and understood from the perspective of key stakeholders in construction in New Zealand.

Table 3.2 provides a table showing philosophical assumptions with examples from the researcher's perspective.

Table 3.2: Philosophical Assumptions with Implications for Practice

Assumption	Questions	Characteristics	Implications for Practice (Examples)
Ontological	What is the nature of reality?	Reality is multiple as seen through many lenses.	Researcher reports different perspectives as themes develop in the findings.
Epistemological	What counts as knowledge? How are knowledge claims justified? What is the relationship between the researcher and that being researched?	Subjective evidence from participants; researcher attempts to lessen distance between them and that being researched.	Researcher relies on quotes as evidence from participants; collaborates, spends time in field with participants, and becomes an “insider”.

Adapted from: (Creswell, 2013)

### 3.7 Research paradigm

Research paradigm is explained by Babbie (2014) as a model or framework for observation and understanding which shapes both what we see and how we understand it. In simpler terms, where theories seek to explain, a paradigm provides ways of looking. The term paradigm has been used to describe the dominant framework in which research takes place. This framework considers how problems are identified and what is to be studied. The epistemological and methodological assumptions behind the research seek to answer how the subject is to be studied and what is done with the research (the nature and value of the knowledge generated) (Hammond & Wellington, 2013). Crotty (1998) notes that a research paradigm describes the philosophical position that lies behind the chosen methodology, and explains how it provides a context for the process. The paradigm grounds the research logic and criteria.

This current study takes the view of Collis and Hussey (2009) who describe theoretical perspective as a framework that influences how research should be undertaken, based on peoples beliefs and assumptions about the world and the nature of knowledge. Further, Collis and Hussey (2009) suggest it is important that researchers have a thorough

understanding of methodological paradigms and be able to underpin, support and, in some cases, defend their chosen research approach. Creswell (2014) sees worldviews as a general philosophical orientation about the world and the nature of research that a researcher brings to a study. The types of beliefs held by the researcher will often lead to embracing a qualitative, quantitative, or mixed-method approach in the research.

The following sections describe two theoretical perspectives: a positivist and a post-positivist/interpretivist paradigm within the context of the current study. Table 3.3 describes four worldviews that are widely discussed, and major elements of each position.

Table 3.3: A comparison of positivist and interpretivist paradigms

<b>Positivism and Post-positivist</b>	<b>Interpretivist and Constructivist</b>
<p>Knowledge is produced through the senses, based on careful observation</p> <p>Regularities and constant conjunctions are identified</p> <p>Inductive reasoning is used for data collection to generalise from empirical instances to general law</p> <p>Reality is unaffected by the research process; facts and values are separate; objective value-free inquiry is possible</p> <p>The methods used are appropriate for studying the social world</p> <p>Reality can be known accurately (knowledge is foundational, using the correspondence theory of truth)</p>	<p>Knowledge is produced by exploring and understanding the social world of the people being studied, focusing on their meanings and interpretations</p> <p>Researchers also construct meanings and interpretations based on those of the participants</p> <p>The research process is considered to be largely inductive in the sense that interpretation is grounded in the data, though it is also recognised that observations are “theory-laden’ because they are construed by ideas and assumptions</p> <p>Reality is affected by the research process; facts and values are not distinct; objective value-free research is impossible.</p> <p>The methods used in natural sciences are not appropriate for studying the social world because that world is not governed by law-like regularities but rather through meaning and human agency</p> <p>Social reality cannot be captured or portrayed accurately because there are different perceptions and understandings.</p>
<b>Post-positivist</b>	
<p>Knowledge of the world is produced through testing propositions</p> <p>Deductive reasoning is used to assume possible relationships and models before data collection</p> <p>Reality can be known approximately, hypothesis can be rejected or provisionally confirmed but not definitively proven to be true</p>	

Adapted from: (Ritchie, Lewis, Nicholls & Ormston, 2014)

### **3.7.1 The positivist paradigm**

Being positivist is an epistemological position that encourages the application of the methods of the natural sciences to the study of social reality and beyond. (Bryman, 2016). There are many meanings or interpretations of positivism but the term is often used to describe a belief that the world is capable of objective interpretation and that social science should follow the methodologies and methods established in natural science (Hammond & Wellington, 2013). Positivism is often related to realism in that both provide assumptions that there is a world out there separate from our descriptions of it, and that social and natural science can and should apply the same principles to gathering and analysing data (Babbie, 2013). Bryman (2016 p.24), provides five key principles of positivism:

1. Only phenomena and hence knowledge confirmed by the senses can be genuinely warranted as knowledge (phenomenalism);
2. The purpose of theory is to generate hypotheses that can be tested, and that will thereby allow explanations and laws to be assessed (deductivism);
3. Knowledge is arrived at through the gathering of facts that provide the basis for laws (inductivism);
4. Science must, and presumably can, be conducted in a way that is value free (objective); and
5. There is a clear distinction between scientific and normative statements.

The positivist approach has an ontological assumption that social reality is objective and external to the researcher. Collis and Hussey (2009) allude to a positivist approach that engages in an epistemological position that only phenomena that are observable and measurable can be validly regarded as knowledge. Therefore, it can be established that the researcher's knowledge is obtained by the gathering of facts that provide the basis of

this current study. The researcher acts independently from the research environment to ensure that the research findings are unbiased. The current research falls within the positivist paradigm.

### **3.7.2 Interpretivism**

A positivist approach would follow the methods of the natural sciences by way of allegedly value-free, detached observation, seeking to discover universal features of humanhood, society and history that offer control and explanation. Hence the interpretivist approach would look for culturally derived and historically situated interpretations of the social living world (Crotty, 1998).

Similarly Bryman (2016) explains interpretivism is a concept provided to an epistemology that contrasts with positivism. It is founded upon the view that a strategy is needed that respects the difference between people and the objects of natural sciences, and therefore needs the social scientist to undertake the subjective meaning of social action. The objective of interpretivist research is to understand the meaning that cultural and institutional practices have for those taking part (Hammond & Wellington, 2013). (Bryman, 2016) explains that taking an interpretive view can mean that the researcher may come up with unanticipated findings, or at least findings that appear surprising from a position that is outside the particular context being studied.

Therefore, in contrast to positivist, interpretivism attempts to understand and explain human and social reality. This current study falls into the realm of interpretivism as the research focuses on people's views and knowledge in consequential interaction between the researcher and the research environment. Table 3.3 describes four worldviews that are widely discussed, and the major elements of each position.

### 3.7.3 Pragmatism

Another position about worldviews comes from the pragmatists. The pragmatist paradigm is a newly emerged research philosophy which is not committed to any one system of philosophy and reality (Creswell, 2014). Pragmatism is defined by Hammond and Wellington (pg.173, 2013) as *“taking a practical orientation to a problem and finding a solution that is fit for a particular context”*. Similarly, (Morgan, 2014) extracts the essence of pragmatism which can be found in its root word, *pragma*, from the Greek word for “action”, which suggests that knowledge comes from taking action and learning from the outcomes. For a researcher contemplating mixed-method research, pragmatism opens the door to a “paradigm of choices” in multiple methods, different worldviews and different assumptions, as well as different forms of data collection and analysis (Creswell, 2014, Morgan, 2014). All four world- views in Table 3.4 have common elements but take different stances on these elements. They focus on different perspectives regarding the nature of reality (ontology), how we gain knowledge of what we know (epistemology) and the process of research (methodology). Table 3.4 provides examples of these common elements, the different worldviews, and how the elements and worldviews are put into practice.

Table 3.4: Common elements of worldviews and implications for practice

<b>Worldview Element</b>	<b>Postpositivism</b>	<b>Constructivism</b>	<b>Pragmatism</b>
Ontology (What is the nature of reality?)	Singular reality (researchers reject or fail to reject hypotheses)	Multiple realities (researchers provide quotes to illustrate different perspectives)	Singular and multiple realities (researchers test hypotheses and provide multiple perspectives)
Epistemology (What is the relationship between the researcher and that being researched?)	Distances and impartiality (researchers objectively collect data on instruments)	Closeness (researchers visit participants at their sites to collect data)	Practicality (researchers collect data by “what works” to address the research questions)
Methodology (What is the process of research?)	Deductive (researchers test an a priori theory)	Inductive (researchers start with participants’ views and build up to patterns, theories, and generalisations)	Combining (researchers collect both quantitative and qualitative data and mix them)

Adapted from: (Creswell & Plano Clark, 2007)

### **3.7.4 Mixed-method research**

Mixed-method research is becoming increasingly articulated and attached to research practice. It is being recognised as the third major research approach, along with qualitative research and quantitative research (Teddie & Tashakkori, 2003, Johnson & Onwuegbuzie, 2007). According to Creswell (2014), mixed-method research is an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. It is thought that this form of inquiry benefits from combining qualitative and quantitative approaches and provides a more complete understanding of a research problem than either approach alone. Greene, Caracelli and Graham (1989) reveal the advantages of employing mixed-methodological strategies to enhancing research. These are summarised below:

1. Triangulation: seeking corroboration between quantitative and qualitative data in the context of mixed-method research.
2. Complementarity: seeking elaboration, enhancement, illustration, and clarification of the results from one method with results from others.
3. Development: the using of research results from one method to develop the other method.
4. Initiation: the discovery of paradox and contradiction, new views of framework modifying of question(s) or result(s); and
5. Expansion: to increase the breadth and range of enquiry through the use of alternative enquiry components.

Mixed-method research is also an attempt to legitimise the use of multiple approaches in answering research questions, rather than restricting or constraining researchers' options

(Johnson & Onwuegbuzie, 2007). Table 3.5 describes the strengths and weakness of mixed-method research.

Table 3.5: Strengths and weaknesses of mixed-method Research

<b>Strengths</b>	<b>Weaknesses</b>
Words, pictures and narratives can be used to add meaning to numbers	Can be difficult for a single researcher to carry out both quantitative and qualitative research
Numbers can be used to add precision to words, pictures and narratives	Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately
Can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach	Methodological purists contend that one should always work with either a quantitative or a qualitative paradigm
A researcher can use the strengths of an additional method to overcome the weaknesses in another method	More expensive
Can provide stronger evidence for a conclusion through the convergence and corroboration of findings	More time-consuming
Can add insights and understandings that might be missed when only a single method is used	Some of the details of mixed research remain to be worked out fully by research methodologists
Can increase the generalisability of results	
Qualitative and quantitative research used to produce more complete knowledge necessary to inform theory and practice	

Adapted from: (Johnson & Onwuegbuzie, 2004)

### **Triangulation design**

The most common and well-known approach to mixing methods is the triangulation design. This is a single-phase design in which researchers implement the quantitative and qualitative methods during the same timeframe and with equal weight. Hence the single-phase timing of this design has also been referred to as “concurrent triangulation design” (Punch, 2009, Franklin, 2012, Creswell & Plano Clark, 2007). Triangulation refers to the combination of different methods, study groups, local and temporal settings, and different theoretical perspectives in dealing with a phenomenon. Its application includes formalising the relation between qualitative and quantitative research, strengthening the quality of qualitative research and designing and conducting qualitative research in an appropriate way (Flick, 2014). Creswell and Plano Clark (2007) explain the strengths of

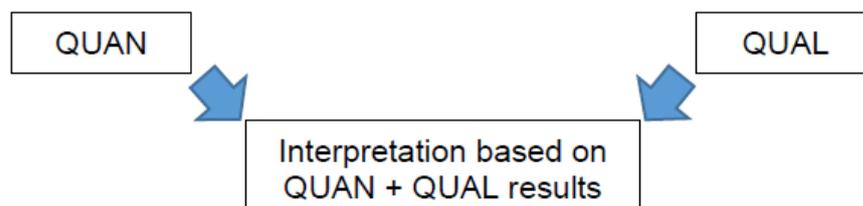
using triangulation design by declaring that it is an efficient design in which both types of data are collected during one phase of the study, at approximately the same time, and that each type of data can be collected and analysed separately and independently, using the techniques traditionally associated with each data type.

In contrast Flick (2014) argues that triangulation design does have its stumbling blocks. One problem is that researchers overly challenge their participants, or they have reservations about one of the methods used but are ready to respond to another. It is further suggested by Flick, that deciding carefully what is expected from triangulation and then employing it at a later stage is expected to be beneficial.

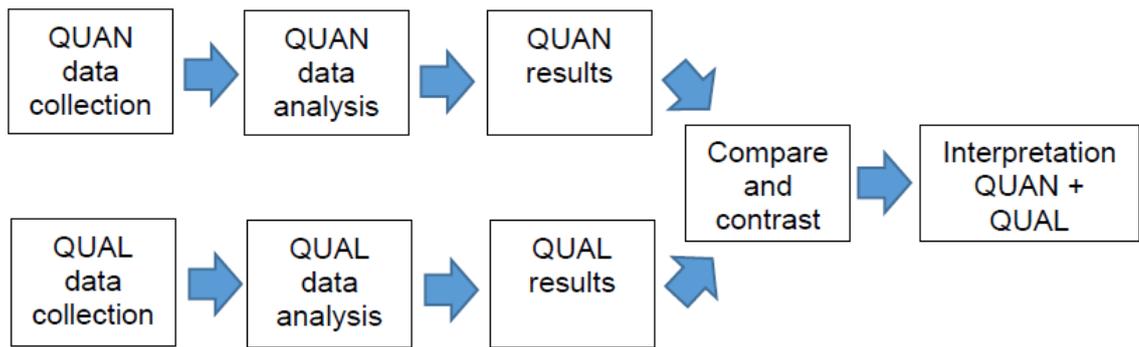
### **Convergent parallel mixed methods**

This is a form of mixed-method design in which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. The researcher typically collects both forms of data at roughly the same time and then integrates the information in the interpretation of the overall results. Contradictions or incongruent findings are explained or further probed in the design (Creswell, 2014). Figure 3.4 (a) – (d) shows the variants of triangulation designs of mixed-method research.

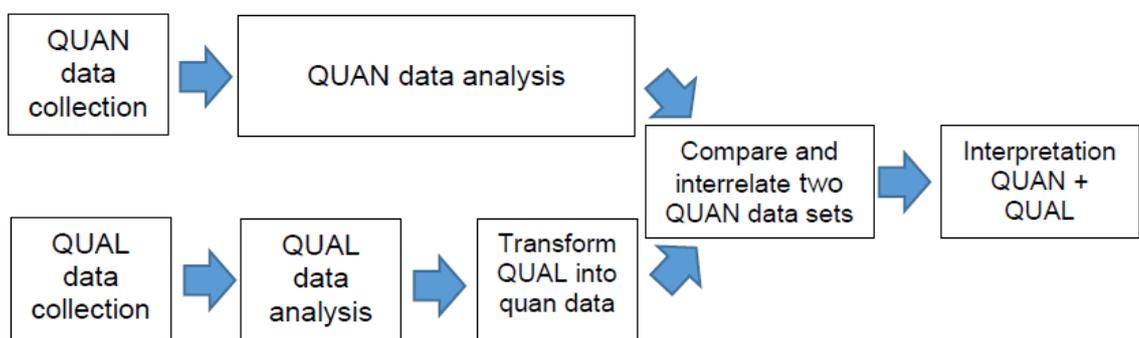
#### **(a) Triangulation Design:**



**(b) Triangulation Design: Convergence Model**



**(c) Triangulation Design: Data transformation Model (Transforming QUAL data to QUAN)**



**(d) Triangulation Design: Validating Quantitative Data Model**

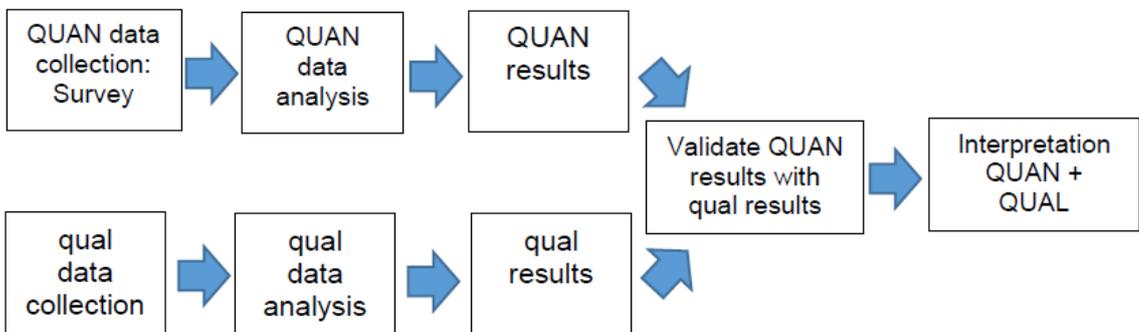


Figure 3.4: Triangulation Design – Adapted from: (Creswell & Plano Clark, 2007 pg. 63).

**3.7.5 Qualitative research**

Qualitative research begins with assumptions and the use of interpretive / theoretical frameworks that inform the study of research problems to address the meaning individuals or groups ascribe to a social or human issue (Creswell, 2013). Kumar (2014) explains that this is embedded in the philosophy of empiricism; follows an open, flexible and unstructured approach to enquiry; aims to explore diversity rather than to quantify;

emphasises description and narration of feelings, perceptions and experiences rather than measurement; and communicates findings in a descriptive and narrative way rather than in analytical manner, placing no or less emphasis on generalisations. According to Creswell (2014), qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data typically collected in the participants' setting, data analysis inductively building from particular to general themes, and the researcher making interpretations of the meaning of the data. The final written report has a flexible structure.

Similarly, Woodwell (2014) further adds that qualitative research attempts to understand relationships underlying a particular single case or small number of particular events, which is why case study research is, by nature, more qualitative. Case studies are seen as the backbone of qualitative research used inductively and deductively (or both), depending on the nature of the study. Qualitative research is particularly convenient for understanding human perceptions and motivations in a way that top-down quantitative research cannot.

Bryman (pg. 32, 2016) explains that qualitative research can be represented as a research strategy that emphasises words rather than quantification in the collection and analysis of data. By using a qualitative approach in the current study, the final report is characterised by rich description and should provide the audience with enough information to determine whether the findings of the study could apply to other people or settings as suggested by Maykut and Morehouse (1994).

### **3.7.6 Quantitative research**

According to Creswell (2014), quantitative research is an approach for testing objective theories by examining relationships among variables. These variables can be measured,

typically on instruments, so that numbered data can be analysed using statistical procedures. Woodell's (2014) quantitative study is usually associated with words such as "statistics" and "regression analysis" in which such tools are often used to help understand trends in data when large number of cases are involved. Therefore, research that is thought of, in general, as quantitative research seeks to understand broad trends involving the characteristics or cause-and-effect relationships inherent among many different variables. Bryman (pg. 33, 2016) explains that quantitative research can be represented as a research strategy that highlights quantification in the collecting and analysis of information that;

- Encompasses a deductive approach to the relationship between theory and research, in which the accent is placed on the testing of theories;
- Has integrated the practices and norms of the natural scientific model and of positivism in particular; and
- Provides a view of social reality as an external objective reality.

Creswell (2003) further adds that a quantitative approach is one in which the investigator primarily uses postpositivist claims for developing knowledge. Methods of inquiry such as surveys and gathered data on predetermined instruments yield statistical data.

Guest, Namey and Mitchell (2013) explain that one of the weaknesses of the qualitative method in proper analysis of text is time-consuming, as it not only involves collecting the data but also transcribing, coding and interpreting it. Much consideration must be given to how much time, cost and resources can be allocated to the analysis. By using both quantitative and qualitative approaches, this weakness identified by Guest *et al.* (2013) will be overcome by the utilisation of both approaches in the current study.

### **3.7.7 Qualitative verses quantitative research**

The word qualitative implies an emphasis on the quality of the entities and on processes and meanings that are not experimentally examined or measured in terms of quantity,

amount, intensity or frequency. In contrast, quantitative studies emphasise the measurement and analysis of causal relationships between variables, not processes (Norman & Lincoln, 2013).

In simpler terms, Bryman (2016) explains that there would be little to the quantitative and qualitative distinction other than the fact that quantitative researchers employ measurement and qualitative researchers do not. Qualitative research emphasises connections between purpose and procedures that are inductive, subjective and contextual, while quantitative research equivalently matches purpose and procedures that is deductive, objective, and general. Consequently, the two approaches offer well-established guidelines for reasoning back and forth among research questions, research design and research methods (Morgan, 2014).

Similarly, Grbich (2013) explains the major difference between the two is that qualitative research tends to be seen primarily as an inductive approach, using a research question to move from instances gained in the data retrieval to some form of conclusion, often via comparison with existing concepts or theory. In contrast quantitative research is generally viewed as deductive, where the conclusions drawn follow logically from certain premises, usually based on rules which are themselves often viewed as proven, valid or true.

Table 3.6 compares these two forms of research according to three basic distinctions where qualitative research is typically inductive, subjective, and contextual, and quantitative research is typically deductive, objective and general.

Table 3.6: Comparing Qualitative and Quantitative Research

<b>Qualitative Research</b>	<b>Quantitative Research</b>
<b>Induction</b>	<b>Deduction</b>
<p><b>Purposes</b></p> <ul style="list-style-type: none"> <li>• Generates theory from observations</li> <li>• Oriented to discovery, exploration</li> </ul> <p><b>Procedures</b></p> <ul style="list-style-type: none"> <li>• Emergent design</li> <li>• Merges data collection and analysis</li> </ul>	<p><b>Purposes</b></p> <p>Tests theory through observations Oriented to cause and effect</p> <p><b>Procedures</b></p> <p>Predetermined design Separates data collection and analysis</p>
<b>Subjectivity</b>	<b>Objectivity</b>
<p><b>Purposes</b></p> <p>Emphasises meanings, interpretation. Tries to understand other perspectives</p> <p><b>Procedures</b></p> <p>Research is involved, close to the data Researcher is the “research instrument”</p>	<p><b>Purposes</b></p> <p>Emphasises things that can be measured Results do not depend on beliefs</p> <p><b>Procedures</b></p> <p>Researcher is detached, distant from the data Relies on standardised protocols</p>
<b>Context</b>	<b>Generality</b>
<p><b>Purposes</b></p> <p>Emphasises specific depth and detail Analyses holistic systems</p> <p><b>Procedures</b></p> <p>Uses a naturalistic approach Relies on a few purposively chosen cases</p>	<p><b>Purposes</b></p> <p>Emphasises generalisation and replications Analyses variables</p> <p><b>Procedures</b></p> <p>Uses experimental and statistical controls Works across a larger number of cases</p>

(Morgan, 2014)

### 3.7.8 Selection of research approach

The literature review undertaken in this study found that risk-based inspection is a relatively new concept in New Zealand, let alone in the construction industry, amongst its stakeholders. An introduction of an alternative regulatory tool will assist the Government and the construction sector. The current review also reveals that the residential housing market is at its peak in its major cities, and this is putting pressure on resources (human and material) and financial instability. Therefore it is important to select a research approach that will achieve the research objectives and address the study questions.

The research approach is important because it provides the foundation for selecting the most congruous research strategies. The worldviews, designs and methods all contribute to a research approach that tends to be quantitative, qualitative, or a combination of both which is commonly referred to as mixed. Creswell (2014) explains that given the possibility of a qualitative, quantitative or mixed-method approach and what factors affect a choice of one approach over another for the design of a proposal, three considerations can be taken into account, namely the research problem, the personal experience of the researcher and the audience. Similarly, Yin (2015) demonstrates that the type of question, the control the researcher has over actual behavioural situations and the degree of focus on contemporary events should all be adapted in selecting a research approach.

With the current research problem and the availability of three research methods, it is appropriate to employ a mixed-method approach. The use of a mixed-method research approach for this study commences with the first phase of collecting quantitative data in conjunction with qualitative data. The arrangement has been conducted in this manner so that the perceptions and knowledge of construction stakeholders with regulatory inspection can be adequately investigated. The rationale for this provision is based on the nature of the research problem and research questions in Sections 3.3, 3.4 and 3.5 of this study. The concepts follow the suggestion by Johnson and Onwuegbuzie (2004) that mixed research can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach and is able to provide stronger evidence for a conclusion through the convergence and corroboration of findings. The research objective and questions will benefit from a mixed-method approach for the purposes of triangulation, complementarity, development, initiation and expansion (Greene, Caracelli & Graham, 1989). The choice of selecting a mixed research method for this study also benefits with the combining of qualitative and quantitative

approaches which provides a more complete understanding of the research problem than either approach alone.

As indicated in Figure 3.4 (b) this study follows the convergence model in that quantitative data and qualitative data were collected in conjunction with each other, at about the same time. The quantitative data collection was in the form of a New Zealand-wide questionnaire survey. The qualitative data collection incorporated semi-structured interviews with housing developers who were in the pressure areas of housing supply and demand.

### **3.8 Research design**

The research design is the road map that a researcher decides to follow during the journey to seek out answers to research questions as validly, objectively, accurately and economically as possible (Kumar, 2014). In simpler terms, it means all the issues involved in planning and executing a research project, from identifying the problem through to reporting and publishing the findings (Punch, 2009). Research design is concerned with turning a research question, a hypothesis or even a thought or idea into a manageable project.

The design process will generally include the initial formulation of the research questions to explore; a consideration of what kinds of data are to be collected and how they are to be collected (methodology and methods); planning and reflecting on the sample (if the study is to be an empirical one) and the access and ethical issues involved with this sample; deciding how the proposed data are to be analysed; and considering how the research is to be presented and disseminated (Punch, 2009, Hammond & Wellington, 2013). Similarly, Bryman (2016) explains that the choice of research design reflects decisions about the importance being given to the range of dimensions of the research process which include expressing connections between variables, understanding

behaviours in social contexts and generalising to larger groups of individuals than those actually forming part of the investigation. Therefore, it was considered that three groups from the New Zealand construction sector would be included in this investigation, with a survey being the most appropriate method. Surveys are less costly to reach larger samples and can guarantee anonymity from participants (Nardi, 2014).

### **3.8.1 Typologies of mixed-method research for the current study**

Figure 3.5 presents the typologies of the current research, showing that the current research incorporates the “what” and “how” types of questions in which the surveys have been used as they suit the research’s descriptive, explanatory and exploratory nature. Both quantitative and qualitative methods have been adopted for the study as both research methods are equally effective. Both can provide stronger evidence for a conclusion through the convergence and collaboration of the findings (Johnson & Onwuegbuzie, 2014). The mixed-method nature of this research was best utilised during the data collection and analysis phases of the research as indicated in Figure 3.5. This layout is in line with Babbie (2014) where key phases of mixed-method research are outlined.

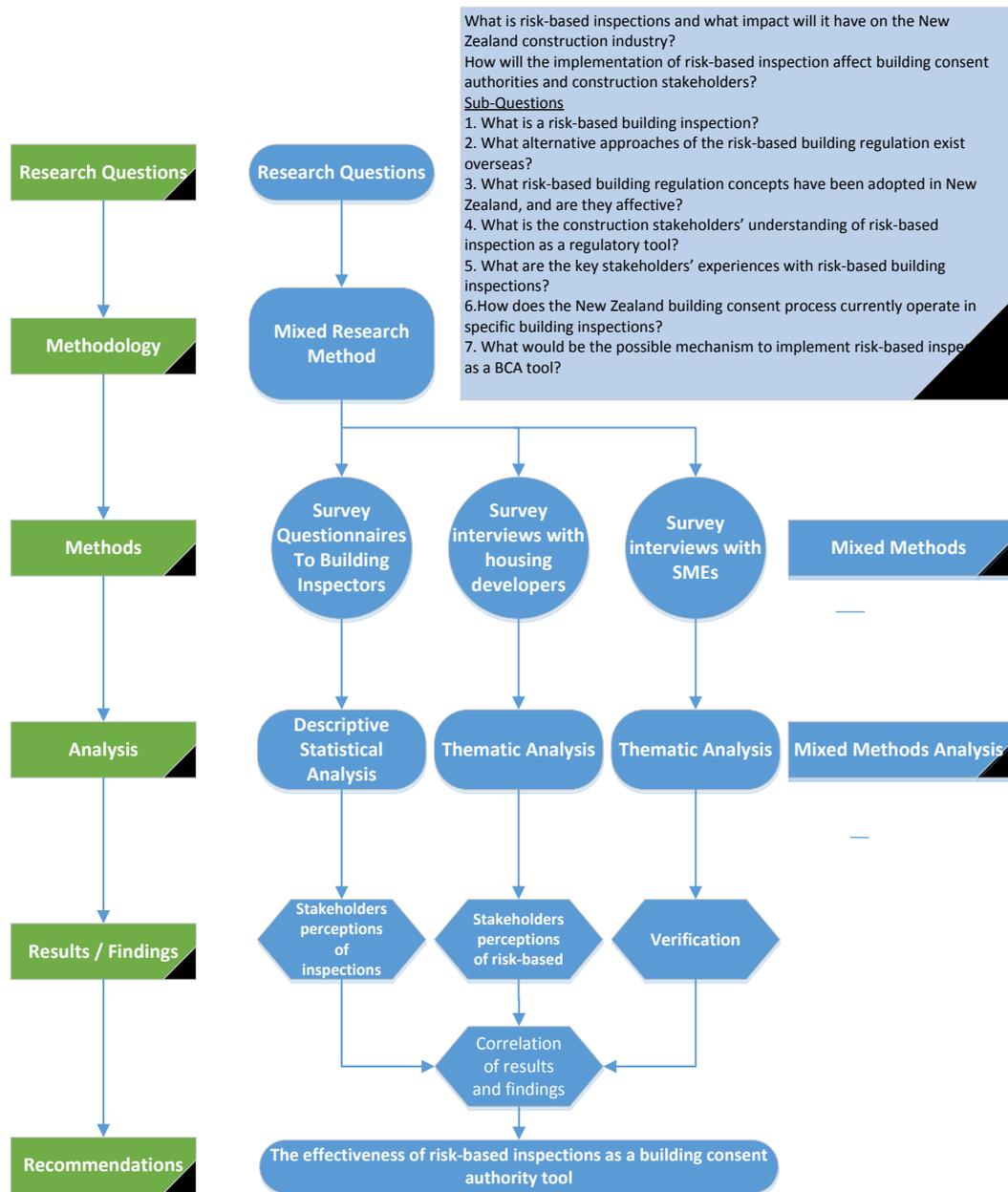


Figure 3.5: Typologies of mixed-method research for this current study  
 Adapted from: (Bryman, 2016 pg. 639).

### 3.9 Pilot study

According to Fink (2005), a pilot test's purpose is to help produce a survey form that is useable and that will provide the information a researcher requires. Self-administered questionnaires depend heavily on the clarity of their language, and pilot testing quickly reveals whether people understand the directions the researcher has provided and if they can answer the survey questions. Two pilot tests were conducted for this research in two phases. The first test involved a semi-structured questionnaire which was administered

to, a building and design organisation in the Auckland region. This was to test the effectiveness of the questionnaire.

To determine a questionnaire's usefulness and suitability, it is important to conduct a pilot test with at least 20 participants (Parfitt, 2005). A total of 40 questionnaires were sent out, and 26 were returned, corresponding to a 65% response rate. One major result from the pilot test was that out of 10 questionnaires that were sent to builders, only one responded. Further investigation into the low response rate revealed that the one of the larger building organisations was restricting correspondence from external parties due to the overload of information on their members. In this particular circumstance, the questionnaire surveys were prevented from being distributed through the organisation member's database. As a result, access to the largest building organisation in New Zealand was restricted. A decision was made that the builders' perspective would be excluded from the survey phase but would be included in the interview stage. Other changes, as a result of the pilot survey, relate to the rewording and rephrasing of the questions.

A couple of sections of the questionnaire contained a list or table which the majority of participants did not complete, as comments ranged from "not enough information to answer" and "question is not relevant". An example was a standard list of notifiable residential inspections (Auckland Council, 2013) in which research participants noted that the list could be condensed as to actual inspections and other inspections (e.g. re-clad\_ which were specific to the Auckland region only.

### **3.10 Research issues**

#### **3.10.1 Ethical considerations**

Ethical consideration is vital to research participants and researchers in conducting any research project. Kumar (2014) suggested that research participants should be aware of the following areas that could pose ethical issues if not dealt with properly: collecting

information, seeking consent, providing incentives, seeking sensitive information, the possibility of causing harm to participants, and maintaining confidentiality. With regard to the researcher, areas of ethical concern include the following: introducing bias, providing and depriving individuals of treatment, using unacceptable research methodology, inaccurate reporting, and the inappropriate use of information (Kumar, 2014). It is fundamental to the researcher that he /she is aware of unethical practice. Researchers must have appropriate strategies in place to deal with unethical practice to protect any stakeholders from harm or discomfort throughout the research process.

Ethical consideration was sought from the AUTECH committee prior to the commencement of data collection. An application (ethics application number 14/301) for the current research was granted by Auckland University of Technology AUTECH Ethics Committee on 25 November 2014 (Appendix A1). The ethical application consisted of the EA1 application for ethics approval by AUTECH and supporting documents such as the participant information sheet (Appendix A2), participant consent form (Appendix A3) and questionnaires for stakeholders (Appendix B1 and B2).

The study's aims and objectives were explained to all participants by the attachment of a participant information sheet to each questionnaire. Participants were also informed about the research process and data collection/analysis. They were told that the information compiled would be in fulfilment of a PhD degree on its conclusion. It was also explained to all participants that participation was voluntary; there was a provision to withdraw at any time prior to the completion of data collection. The final page of the participant information sheet provided the contact details of the researcher, project supervisor and AUTECH executive secretary if a participant had any queries or concerns about the research.

### **3.10.2 The principle of partnership**

The methodologies used (personal experiences, narrative inquiry, face-to-face discussion) engage both the researcher and participants in a partnership which reciprocates respect with the knowledge they are contributing to the researcher's field of expertise and encouraging sector growth. These factors are fundamental to any partnership to ensure the relationship between the two parties is not only secured but connected. All participants are governed morally or ethically, either through regulations or the Code of Ethics for building control officers or building institutes or affiliated groups such as Master Builders, Engineers of New Zealand (IPENZ) and Architects of New Zealand (NZIA).

### **3.10.3 The principle of participation**

Quality participation is required in this research to determine processes and procedures that could encourage the New Zealand economy to grow through increasing the productivity of the construction sector. Therefore a synthesis from both participants and the researcher's discussions will evaluate the effectiveness of risk-based inspections as a regulatory tool in New Zealand. This research has aimed to evaluate risk-based inspection for its effectiveness or deterrent as a Building Consent Authority tool in New Zealand.

### **3.10.4 The principle of protection**

All participants were protected during quantitative surveying in that all transcripts and data collected from participants are referred to only by way of pseudonyms. The information provided is totally anonymous as names and addresses were not required on the questionnaire. As a result, there were no issues of discomfort and risk regarding privacy and confidentiality. There is no way of identifying any participant's responses in any future publications since no demographic details have been disclosed.

All participants undertaking qualitative Interviews have been protected, as all of the interviews were conducted individually; this helps protect the participants' views and opinions. Individual interviews gave the participants a sense of security as they had the privacy to disclose any information that would contribute to risk-based inspections. The participants' anonymity is protected with no names used within the study. Verbal exchanges through interviews will have no way of identifying any participant's responses in any future publications since no demographic details have been disclosed.

### **3.10.5 Privacy and confidentiality**

All participants were assured of their rights to privacy, confidentiality and anonymity throughout the study. The identity of participants is protected by a numeric code and no participant has been directly identified within the research and/or publications which have arisen from this study. Any direct quotes from participants are presented by way of pseudonyms and any direct references to identifiable personnel have been deleted to ensure their privacy and confidentiality. The data gathered was kept confidential under secured premises and not disclosed to anyone other than the researcher and associated supervisors. Strict caution was taken that no information was shared or discussed with any other participants. The privacy and confidentiality of each participant was protected throughout the research. Participants were also informed that potential discomfort and risk associated with this research was limited to privacy and confidentiality. All responses were treated in strict confidence; information provided has only been utilised for the purpose of this research.

### **3.10.6 Social and cultural sensitivity of the participants**

The researcher is a citizen of New Zealand and has over 20 years' experience within the New Zealand construction industry, either through trade or regulatory functions. The research participants are all be affiliated within the New Zealand construction industry

and during the methodology phases a professional approach was undertaken between researcher and participants. All participants are governed morally or ethically either through regulations or the Code of Ethics for building control officers or building affiliated groups such as Master Builders, IPENZ, and Architects of New Zealand NZIA. The researcher ensured that social and culture sensitivity was respected during the collection of data during this study. The research does not focus on any area that involves Treaty of Waitangi obligations.

### **3.10.7 Research scope**

The data used for this research was gathered from key residential construction stakeholders within six regions in New Zealand. These regions were Auckland, Canterbury, Central North Island, Southland/Otago, Midlands and Cook Strait. The Auckland region took into account the amalgamation of past legacy regions which consisted of the North Shore, Papakura, Franklin, Waitakere, Rodney and Manukau. The scope of the regions was in line with the six major cities in New Zealand in which key stakeholders had set up offices for business. The Auckland and Christchurch regions, through the literature review conducted in chapter two, detailed the housing sector pressures evident in these areas and are therefore the main focus of this current study. Table 3.7 provides the coverage area of the current study.

Table 3.7: Data coverage area

<b>Auckland Region</b>	<b>Canterbury Region</b>	<b>Central North Island Region</b>	<b>Southern Region</b>	<b>Midland Region</b>	<b>Cook Strait Region</b>
Auckland	Canterbury	Taranaki	Otago	Waikato	Wellington
Northland	Ashburton	Wanganui	Gore	Tauranga	Wairarapa
	South Canterbury	Hawkes Bay	Southland	Whatatane	Nelson
		Manawatu		Rotorua	Marborough
		Gisbourne		Taupo	West Coast

### 3.10.8 Research limitations

This research envisaged capturing the perceptions of housing construction stakeholders in New Zealand regarding risk-based inspection as a regulatory tool for building consent authorities. With the rise of the internet, there has been a major shift to the online mode being the dominant form of collecting data from surveys (Toepoel, 2016).

One of the data collection methods used in this study was an online survey. The survey questionnaire was initially aimed at three main residential construction stakeholders in New Zealand: builders, designers and regulatory building inspection authorities. As Fink (2009) suggested, testing helps make the survey run smoothly. That might mean obtaining permission from people to be in the try-out phase. As discussed in section 3.9, an initial pilot test was conducted with the three stakeholders where a very low response rate was received by builders. The pilot may have been an expensive exercise in terms of cost and time to implement, but the reverse benefits of saving money and time outweighed not conducting a pilot at all. Oppenheim (1992) explains that routine administrative matters, with sampling and fieldwork that could not possibly go wrong, will go wrong.

After many consultations and much time encouraging the benefits of this study to the Master builder's organisation it was decided to remove builders from this phase of data

collection. However, they would be included in a qualitative method of data collection through the face-to-face interviewing process. Therefore the research methodology employed in this current study had its limitations. The semi-structured interviews, which ran in conjunction with the online survey, were limited to the building sector of the construction industry; this method was limited to smaller numbers and the qualitative method was seen as complimenting the quantitative results in mixed- method research (Nardi, 2014, Johnson & Onwuegbuzie, 2014). There was also a risk of the response rate being low, as discovered in the pilot test of the survey questionnaire.

An extrinsic motivator is an important part in increasing response rates and encouraging participants to complete a survey questionnaire (Fink, 2009, Tolich & Davidson, 2011). As declared in the researcher's ethics process, the kind of extrinsic motivator offered in this current study was in the form of appreciation and acknowledgement to participants for their time and effort.

### **3.10.9 Reliability**

Reliability refers to the purity and consistency of a measure, to repeatability, and to the probability of obtaining the same results again if the measure were to be duplicated (Oppenheim, 1992, p.144). Similarly, Babbie (2013) explains in simple terms that reliability is a matter of whether a particular technique, applied repeatedly to the source, provides the same outcome each time. According to Franklin (2012), reliability refers to consistency in the administration, calculating, and internal scoring of a research instrument, e.g. a survey question or coding scheme. Reliable instruments need to be internally consistent. For example, a coding scheme yields the same results for different coders most of the time, is reliable for different time periods ( a survey from one year to the next) and is not susceptible to ambiguity or errors of measurement (Franklin, 2012). Yin (2009) explains it in simpler terms as the objective is to be sure that, if a later

investigator was to follow the same procedures as an earlier researcher and conducted the exact study all over again, the later investigator should arrive at the same findings and conclusion.

Therefore, it was crucial that phase one's survey questionnaires, which went specifically to building inspectors and designers, were distributed in the same time period as the second phase of interviews that were targeted specifically at home developers. This would limit any potential threat to the reliability of this study.

The general way of approaching the reliability problem is to make as many phases as operational as possible and to conduct research as if one was under supervision at all times (Yin, 2009). The search for reliability underpins the arguments for triangulation. It was also imperative that the survey questionnaire and interview participants that were selected had sufficient knowledge and experience of the New Zealand residential construction industry so that the terminology and jargon which were contained in some of the questions were understood.

All the participants selected for the interviews were competently qualified, experienced in their field and well-established in the New Zealand construction sector, as profiled in chapters five and six. Therefore, it can be argued that the research findings from the current study, that address the research problem by the participants, are reliable.

#### **3.10.10 Validity**

Babbie (2013) suggests that in normal circumstances, validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration. Similarly, Hesse-Biber and Leavy, (2011) suggest that validity is a process whereby the researcher earns the confidence of the reader that he or she has "gotten it right". The concept of validity can be applied to every aspect of the research process. In

its simplest form, validity refers to the appropriateness of each step in the research process. The concept of validity is associated with measurement procedures; validity has the ability of an instrument to measure what it is designed to measure (Kumar, 2014). Creswell (2014, p.201) identifies eight strategies to check the accuracy of findings in any research and to convince readers of that accuracy. The eight primary strategies, organised from those most frequently used and easy to implement to those occasionally used and more difficult to implement, include:

- triangulating different data sources of information and using them to build a coherent justification for themes
- using member checking to determine the accuracy of the qualitative results
- using rich and full descriptions to convey the results
- clarifying the bias the researcher brings to the research
- presenting negatives or discrepant information that runs counter to the themes
- spending prolonged time in the field
- using peer debriefing to enhance the accuracy of the account
- using external auditors to review the entire project

Bryman (2016), Guest, Namey and Mitchell (2013) explain that, at the very minimum, a researcher who develops a new measure should establish that it has “face validity” and that the new measure apparently reflects the content of the concept in question. In simpler terms, people (possibly those with experience or expertise in the field) are asked to verify whether, on the face of it, the measure seems to reflect the concept concerned. Face validity is therefore an essentially intuitive process (Bryman, 2016). The current research established the research problem and questions from a comprehensive literature review and the opinions of SMEs. The research questions were formulated to address the research problem through a mixed-method approach. The findings produced after the analysis of the data collection were more than verified using SMEs in the residential construction field. The use of triangulation design to obtain complementary quantitative and

qualitative data on the same topic, bringing together the different strengths of the two methods and then validating the findings through SME interviews, assured the validity of this current study (Punch, 2009).

### **3.11 Sampling frame**

#### **3.11.1 Unit of analysis**

Unit of analysis is related to the fundamental problem of defining the “case”, in which an individual person is the case study, and the individual is the primary unit of analysis (Yin, 2009). The sampling units for this study consist of regulatory building inspectors, designers and housing developers in New Zealand as the main sampling frame. These construction stakeholders were selected as they are key players in the building consent process. A sample of building inspectors was randomly selected from data obtained from Auckland and Christchurch building control inspector staff lists supplied by each council’s operations team. The data provided comprised building inspectors who carried out residential home inspections. The building designers were randomly selected through the New Zealand Institute of Architects (NZIA) database in which the pre-requisite was residential construction in Auckland and Christchurch. Finally, housing developers were selected on their demographic coverage in Auckland and Christchurch and the number of houses their companies built annually.

#### **3.11.2 Sampling approach**

Sampling is one of the most important facets of research design. In the research context, sampling refers to the process of selecting a subset of items from a defined population for inclusion in a study (Daniel, 2007, Guest *et al.* pg. 41, 2013). Similarly, Babbie (2013) explains that the process of selecting observations is called sampling. The selection of sampling in quantitative and qualitative research can be explained by two opposing philosophies. In quantitative research, selecting a sample is done in a way that it is

unbiased and represents the population from where it is selected. Qualitative research has a number of considerations which may influence the selection of a sample, such as the ease of accessing the potential respondents and the judgement that those selected have extensive knowledge about the episode, event or situation of interest (Kumar pg. 192, 2011).

Babbie (2014) and Kumar (2014) comment that the type of sampling strategy that is employed will influence the ability to make generalisations from the sample findings about the study population, and the type of tests that can be applied to the data. Babbie (2014) indicates that there are two major types of sampling: non-probability and probability sampling. Probability sampling gives every element in the target population a known or non-zero chance of being selected whereas non-probability sampling does not (Daniel, 2012).

Purposive sampling or judgement sampling is a type of non-probability sampling in which the units to be observed are selected on the basis of the researcher's deliberate aims in mind, and about which ones will be the most useful or representative (Babbie, 2014, Hammond & Wellington, 2013). Perhaps the most intuitive way to describe purposive sampling is selecting participants based on the purpose of their involvement in the study (Guest, Namey & Mitchell, 2013).

As the research objective for this study was based around key residential construction stakeholders in New Zealand (regulatory building inspectors, designers and housing developers), these subset groups were the population to be considered for the questionnaire surveys and interviews. In the context of this study, purposive sampling was used for the first phase of the questionnaire survey and semi-structured interviews.

Again, for the second phase of the study of SME interviews, purposive sampling was adapted. The following sections provide the specific sampling techniques used in each phase of the study.

### **3.11.3 Questionnaire survey – purposive sampling**

The current study targets a particular group or population (designers, building inspectors and housing developers). Daniels (2012) explains that purposive sampling provides more control over who is selected to be included in a sample, and is more appropriate for research focussed on particular segments of a target population. The study has assessed its purpose, budget and timeframe for the purposive sampling technique as suggested by Babbie (2014). A common goal of survey research is to collect data representative of a population (Bartlett et al., 2001). To establish a sample size to be utilised in the questionnaire surveys, the research considered the participation of key stakeholders in the residential construction sector. The stakeholders play an integral part in the construction of residential housing in New Zealand. The designers provide compliant design plans for construction. Housing developers are responsible for building to the consented plans in which the building inspectors perform regulatory checks at notifiable stages of the construction. To determine sample size, Cochran formulae for continuous data were used to calculate the sample size for each of the population groups (Barlett, Kotrlik, & Higgins, 2001).

Equation 3.1: Minimum sample size (n)

Adapted from: (Bartlett et al., 2001)

$$n = t^2 \times s^2 / d^2$$

Equation 3.2: Adjusted sample size (N)  
Adapted from: (Bartlett et al., 2001)

$$N = \frac{n}{1} + \left( \frac{n}{\text{population}} \right)$$

The conditions used for the sample size choice are:  $t = 1.96$  (value for selected alpha level of 0.025 in each tail equals 1.96 (the alpha level of 0.5 indicates the level of risk the researcher is willing to take; the true margin of error may exceed the acceptable margin of error)).

$s = 1.25$  (estimate of standard deviation in the population. Estimate of variance deviation for a five- point scale calculated by using 5 (inclusive range of scale) divided by 6 [number of standard deviations that include almost all (approximately 98%) of the possible values in the range]).

$d =$  acceptable margin of error for the mean being estimated = 0.03

$N =$  sample size

The next section provides the population group and the sampling method adopted to exemplify the sample size.

**a) Building designers**

As calculated in accordance with equations 3.1 and 3.2 (sample size exceeds 5 per cent of the population) 185 participants were randomly selected from 600 members of the New Zealand Institute of Architects (NZIA).

**b) Regulatory building inspectors**

As calculated in accordance with equations 3.1 and 3.2, 114 participants were randomly selected from 200 members of the Building Officials of New Zealand (BOINZ). Table 3.8 summarises the selection of the questionnaire survey sample for this study.

Table 3.8: Survey sample for this current study

<b>Participant group</b>	<b>Population source</b>	<b>Population identified</b>	<b>Medium of distribution</b>	<b>Number of questionnaires distributed</b>
Designers	NZIA	600	Directly administered through NZIA members through Survey Monkey	185
Building Inspectors	BOINZ BCA	200	Directly administered through BCA members through Survey Monkey	114

#### **3.11.4 Interviews – purposive sampling**

The purposive sampling method was adopted for the semi-structured interviews. This was a subset of the larger population in which many members of the subset were easily identified but the enumeration of them all would be nearly impossible. It was essential to use purposive sampling in the current study because all the participants were key stakeholders in the residential construction industry (designers, building inspectors and housing developers) and all have the knowledge, experience and expertise to consider the issues of the current regulatory inspection process in the New Zealand housing sector. The housing developers were purposively sampled during the first phase of the study because they were not represented in the online surveys. Furthermore, experts in the field of residential construction were purposively sampled during the verification stage of the study.

#### **3.12 Data collection strategy**

The data collection provided for in this research consisted of both quantitative and qualitative strategies, as merging the data provided a better understanding of the problem than if either dataset had been used alone (Johnson & Onwuegbuzie, 2014). Conducting survey research is a skill, an art, and an intellectual process involving collaboration, patience, and creativity (Nardi, 2014). There are numerous methods for collecting data in research and there is no one perfect method. The current environment for collecting data

for the study was quite difficult and, at times, very sensitive as discussed in the limitations section. Due to the sensitivity and confidentiality of the information that was being requested of the research participants, it was vital that individuals' identities would be protected. Some details supplied by participants were deliberately excluded so that individuals' identities would be kept anonymous. This survey method was adopted for data collection for the study. Surveys were information-collection methods used to describe, compare, or explain individual and societal knowledge, feelings, values, preferences and behaviours (Fink, 2009).

Similarly, Babbie (2014) explains that surveys are a great vehicle for measuring attitudes and orientations in large populations. Surveys are best when one needs information directly from people about what they believe, know and think (Fink, 2009). Other benefits of surveys are economical and timely, with the possibility of anonymity and privacy to encourage more responses on sensitive areas such as those addressed in the research. Surveys can comprise a quantitative method which involves establishing questions for surveys and in-depth interviews, learning to quantify or count responses, and statistically (mathematically) analysing archival, historical, or other data (Nardi, 2014).

Each method of collecting data, whether quantitative surveys or structured face-to-face-interviews, has its advantages and disadvantages. A quantitative survey was selected because it was less costly to reach larger samples around the country, able to address multiple topics in one survey and ideal, being a computer-based survey and all targeted participants had access to a computer. This method also had its disadvantages: there was no guarantee that any respondent answering the survey was the person intended, due to resource sharing, difficulty in probing answers and errors due to complicated and long survey answers.

The advantages of face-to-face interviews are: standardised questions for structured interviews, the ability to explore and probe for additional information and unanticipated answers can lead to new, unexpected findings. The difficulty with conducting interviews is that they are limited to small numbers and face-to-face interviews are time-consuming, not only the interview itself but the logistics to set them up and organise the parties beforehand. Table 3.9 presents' further advantages and disadvantages for quantitative and interview data collection.

Table 3.9: Data collection: Survey and interview advantages and disadvantages

<b>Quantitative survey advantages</b>	<b>Quantitative survey disadvantages</b>
Ideal for asking about opinions and attitudes	Self-report requires reading ability in the language
Less labour-intensive to collect data or train researchers	Possible gap between what people report and what they actually do
Can guarantee anonymity	Return rate low for mailed and computer-based surveys, thus limiting generalisability
Suitable for probability sampling and more accurate generalisation	Closed-ended questions can be restrictive and culturally insensitive
Easier to code closed-ended items	Difficult to explain the meaning of items
Respondents can answer at their own pace	Difficult to probe answers
Better for sensitive and personal topics	Depend on asking recollected behaviour
Easier to replicate a study	More difficult to code open-ended responses
Easier to compare with other studies using similar questions	Requires skill in questionnaire design
	Easy to overlook and misunderstand questions
	More difficult to generate reliability and validity for one-time-use questionnaire
<b>Interview advantages</b>	<b>Interview disadvantages</b>
Can clarify meaning of questions	More difficult to code open-ended responses
Less likely to have skipped or missed questions	Interviewers' characteristics and style could be bias response
	Not ideal for collecting sensitive or personal information
	More difficult to replicate
	Face-to-face interviews are not anonymous

(Nardi, 2014 pg.20)

Therefore, the major data-collecting methods used in this research were the online questionnaire and face-to-face interviews. The questionnaire was used as the survey instrument for the first field investigation because it was considered less costly; it reached

large samples and was better for sensitive and personal topics (Nardi, 2014). For the conjoining second field investigation, a structured interview technique was adopted. Another advantage of using interviews is that of the improved response rate in comparison to postal surveys which easily produce a response rate of 40 per cent. Interviews can generally do much better than this but not always (Oppenheim, 1992). An online questionnaire to designers and building inspectors was used to get statistically significant results so the study had a true representation of key stakeholders that were in the frontline of regulatory building inspection in New Zealand. A concluding face-to-face interview was conducted with subject matter experts to validate the findings from the previous phase analysis. In short, it is not enough to simply collect and analyse quantitative and qualitative data; data must be mixed in some way so that together it form a more complete picture of the problem than when considered alone (Creswell & Clark, 2007).

### **3.12.1 Questionnaire survey**

Surveys are information-collection methods used to describe, compare, or explain individual and societal knowledge, feelings, values, preferences, and behaviour (Fink, 2009). Franklin (2012, p.201) provides eight techniques when setting up (semi-) standardised questionnaires:

- ask clear, easy-to-understand questions
- provide a clear estimate of time needed to complete the survey
- provide an orderly organisation of the questionnaire
- start with easier, information-based questions and move from the general to the more specific
- formulate questions that make sense to the targeted population and respondents
- keep the list short
- allow for expressions of variability
- try mixing up the sorts of questions between single answer to multiple answers to avoid response bias

A good way of finding out what people think is to ask them an open-ended question as this requires the respondent to write out, or, if in an interview, to speak about their responses using their own words and ideas. However, respondents often don't like to answer too many open-ended questions because it can become very time-consuming, so closed-ended items can be incorporated. These give the respondents standardised answers to select from, similar to questions on a multiple-choice test. It is easier and quicker for respondents to complete; coding responses is simpler for the researchers and more efficient than with open-ended items (Nardi, 2014).

### **3.12.2 Computer-assisted and web-based surveys**

In today's modern world where technology has rapidly evolved as the main choice of communication, a popular way of creating and distributing self-administered questionnaires is with computers and the use of the World Wide Web. Questionnaires can be sent to respondents by email, or respondents can be directed by an internet link to a website that hosts the survey, such as the popular Survey Monkey platform.

One of the benefits of utilising these computer programs is that the questionnaires are set up to allow for instant coding of the data, thereby eliminating a source of error that often occurs when researchers or their assistants manually enter data from a completed questionnaire (Nardi,2014). Bryman (2016, p.235) provides a list of advantages and disadvantages of online surveys, compared with postal questionnaire surveys, in Table 3.10.

Table 3.10: Advantages and disadvantages of online surveys compared to postal questionnaire surveys

<b>Advantages</b>	<b>Disadvantages</b>
Low cost	Low response rate
Faster response	Restricted to online population
Attractive formats	Requires motivation
Mixed administration	Confidentiality and anonymity issues
Unrestricted compass	Multiple replies
Fewer unanswered questions	
Better response to open-ended questions	
Better data accuracy, especially in web surveys	

### 3.12.3 Interviews

#### House developers

The participants for the interviews were purposively sampled, as discussed in section 3.11.4. Daniels (2012) mentions that purposive sampling is often focused on specific units (individuals, groups of individuals, organisations) of a target population. Obviously, interviews are costly and time-consuming, and so there are usually extraneous pressures to reduce interviews to a minimum. However, quality, rather than quantity, should determine the essential number of interviews (Oppenheim, 1992).

The housing developers were specifically targeted for these interviews as they are key stakeholders in the New Zealand housing sector and the building consenting process. The stakeholders were contacted initially by email, and followed up by a telephone call in which an invitation was extended to them to be part of a research project that had the potential to improve the productivity of the housing market in New Zealand.

Face-to-face interviews were performed with 10 housing developers. Crouch and Mckenzie (2006) make a virtue of small sample sizes, arguing that samples of fewer than 20 increase the qualitative researcher's chance of getting close involvement with their participants in interview-based studies and thereby generate rich data. The size of samples

that is able to support convincing conclusions is likely to vary somewhat from situation to situation, in purposive sampling terms, and qualitative researchers must recognise that they are engaged in a delicate balancing act (Bryman, 2016). Surveys are often conducted by interviewers who read the questionnaire items to respondents in a face-to-face situation (Nardi, 2014, Oppenheim, 1992). The interview technique in the current study applied semi-structured questions which provided an in-depth understanding of the research topic with relevance to the stakeholders. Structured interviews are in the hands of the researchers who control the flow and ordering of the questions asked, know who is completing the survey, and can employ various visual aids such as charts and list of responses (Nardi, 2014).

The key to successful interviewing is learning how to probe effectively; stimulating a respondent to produce more information, without injecting the interviewer's own views, this results in a reflection of the interviewee's own voice (Bernard, 2013). The semi-structured interview enlisted this process, whereby the researcher was able to prompt and probe for better answers. The structure of the interview questions was open-ended so questions could be rephrased and covered by the researcher in any sequence or order. The experience and knowledge of the housing developers in the regulatory building inspection process was considered vital as this ensured that their opinions and responses were credible and reliable to the research findings.

### **Subject matter experts (SMEs)**

As suggested by Bryman (2016), the very minimum a researcher should establish that research has 'face validity' and that interviews apparently reflects the content of the concept in question. The face validity for the current research came in the form of the subject matter expert (SME). A validation exercise was conducted through interviews with three key construction stakeholders to validate the findings of the current research.

The SMEs were selected for their expertise and experience in residential construction in New Zealand. They were engaged in the research to complete triangulation in the research process. The strength of in-depth interviews allows the researcher to get “deep” answers to important questions from “experts” on the issue (Guest, Namey & Mitchell, 2013). The three key SMEs which were purposely sampled for the validation exercise included a representative from New Zealand Institute of Architects (NZIA), Building Officials Institute of New Zealand (BOINZ), and the Master Builders Federation (MBF). The selected SMEs were also strategic leaders in the field in which they held the role of director, senior executive and senior management in their organisations respectively.

Face-to-face interviews were conducted with the three SMEs in a similar manner to that conducted with the housing developers. The semi-structured questionnaire presented to the SMEs for verification and comment contained key issues and themes that emerged from the questionnaire survey (with the designers and building inspectors) and interviews (with the housing developers and key construction stakeholders). Brief information on the three SMEs recruited for the current study were provided:

1. A representative from the New Zealand Institute of Architects (NZIA). This participant has over 25 years’ experience in the development of sound technical resolutions to complex constructional challenges in the New Zealand construction sector. Currently, this person is a senior figure of NZIA and has represented the institute on Building Research Association of New Zealand (BRANZ) programmes on numerous occasions. The participant was selected as an SME to verify and comment on the research outputs on issues around the current consenting regime and risk-based inspection as a regulatory tool in New Zealand.
2. A representative from the Building Officials Institute of New Zealand (BOINZ). This participant holds a senior role in the organisation and has over 25 years’ experience in the residential construction sector. The SME has very good knowledge of the building inspection process and legislative documentation used

in the construction sector. The participant was purposely selected as an SME to provide opinions on issues around the building inspection process in New Zealand.

3. A representative from the Master Builders Federation (MBF) and a senior member of the organisation. The participant has 25 years' experience in the construction industry, including project management, residential carpentry and regulatory consenting. The participant was selected as an SME to address aspects of the current building inspection regime and regulatory inspection structure.

The accumulation of material through interviews with a number of respondents provided a rich qualitative dataset that could be analysed to address the range, nuance, and complexity of important research questions (Guest, Namey & Mitchell, 2013). The information obtained from this verification exercise enabled the researcher to clarify and, in some cases, reaffirm findings beyond those generated from the secondary data collection and analysis in the first phase of the study. The organising and managing of this data will be discussed in the next section.

### **3.13 Data management**

Organising or managing survey data is a vital part of data analysis. It is the part of the analytical process in which data is arranged into a database where results can be produced. It is also essential that before data can be entered, the researcher should decide how to prepare the results so that information is in a usable form (Fink, 2009). Similarly, Flick (2014) suggests that researchers need to develop a way of managing the data, so interviews can be recalled overtime, and so that excerpts in the data can be traced to the context in which a statement or observation was made. The initial data for this current study was sourced from designers, building inspectors and building associations which covered New Zealand's geographic landscape. This data was then reduced to the six geographic regions (Auckland, Canterbury, Central North, South, Midland and Cook Strait). Each region contains one of the six largest cities in New Zealand.

The data collected for the online survey was managed using web survey software. The selection of the software depended on a number of issues such as budget, technical skill and question type. As this is the tool that both researcher and respondents needed to use in order to provide the content and answer the questions, it was very important to select a tool that met the needs of the specific research (Toepoel, 2016). The online survey was collected by using the website tool “Survey Monkey” which is an online development cloud-based software providing data collection and data analysis. Survey Monkey maintains that each participant was provided with a unique code. Progress was monitored, including surveys partially or fully complete.

The data, once collected using Survey Monkey, was then transferred in its entirety to the Statistical Package for the Social Sciences (SPSS) for quantitative data analysis. Babbie (2014) describes quantitative analysis as numerical representation and manipulation of observations for the purpose of describing and explaining the development that those observations reflect. SPSS automatically provided each individual response with a unique identification description. One of the benefits of selecting Survey Monkey as a data collection tool was its export function of results directly into SPSS. As the online survey contained a few open- ended questions, the data collected was analysed using the qualitative data analysis (QDA) program NVivo.

The interviews conducted with the housing developers and the SMEs were recorded and then transcribed verbatim into transcripts. These transcripts provided a complete record of the interviews, which were entered into NVivo for data analysis. The transcripts and notes were then reviewed for readability and clarity with audio-recorder versions. A thematic analysis was conducted through the use of NVivo on the information obtained from the interviews with housing developers and SMEs.

Qualitative data analysis programs can be used to organise documents and interview scripts in preparation for analysis utilisation of three-key tool coding, memoing, and concept mapping (Babbie, 2014). NVivo allowed the coding of data, dividing the text into small units (phrases, sentences, and paragraphs) and categorising these units into themes, thus allowing the researcher to explain such patterns, and providing answers to the qualitative research questions (Creswell & Plano Clark, 2007). In preparing the data for computer analysis, protecting each participant's identity was necessary to ensure privacy and confidentiality. The 10 housing developers that were interviewed in the first phase of the study were allocated the coding of HD01 for the first interviewee, the second was HD02 and so on. The identification of the subject matter experts were coded for privacy reasons in the same manner. The Master Builder representative is referred to as SME 1, the building official representative is referred to as SME 2 and the representative from NZIA is referred to as SME 3.

Assigning labels to differentiate between the main themes and sub-themes was presented through the thematic names of theme 1 and sub-themes, theme 2 and sub-themes and so on. Toepoel (2016) suggested creating clear variable names, variable labels and value labels as many types of analysis report data errors, and it is necessary to perform systematic data cleansing in order to delete inaccurate entries. This is discussed in the next section.

### **3.13.1 Data clean-up exercise**

The objective of cleansing the data was to review the initial data collected from the designers and building inspectors, removing any obvious errors and dealing with incomplete data from the survey questionnaires. According to Fink (2009), once data is entered, it must be cleaned, as a clean data set can be used by anyone to get the same results when running the same analysis. The cleaning up of data can also include having

to deal with the complete absence of data because surveys have not been returned. Missing data from surveys that have been returned is another issue. Some survey information was totally different from that given by other respondents. The reason the data was returned incomplete may be due to the fact that the participant did not wish to answer, did not know the answer or did not have an opinion on it for various reasons. The data collected from designers and inspectors required reviewing for descriptive analysis and also for missing information and obvious errors throughout the survey. Questions that were not answered by the majority of the participants were excluded from the analysis and were treated as missing data.

There are several ways of dealing with missing values. One way is to leave the response blank; the computer program will treat it simply as missing and will not use it to calculate statistics, or the missing answers could be coded with a number not likely to be a real answer. In coding a missing answer without leaving it blank, it can later be analysed to see if there are other emergent patterns (Nardi, 2014). The current study employed the strategy of leaving the missing data blank, as this method did not interfere with the existing collected numerical data.

### **3.14 Data analysis strategy**

Bernard (2013) explains that analysis is the search for patterns in data and for ideas that help explain why those patterns are there in the first place. Quantitative and qualitative data follow a distinct approach with regard to data analysis. For both forms of analysis, researchers go through similar processes of: preparing the data for analysis, exploring the data, analysing the data, representing the analysis, and validating the data (Creswell & Plano Clark).

In analysing and evaluating the data for this current study, qualitative and quantitative approaches were adopted in order to achieve the research objectives. The two methods of

analysis included descriptive analysis and thematic analysis. Descriptive statistics were used for the analysis of the online questionnaires, while thematic analysis was performed on the open-ended questions from questionnaires and interviews. Both methods of analysis are briefly described in the following sections, followed by some explanation of the tools that were used to facilitate the analysis.

### **3.14.1 Descriptive statistics**

Descriptive statistics are used to organise and describe the characteristics of a survey's respondents and their responses (Salkind, 2004). Simple summaries are provided about the sample and the responses to some or all questions. Descriptive statistics for surveys include frequency or frequency distribution (number and percentages) measures of central tendency (the mean, median, and mode), and measures of variation (range and standard deviation) (Fink, 2009). Similarly, Babbie (2013) describes descriptive statistics as statistical computations, indicating either the characteristics of a sample or the relationship among variables in a sample presenting quantitative descriptions in a manageable form. Descriptive statistical analysis was employed to explore the data and present it in tables, charts and graphs to show the data distribution patterns that emerged after different statistical queries had been run. The descriptive statistics for the analysis performed are provided in chapters four and five.

### **3.14.2 Inferential statistics**

Inferential statistics involve making inferential statements on a population, using a representative sample. The current study employed T-test and correlation analysis. These inferential statistics techniques are described in the following sections.

### **3.14.3 T-tests**

T-Tests were conducted on key stakeholder data sets to compare the mean score on some continuous variables. An independent sample of t-tests was used on two different

(Independent) groups of people (designers and building inspectors) in comparing their scores. An independent sample t-test produces information on whether there is a statistically significant difference in the mean scores for the two groups, in statistical terms, testing the probability that two sets of scores have come from the same population (Pallant, 2016). The calculations for interpreting values of means in t-test is by Eta squared. Eta squared can be calculated manually, using the information provided in the output.

The formulae for calculating Eta squared are as follows:

$$\text{Eta squared} = \frac{t^2}{t^2 + (N1 + N2 - 2)}$$

$$\text{Eta squared} = \frac{-.1.416^2}{-.1.416^2 + (80 + 46 - 2)}$$

$$\text{Eta squared} = .001$$

The guidelines (proposed by Cohen 1988, pp. 284 – 7) for interpreting this value are:

.01 = small effect, .06 = moderate effect and .14 = large effect. (Pallant, 2016)

#### **3.14.4 Correlation**

The use of Pearson correlation, or Spearman correlation, explores the strength of the relationship between two continuous variables. It provides an indication of both direction (positive and negative) and the strength of the relationship. A positive correlation indicates that as one variable increases, so does the other. A negative correlation indicates that as one variable increases, the other decreases.

In the current study, a cross-tabulation was performed to identify strong correlations among the measured parameters. The stronger the independence between the parameters, the more powerful conclusions could be drawn regarding the stakeholders' understanding risk-based regulations in the residential building sector.

### **3.14.5 Thematic analysis**

Braun and Clarke (2016) argue that thematic analysis provides a rich and comprehensive, yet complex, account of the data and therefore should be a method in its own right. Thematic analysis involves identifying the main ideas or themes of the participants' responses or behaviours, and then grouping common themes together (Adams & Lawrence, 2015). As data collection can amount to the accumulation of excessive information, Grbich (2013) describes thematic analysis as the process of reducing data and that once the preliminary data analysis has been completed and all data is in, the database has been formulated and contains aspects that may not have been considered central to the research questions(s). Braun and Clarke (2006, p.79) define thematic analysis as:

A method for identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the research topic.

According to Boyatzis (1988), thematic analysis can exist in two types: manifest thematic analysis and latent thematic analysis. Boyatzis (1998) describes manifest thematic analysis as an approach involving the reporting of data on the surface, for example reporting only from data that is visible to the researcher. Latent thematic analysis is underlying and implicit levels of meaning produced in actions and interactions or, in simpler terms, involving deeper analysis of the underlying information presented by the data and comparing it with other sources (Flick, 2014). Braun and Clarke (2006) suggest that thematic analysis is the first qualitative method of analysis that should be studied by researchers, because thematic analysis provides the foundations for using other forms of qualitative analysis.

Flick (2014) provides six steps in thematic analysis. The first step is reading the transcription several times. In the second step, codes are developed from the material. The third step entails the sorting of the codes into various themes and collating the relevant data extracts in the themes. Step four aims at a refinement of the developed code system by breaking down themes into subthemes, and leaving out less relevant themes. The fifth step is thematic maps (visual representations of themes and subthemes and links between them). The sixth and final step involves the presentation of the findings from this procedure.

### **3.14.6 Quantitative data analysis**

The Statistical Package for Social Sciences (SPSS) was used for the analysis of data for this research. Data analysis begins with the recognition of variables. In a general sense, the term ‘variable’ describes anything that changes. Wetcher-Hendricks (2011) defines variables as each datum collected by a researcher provides information about a particular unit of analysis. The term variable applies because the information gathered generally addresses behaviours, attitudes and characteristics that change from subject to subject. SPSS shows its users three screens at various points during analysis. Raw data is imputed or exported into a “data view” screen which resembles a spreadsheet. By clicking the “variable view” screen, information about variables are entered. Wetcher-Hendricks (2011) explains that at the variable view, the researcher is able to,

- identify a name of each variable in the column entitled “Name”
- inform SPSS of any special units of measurements or characteristics of the data in the column entitled “Type”
- increase or decrease the number of digits visible in the column entitled “Width”
- adjust the appearance of numerical values in the column entitled “Decimals”
- provide a description of each variable in the column entitled “Label”
- provide a coding scheme for qualitative data in the column labelled “Values”

A third SPSS screen appears when the researcher requests statistics or illustrations from the program. This “output” screen varies greatly in appearance, depending on the function that is required to be performed.

In the current research, simple interpretive and descriptive statistical analysis was used to provide a general idea of the key stakeholders’ level of knowledge of current building regulations, and the newly introduced risk-based inspection scheme in terms of frequency counts, means, ranges, standard deviations etc. In many cases, together with simple graphic analysis (such as tables, charts and graphs), they form the basis of practically every quantitative analysis of survey data (Fink, 2009).

#### **3.14.7 Qualitative data analysis**

Creswell (2013) suggests data analysis in qualitative research consists of preparing and organising the data (text data, as in transcripts) for analysis, then reducing the data into themes through a process of coding and condensing codes, and finally representing the data in figures, tables or a discussion. Qualitative analysis allows a researcher to sort and summarise data from qualitative measures such as interviews, narrative observations, and open-ended responses on a questionnaire, in turn providing rich information about the sample (Adams & Lawrence, 2015). Similarly, Flick (2014) describes qualitative data analysis as the interpretation and classification of linguistic material in which to make statements about implicit and explicit dimensions.

The current study conducted 13 interviews (10 semi-structured interviews and three SME interviews) within the New Zealand residential building sector, in order to gain perceptions and opinions about risk-based inspection as a regulatory tool for Building Control Authorities. The questionnaire also included open-ended questions which provided qualitative data to the questionnaire survey. The open-ended questions provided

qualitative data which was transcribed and then categorised, depending on the themes that emerged from the responses.

#### **3.14.8 QSR NVivo 10**

NVivo is a software package from QSR international. NVivo helps manage, shape, and analyse qualitative data. One of its benefits is that it provides security by storing the database and files in a single file. It also enables a researcher to easily manipulate the data, conduct searches and, further, it can display the codes and categories graphically (Creswell, 2013). The NVivo 10 programme was used in the current study, as it provided the following benefits:

- NVivo 10 helps to store and organise qualitative data. The program provides a convenient way to store qualitative data. The interview transcripts produced up to 200 hundred pages of data, too large and complex to manage manually
- after reviewing many pages, a search function of the program could locate all the text segments that fit a coded label
- NVivo 10 helps to locate common passages or segments that relate to two or more coded labels
- the computer program is capable of writing memos and storing them as codes, this creating a qualitative report during data analysis, or simply recording insights as they emerge

NVivo introduces the researcher to a number of key concepts and terms which are listed below in Table 3.11.

Table 3.11: NVivo key concepts and terms

<b>Concepts and Terms</b>	<b>Meaning</b>
Sources	Research materials including documents, PDFs, datasets, audio, video, pictures, memos and framework matrices
Coding	The process of gathering material by topic, theme or case.
Nodes	Containers for coding, able to gather related material in one place to identify emerging patterns and ideas.
Source classification	Recording information about sources, for example bibliographical data
Node classifications	Records information about people and places, and demographic data about people

Adapted from: (QSR International, 2013)

### 3.15 Chapter summary

This chapter has provided an outline and justification of the overall research methodology and philosophical position that applies to this current study. The chapter provides justification for the research approaches employed, research strategies, data collection and data analysis techniques.

Quantitative and qualitative approaches are discussed as the main methods of data collection and analysis. A survey research approach was adopted for the study which involved online survey questionnaires to designers and building inspectors, and face-to-face interviews with housing developers and SMEs.

The responses for the online surveys were analysed using descriptive statistics through the SPSS computer program, and the interviews were analysed using thematic analysis through NVivo 10 computer software.

This chapter also addressed credibility where applicable, as well as ethical considerations and research limitations of the current study.

Chapters four and five of this research will discuss the findings of both the quantitative and qualitative approaches.

## Chapter 4 Analysis and Presentation of Questionnaire Survey Results

This chapter presents the analysis of results from the questionnaire survey of regulatory building inspectors and designers, which was developed to address the research objectives and questions in Table 4.1:

Table 4.1: Research objectives and questions for the questionnaire survey

<b>Main Research Questions</b>	
<b>Research objectives</b>	<b>Research questions</b>
1. What are risk-based inspections and what impact will it have on the New Zealand construction industry?	
2. How will the implementation of risk-based inspection affect building consent authorities and construction stakeholders?	
O1. To establish an understanding of risk-based inspection in the context of building regulations	Q1. What is a risk-based building inspection?
O2. To investigate risk-based models used in building regulations overseas	Q2. What alternative approaches in risk-based building regulation exist overseas?
O3. To review existing risk-based models and their effectiveness in New Zealand building consent process	Q3. What risk-based building regulation concepts have been adopted in New Zealand, and are they affective?
O4. To determine the real position in New Zealand regarding risk-based building regulations	Q4. What is the construction stakeholders' understanding of risk-based inspection as a regulatory tool?
O5. To investigate from construction stakeholders experiences of risk in the building inspection process	Q5. What are the key stakeholders' experiences with risk-based building inspections?
O6. To determine the current position of building inspections in New Zealand building consent process	Q6. How does the New Zealand building consent process currently operate in specific building inspections?
O7. To capture the extent of building consent authority inspection bottle-necks contributing to the construction sector's lack of productivity	
O8. To determine changes and seek suggestions from construction stakeholders about whether risk-based inspections could be a regulatory tool in New Zealand.	Q7. What would be a possible mechanism to implement risk-based inspection as a BCA tool?

The survey helped to achieve the overarching aim of the study. This chapter begins by summarising the responses from six regions that cover the major geographic composition of New Zealand's population. It then presents demographic information about the research participants. The survey results are presented under four main theme's aligned with the research objectives and research questions. The chapter concludes with the presentation of responses to the open-ended questions of the online questionnaire survey.

#### **4.1 Questionnaire administration**

The questionnaire was administered via an online survey tool, "Survey Monkey" ([www.surveymonkey.net](http://www.surveymonkey.net)), to regulatory building inspectors and residential building designers in New Zealand. Survey Monkey was selected because its software programme is user-friendly and possesses data analysis summary functions. Also, SurveyMonkey allows data collected from respondents to be formatted into the SPSS program for analysis and storage, hence saving time and keeping the accuracy of the research data intact.

##### **4.1.1 Invitation to participate**

Two separate survey links were sent out to designers and building inspectors with an attached email message. The message outlined the current research and gave a link to the survey that opened up to a participation information form. The two surveys contained four key sections, with three sections requiring the same information throughout. However, one section specifically focused on the participants' professions and the work they do. The versions of the questionnaire are attached in Appendices (B1). The surveys were distributed to participants at about the same time through the Survey Monkey online portal.

##### **4.1.2 Response rate**

Table 4.2 shows that a total of 197 responses were received (only 183 were capable of data analysis), from 331 emails sent out through the online survey. A total of 14

questionnaires were rejected because the participants did not answer at least a quarter (25%) of the survey questions. The response rate percentage, (49.31%) from building inspectors and 67.56% from designers, provided an overall response rate total of 58.09% which is a satisfactory response rate in accordance with Fink (2009). Fink (2009) explains that the desired response rate tends to be entirely subjective, and the general rule is the “higher is better”. The survey results were above the 50% satisfactory threshold.

Table 4.2: Survey distribution and response rate

<b>Participant group</b>	<b>Medium of distribution</b>	<b>On-line survey Invites</b>	<b>Responses</b>	<b>Number of useable Responses</b>	<b>Response rate (%)</b>
Building Inspectors	Directly administered through BCA members through Survey Monkey	146	72	63	49.31%
Designers Architects	Directly administered through NZIA members through Survey Monkey	185	125	120	67.56%
<b>Total</b>		<b>331</b>	<b>197</b>	<b>183</b>	<b>58.09%</b>

## 4.2 Summary of responses to the survey

This section gives a summary of the main sectors that were presented to the participants for their responses. The participants were randomly selected through their purposively selected professional associations: Building Officials Institute of New Zealand (BOINZ) and New Zealand Institute of Architects (NZIA). The intent of the study was to have building inspectors and designers comment on the current building inspection regulations in New Zealand and provide their views on risk-based inspection as a regulatory tool. The semi-structured questionnaire comprised four key sections (A–D): Construction stakeholders in regulatory inspections, Building Regulatory balance in New Zealand, Risk-based inspections, and the Current building inspections regime (refer Appendix B1).

Section A covered demographic information about the construction stakeholders. Sub-aspects of section C and D were open-ended questions that required thematic analysis.

Responses from questionnaire are presented in sections 4.4 to 4.7. The questions were based on the ordinal Likert-type scale, where participants are asked to tell how closely they agree or disagree with a statement. The number at one end of the scale represents the least agreement, or strongly disagree, and the number at the other end of the scale represents the most agreement, or strongly agree (Fink, 2009). Predominantly, Yes/No type questions were used and a five-point Likert scale was utilised, ranging from 1 (outstanding) to 5 (poor). The open-ended questions contained in section C and D allowed participants to comment further on risk-based inspection and on the research itself (this is documented in Section 6.8).

### **4.3 Structure of the survey questionnaire**

Figure 4.1 shows how each of the four objectives and seven research questions relate to the survey participants. The survey was divided into four sections: Construction stakeholders in regulatory inspections, Building Regulatory balance in New Zealand, Risk-based inspections, and the Current building inspections regime. Within the survey, were questions which were deliberately asked to determine the feasibility for implementing the risk-based inspection tool in New Zealand. Stakeholders' opinions are captured within parts of the survey questionnaire, and presented alongside the key research questions as presented in figure 4.1.

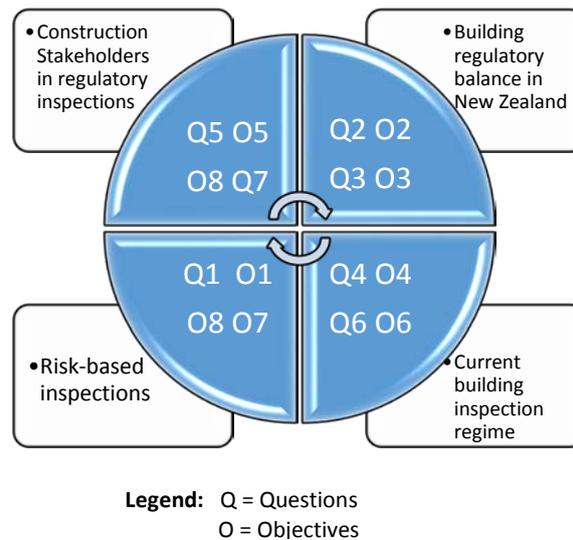


Figure 4.1: Structure of the survey questionnaire

#### 4.4 Demographic information of research participants (Section A)

The first section of the questionnaire survey looked at each participants' background and collected geographic and demographic information about their stakeholder group. The first section was identified as Section A, where survey participants were asked to indicate their geographic region, years of experience in the New Zealand construction industry, years of experience in their professional field, types of buildings they provided (designers only) and what equipment they currently used to record their inspections (building inspectors only). The objective of this section was to get some background reference of the participants with a view to gain an understanding of their responses during the other sections of the survey questionnaire. The following sections present an analysis of the geographic and demographic information of the survey participants.

##### 4.4.1 Geographic information of participants

The survey aimed to collect a representative number of responses across New Zealand. Survey participants were asked to indicate the main geographic region where they undertook their work. Table 4.3 shows the responses represented all major cities and regions in New Zealand, with the majority of participants based in Auckland, Wellington

and Christchurch. This reflects the most populated areas and the highest number of new construction development that was taking place at that time.

Table 4.3: Geographic location of research participants

Region Options	Building Inspectors		Designers	
	Response count	Response rate (%)	Response count	Response rate (%)
Auckland (including Northland)	43	68.30	46	38.30
Canterbury (Canterbury, Ashburton, South Canterbury)	16	25.40	20	16.70
Central North Island (Taranaki, Wanganui, Hawkes Bay, Manuwatu, Gisbourne)	0	0.00	10	8.30
Southern (Otago, Gore, Southland)	3	4.80	6	5.0
Midlands (Waikato, Tauranga, Whakatane, Rotorua, Taupo)	1	1.60	6	5.0
Cook Strait (Wellington, Wairapapa, Nelson, Marlborough, West Coast)	2	3.20	26	21.70
Other	2	3.20	6	5.0
<b>Totals</b>	<b>63</b>		<b>120</b>	

#### 4.4.2 Experience in the construction industry

Experience in the construction industry, for both building inspectors and designers, is presented in Figure 4.2 which shows that 57.14 per cent of building inspectors and 58.33 per cent of designers had more than 20 years of construction experience in New Zealand. Two stakeholders indicated that 57.73 per cent of the participants made had more than 20 years' experience in the New Zealand construction sector and only 2.45 per cent of respondents had less than two years' experience. This data indicated that the participants' experience in the New Zealand construction industry was reliable so they were able to adequately respond to the questionnaire.

### 4.4.3 Experience as a professional

Experience as a professional in the construction industry, for building inspectors and designers, are presented in Figure 4.2. It shows that 52 per cent of building inspectors on average have two to 10 years' experience in their chosen profession. Designers indicated that 53 per cent of them had more than 20 years of experience in their elected profession and only 2.5 per cent of the respondents had less than two years. The implications of this are that the respondents had enough experience in their elected professions to appropriately answer the questionnaire survey.

The demographic information provided in this section suggests that the questionnaire survey covered the population targeted for this research. The data analysis shows that the participants' experience and qualifications in the field of residential construction were satisfactory and reliable for this research study of risk-based inspection as a building consent authority tool.

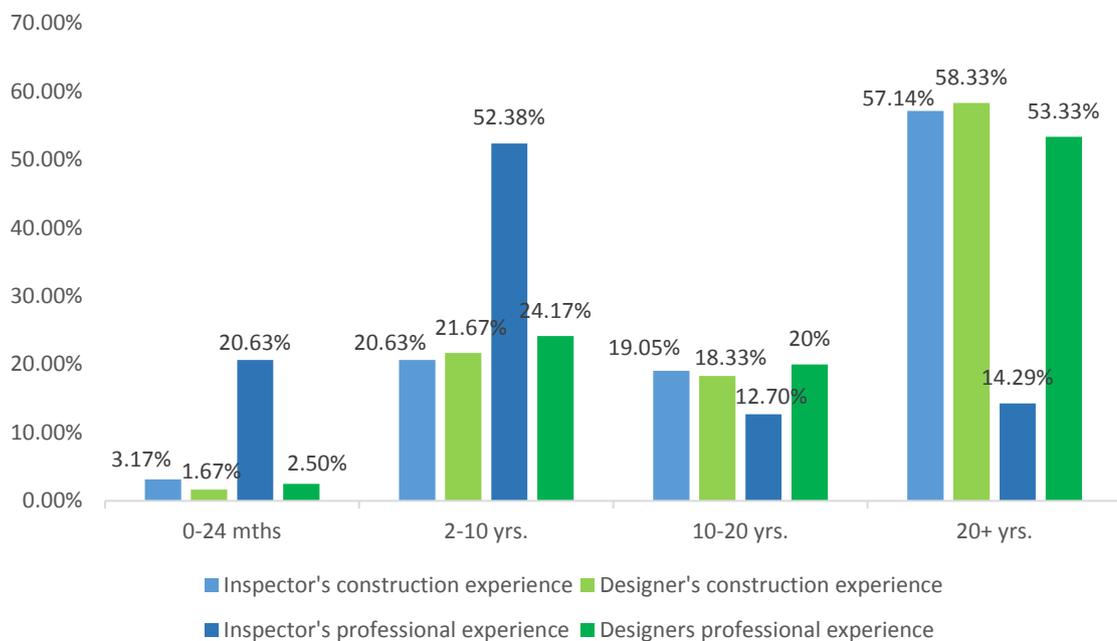


Figure 4.2: Experience in the construction Industry and as a professional

## **4.5 Regulatory balance in New Zealand (Section B)**

Section B covers the knowledge of building inspectors and designers about the Building Act and the building regulations, as well as their thoughts on regulatory balance. This section was divided into four main parts, where the first three looked at the building regulations.

The first three questions in this section were about the building regulations (the Building Act 2004, the Building Amendment Act 2012 and the government review of the Building Act 2004 in 2009). The final section required participants to align responsibility and accountability in the building consent process to key construction stakeholders. This section sought to obtain the knowledge of stakeholders, in terms of existing building regulation documents that contain risk-based concepts. The findings from this section are in line with the research objective (1) determining the real position in New Zealand regarding “risk-based building regulations” amongst construction stakeholders.

### **4.5.1 Building regulatory documents**

Table 4.4 provides a breakdown of the number of responses per regulation documents covered in this section B. The first question in this section requires the participants to select the form of existing regulatory documentation they are familiar with. The objective of this question is to ascertain the depth of knowledge that key stakeholders have with the Building Act 2004 and its associated regulatory documents, in particular the building regulations and Building Code as these documentations provide the basis of risk-based regulation as a building control tool. Table 4.4 shows that for building inspectors, all were familiar with the Building Act 2004, 80 per cent were familiar with the Building Amendment Act 2004 and 98 per cent were familiar with the New Zealand Building Code (NZBC). Similarly, the designers had a 90 per cent familiarity with the Building Act 2004, 67.7 per cent with the Building Amendment Act 2004 and 67.7 per cent were familiar

with the New Zealand Building Code (NZBC). The results indicate that the regulatory building inspectors and designers had a pretty good understanding of the Building Act 2004 and sufficient understanding of the regulations in the Building Amendment Act 2004 and NZBC.

A key finding of the low-awareness response to the DBH multi-use consent was that the consent type was introduced to save time when applying for a building consent. Issues here were consistency when applying for building consents and different authorities and wanting to provide customers with a lower-cost option (MBIE, 2015).

The response from participants noted that only 38 per cent of building inspectors and 20.4 per cent of designers were familiar with the DBH multi-use consent. Another DBH risk-based concept with a fast-track initiative, the simple house design, which only 20.4 per cent of designers and 58 per cent of inspectors were aware of. These two documents have aspects of risk-based consenting as regulatory time frames for processing decreased from 20 days to 15 and five days respectively. It could be inferred that inspectors and designers have not fully grasped the concept of risk-based regulations.

Table 4.4: Participants' knowledge of building regulation documents

Building Regulation Documents	Building Inspectors		Designers	
	Response Count	Response rate (%)	Response Count	Response rate (%)
Building Act 2004	50	100.00	84	90.30
Building 2004 Amendment Act	40	80.00	63	67.70
NZ Building Regulations 1991	42	84.00	62	66.70
NZ Building Code	49	98.00	92	98.90
NZ/AS Standards	47	94.00	85	91.40
Fencing of Swimming Pools Act 1987	36	72.00	63	67.70
Restricted Building Work	47	94.00	78	83.90
DBH Multi-use Building Consent	19	38.00	19	20.40
DBH Simple-house Design	29	58.00	19	20.40
Building Act 2004 Schedule 1 Exemptions	38	76.00	38	40.90
<b>Totals</b>	<b>50</b>		<b>93</b>	

#### 4.5.2 Government's 2009 review of the Building Act 2004

The second question required participants to indicate if they were familiar with key themes from the Government's 2009 review of the Building Act 2004. The three themes from the review are: 1) problems with ensuring that responsibility sits in the right place, 2) moving to a more balanced approach to building control, and 3) building consumer confidence. The objective of this question was to determine each stakeholder's familiarity with the 2009 review. Figure 4.3(a) shows that 62 per cent of building inspectors were familiar with the first two themes of the Government's review and, overall, 50 per cent of building inspectors were familiar with all three themes. Twenty-two per cent of building inspectors indicated they were not familiar with the three themes.

Figure 4.3(b) shows that 50 per cent of designers were familiar with the first theme and, overall, 35 per cent are familiar with themes two and three. Thirty-three per cent of designers indicated not being familiar with the three themes.

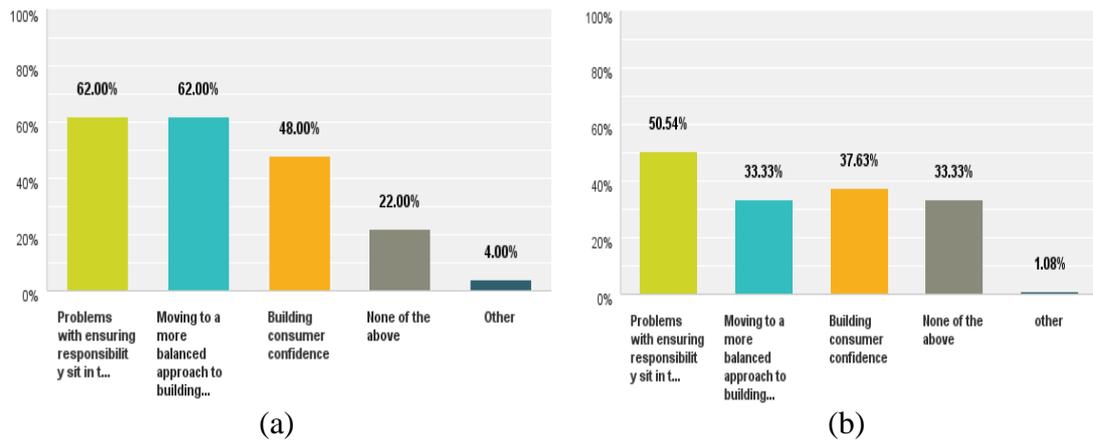


Figure 4.3: Building inspectors' and designers' familiarity with 2009 Government review

### 4.5.3 Government's 2009 review of the building consent types

The third question in this section required stakeholders to indicate their familiarity with the four proposed building consent types and additional processes described within the Building Act Amendments 2012. The consenting types are: standard building consent, low-risk building consent, simple residential building consent and commercial building consent. The consent types provide stakeholders with an indication of the risk groups the Government has categorised as building construction works.

Three additional categories were presented to participants to gauge their familiarity with these processes. These three categories were: 1) approved risk profile, 2) approved quality assurance, and 3) safety system review. Figure 4.4 indicates that between 70 and 76 per cent of building inspectors were very familiar with the proposed consenting type's standard low and simple risk, with 46 per cent familiar with commercial building consents. Responses to the additional three categories indicated that 28 per cent of building inspectors were familiar with the content of the review. Overall 10 per cent of the participants were not familiar with any part of the Government's 2009 review of the Building Act 2004.

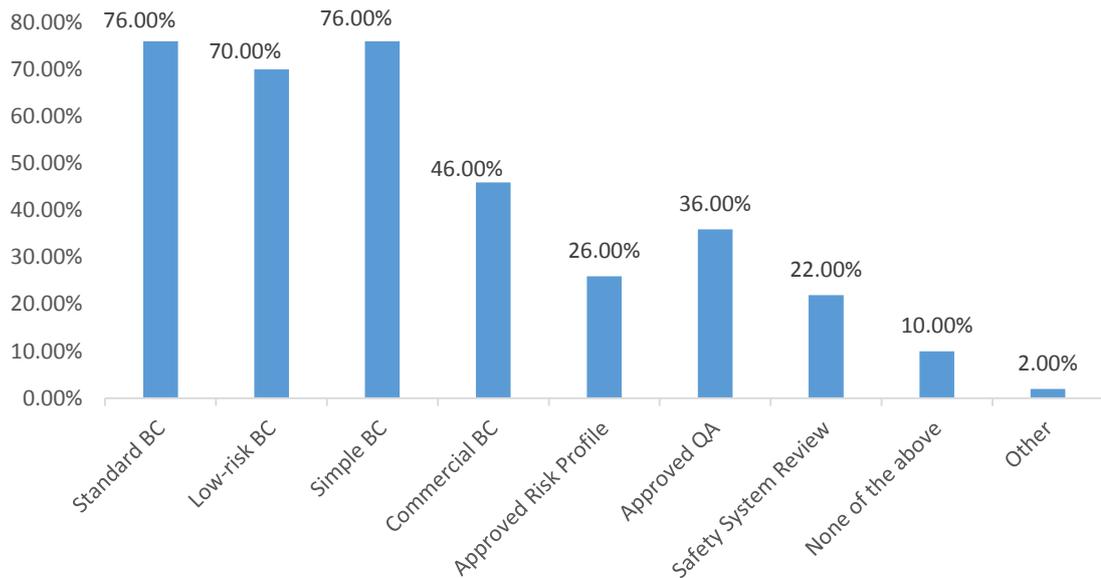


Figure 4.4: Familiarity of building inspectors with the 2009 review of building regulations

Figure 4.5 indicates that 70 per cent of designers were very familiar with the standard building consent, 24.7 per cent were familiar with low-risk, 39.8 per cent had knowledge of simple risk, and 50 per cent were familiar with commercial building consents. The additional three categories indicated that 10 per cent of designers were familiar with the content. Overall, 12.9 per cent of participants were not familiar with any of the 2009 review of the Building Act 2004 initiatives.

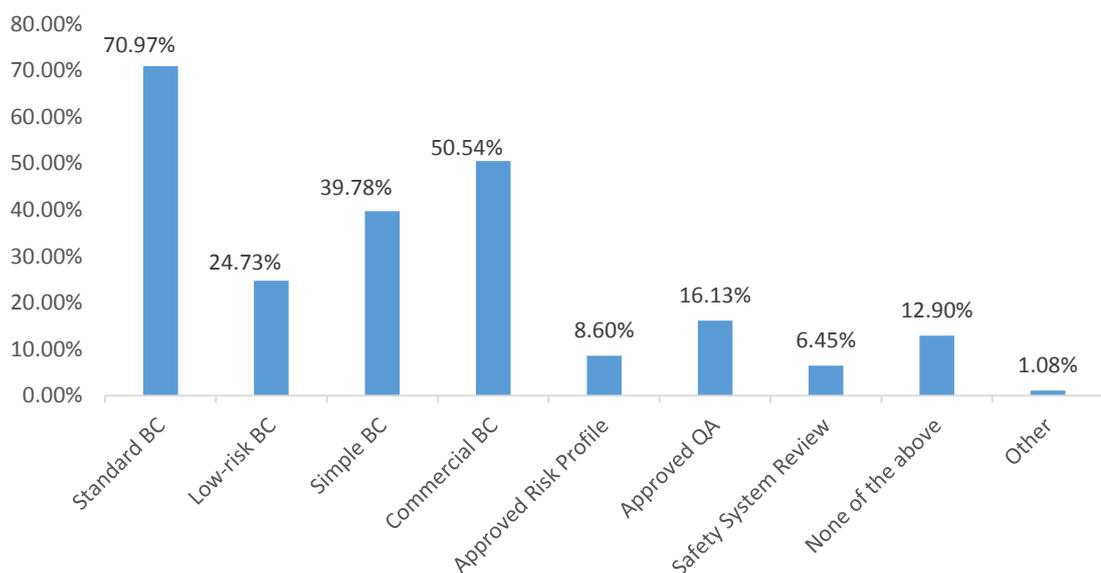


Figure 4.5: Familiarity of designers with the 2009 review of building regulations

#### **4.5.4 Responsibility and accountability of stakeholders during the building consent process**

The final question in this section required participants to align stakeholders to phases during the residential construction process where they were best suited to deal with risks. The four areas of the building consenting process are: consent lodgement and processing, construction, inspections, and code compliance certification (see literature review section 2.3.4 and figure 3.3). The participants' options for selection included five key stakeholders in the residential construction industry: building owners, designers, builders, building consent authorities and material/product manufacturers. The objective was for participants to allocate for each stakeholder the percentage of responsibility and accountability for building code compliance at each phase of the building consent process. They show that between 60 and 80 per cent of participants thought that designers (80 per cent) and the BCAs (70 per cent) should be responsible and accountable for building consent compliance during the lodgement and processing of consents.

During construction, 60 to 70 per cent of participants indicated that builders (75 per cent) should bear the responsibility and be accountable. It was also shown that between 60 and 90 per cent of participants believed that responsibility and accountability at the building inspection stage should be that of the BCA (66 per cent) and builders (33 per cent).

At the Code Compliance Certificate (CCC) stage, the majority of participants (60 to 90 per cent) showed that BCAs (90 per cent), builders (70 to 80 per cent) and building owners (60 per cent) all shared responsibility and accountability for building code compliance.

The variability of the results obtained appears to indicate that during the building consenting process, responsibility, accountability and those best suited to deal with risk can be aligned, as shown in Table 4.5. For ‘lodgement’ of building consent, designers are suggested to be in the best position to deal with risk. This supports the finding from the Department of Building and Housing (2014), where it suggests that there are five key steps in the successful processing of a building consent application. Two of the key steps are: the designer prepares sketch plans, detailed plans and specifications for the building consent application. The next phase of the building consent process contains the processing of consents. Majority of stakeholders thought that this best sat with BCAs. This is also supported in the literature review (see Section 2.3.2) which governs the processing of building consents under the Building Act 2004. During the construction phase of the building work, stakeholders are aligned with builders, which is in line with their responsibilities under the Licenced Building Practitioners scheme (see Section 2.5.6). The carrying out of notifiable inspections with the BCAs at their requirements is under the Building Act 2004. Finally, stakeholders’ suggested the BCAs were in the best position to deal with code compliance certificate’s according to the participants’ results. This finding aligns with the BCAs’ risk-averse approach due to the findings from leaking building enquires (Hunn et al., 2002).

Table 4.5: Responsibility and accountability during the building consent process

Building Consent Process	Prioritisation of Responsibility and Accountability			
	Stakeholder 1	%	Stakeholder 2	%
Lodgement of Consent	Designers	80%	BCAs’	70%
Processing of Consent	Designers	80%	BCAs’	70%
Construction of Building	Builders	75%		
Notifiable Inspections	BCAs’	66%		
Code Compliance Certificate	BCAs’	90%	Builders	80%

## **4.6 Risk-based building inspections (Section C)**

Section C of the questionnaire covered risk-based inspection; it required participants to indicate their understanding and knowledge of this topic. Risk-based inspection, as discussed in the literature review (see sections 2.9 to 2.12), seeks to allocate resources in accordance with risk. In the case of building inspections, notifiable inspections (see Table 3.0 of the literature review section) are reduced in accordance with its building consent type (see section 2.3.3.5). Questions within this section sought participants' understanding of risk in association with current notifiable inspections. The findings for this section have assisted in achieving the fourth research objective of this study. The following sub-sections present the results of the third section in the questionnaire.

### **4.6.1 Stakeholders' understanding of risk-based inspection**

The first question in this section sought the stakeholders' (designers' and building inspectors') understanding of risk-based inspection. Participants were required to select their level of understanding on a scale of 1 to 6 with 1 being 'Outstanding' and 6 being 'None'.

Figure 4.10 shows that 75 per cent of building inspectors had an adequate (34.78 per cent), good (32.61 per cent) to outstanding (10.87 per cent) understanding of risk-based inspections. This result was in contrast to those obtained from designers, where over 60 per cent of designers indicated they needed improvement (49.4 per cent), had poor knowledge (11.4 per cent) and 2.5 per cent revealing they had no understanding of risk-based inspections.

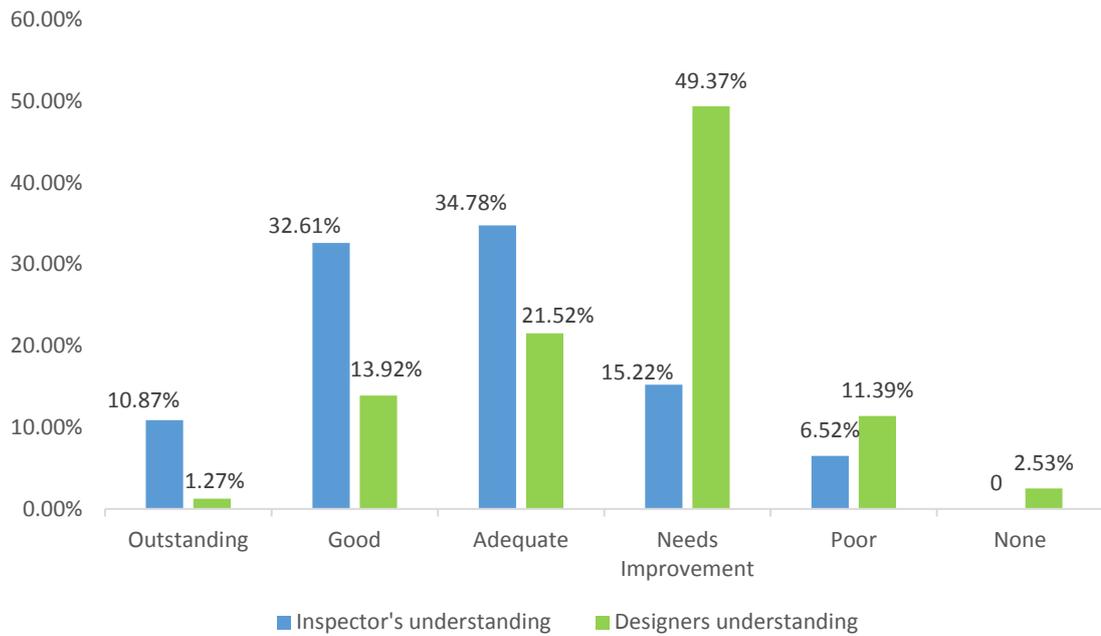


Figure 4.6: Participants' understanding of risk-based building inspection

#### 4.6.2 Building inspectors' and designers' risk association with current notifiable inspections

The results displayed in Figure 4.11 to Figure 4.14 show building inspectors' and designers' risk assessment of existing regulatory inspections. The objective of this section was to determine how building inspectors and designers perceived risk, in terms of current notifiable inspections. From the results shown in Figure 4.11, building inspectors indicated five notifiable inspections that ranked as high risk for them: Final residential inspection (77.78 per cent), code compliance certificate (66.67 per cent), cladding (67.39 per cent), framing (66.67 per cent) and foundations (64.44 per cent). The building inspectors also indicated their five lowest risk inspections as siting (26.67 per cent), pre-line building (17.39 per cent), drainage (17.39 per cent), roofing (15.22 per cent) and membrane tanking (15.22 per cent).

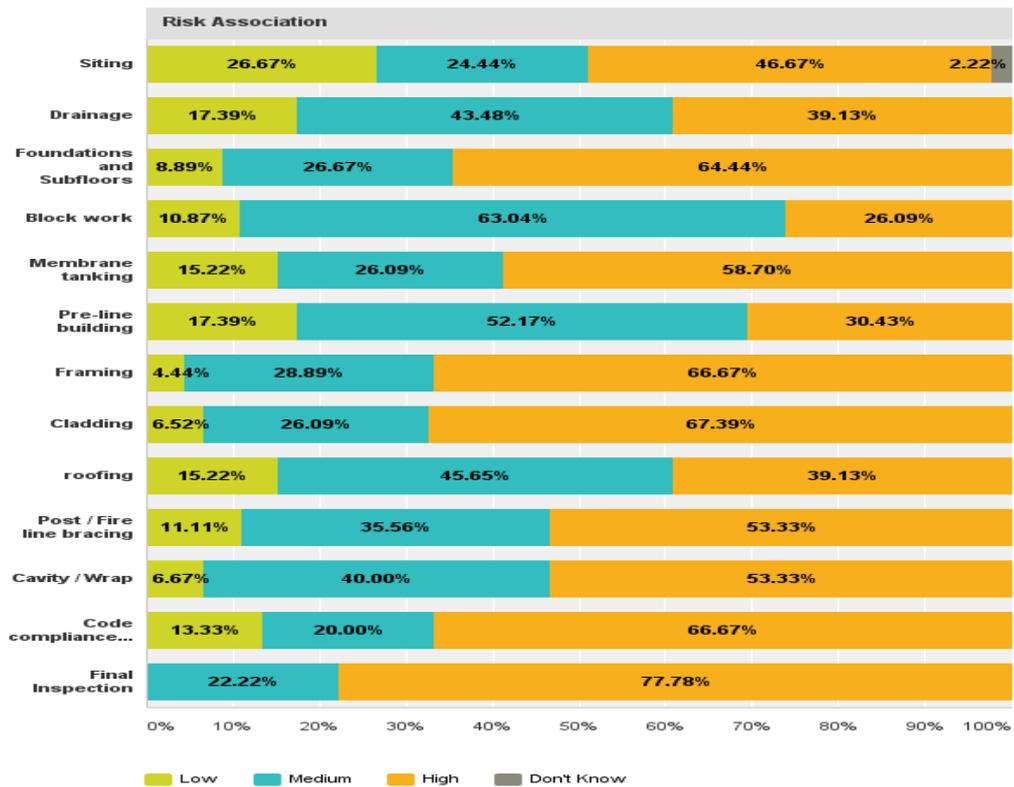


Figure 4.7: Building inspectors risk association at current notifiable inspection

The results displayed in Figure 4.12 show the building inspectors’ feedback on current notifiable inspections and the need for regulatory intervention. The building inspectors indicated that the majority (> 70 per cent) of the notifiable inspections (nine out of 13) required regulatory building inspections.

These inspections included final residential inspection (95.56 per cent), cavity wrap (84.09 per cent), code compliance certificate (82.22 per cent), cladding (80.43 per cent), framing (80.43 per cent), pre-line building (78.26 per cent), post-line bracing (73.33 per cent), foundations (71.74 per cent) and drainage (71.74 per cent). The building inspectors also indicated those notifiable inspections that did not require having regulatory inspection as roofing (47.83 per cent), blockwork (43.48 per cent), and siting (41.30 per cent).

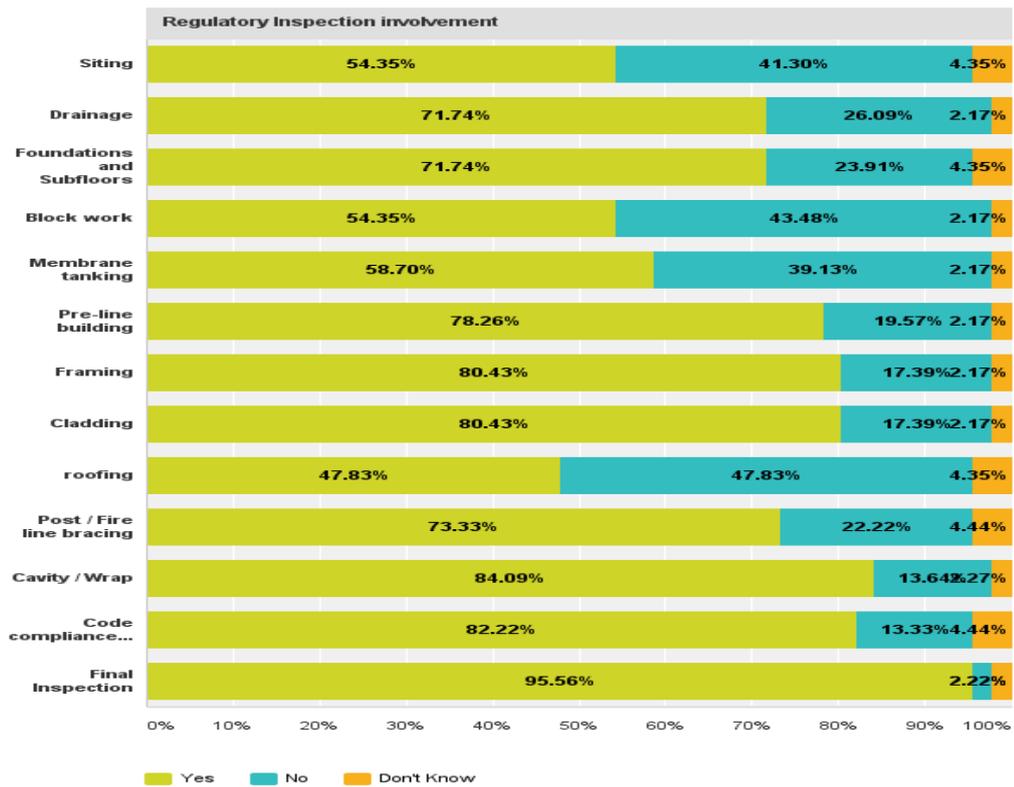


Figure 4.8: Building inspectors’ regulatory inspection involvement

Figure 4.13 shows the designers’ results on risk association in accordance with current notifiable inspections. The results show that membrane tanking (84.81 per cent), cladding (63.75 per cent), roofing (56.25 per cent) and foundations (53.75 per cent) as their highest risk inspection. In regard to what they thought were the least risky inspections, framing (35 per cent), siting (29.11 per cent), pre-line building (27.50 per cent), final inspection (27.85 per cent) and code compliance certificate (24.05 per cent) were their top five. The designers also nominated inspections in the medium-risk category. These included blockwork (56.25 per cent), framing (55 per cent), drainage (52.50 per cent), and post-

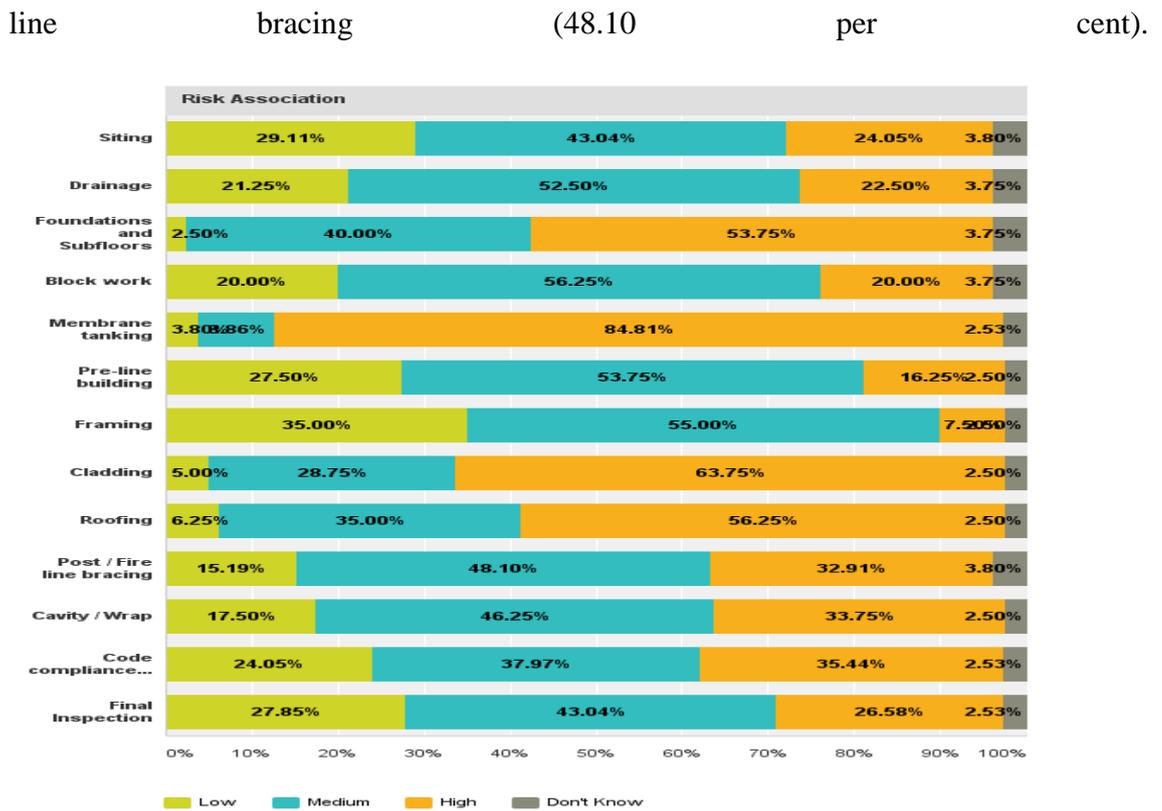


Figure 4.9: Designers’ risk association at current notifiable inspection

The designers were asked their selection ranking on regulatory intervention at current notifiable inspections. The results show that the designers agreed that the majority (11 out of 13) of notifiable inspections required regulatory intervention. In particular, code compliance certificate (90 per cent), final inspection (74.68 per cent), membrane tanking (68.35 per cent), drainage (35 per cent) and cladding (66.25 per cent). The designers’ results also showed that siting (49.37 per cent), blockwork (47.50 per cent) and framing (45 per cent) in their opinion did not require regulatory building inspections. Figure 4.14 shows the results from the designers.

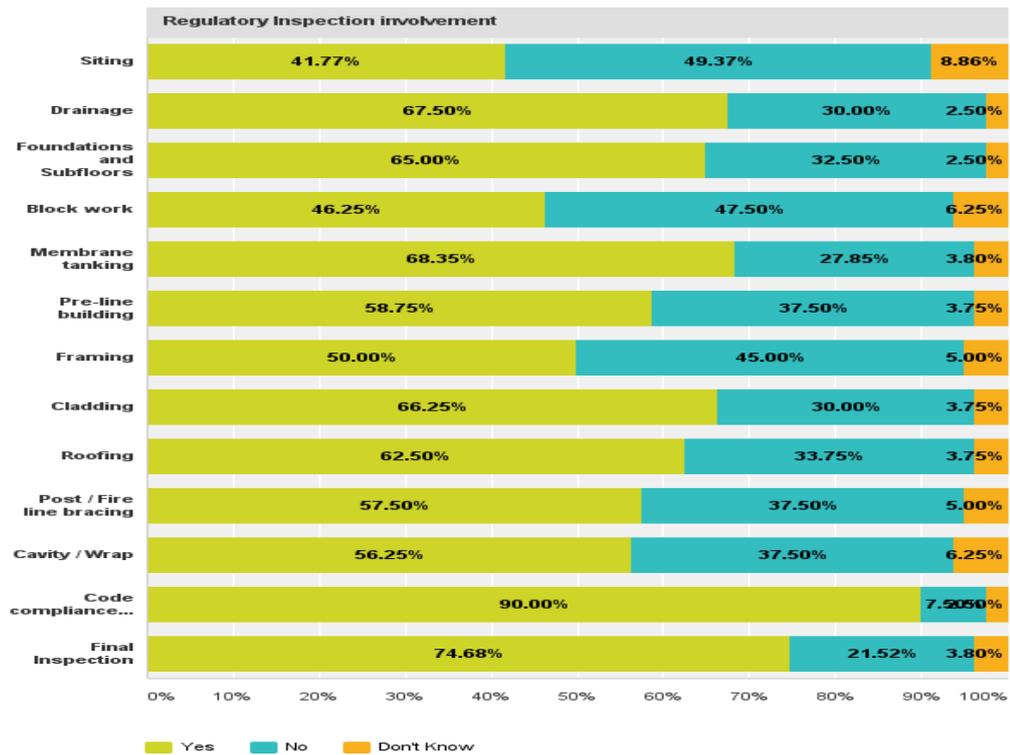


Figure 4.10: Designers' regulatory inspection involvement

### 4.6.3 Building inspectors' and designers' thoughts on risk-based building models

This section required participants to answer three questions affiliated with the risk-based concept. The first question looked at the current regulatory building inspection phases and the number of inspections required to construct a residential building. The participants were asked if the current building inspection regime required a review.

The second question was about the United Kingdom's risk-based inspection model (see literature review section 2.12.4). Participants were asked if they were in favour of risk assessment of projects resulting in a reduction of current notifiable building inspections.

The final question for this section required participants' opinions about the New Zealand construction industry being ready for current regulatory inspections to be relaxed. Were they in favour of a risk-based-assessment approach?

The purpose of these three questions was to determine the participants' views on the current building inspection regime, their thoughts about the UK's risk-based inspection model, and the state of mind of the New Zealand residential construction sector on regulatory change. These questions were important, as the answers will enable the residential sector to know the impact that risk-based inspection will have on the building consent process. The result of this analysis is presented in bar chart format as Figure 4.15.

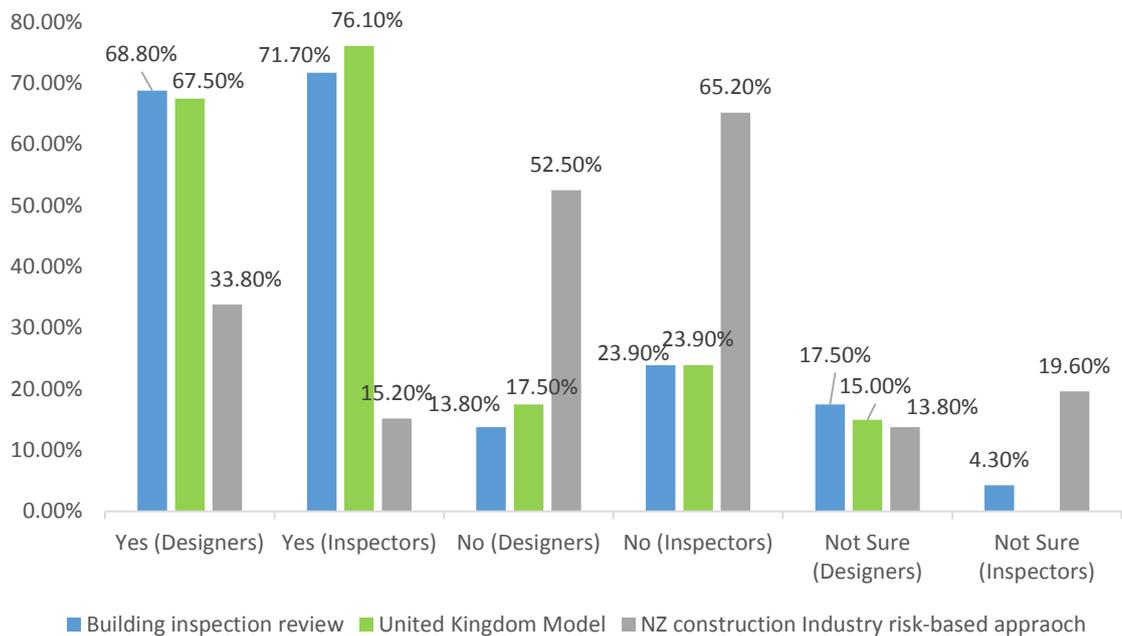


Figure 4.11: Participants' thoughts about risk-based building inspection

Leading on from this, the figure shows that about 70 per cent of participants (71.70 per cent of the building inspectors and 68.80 per cent of the designers) agreed that the current notifiable inspection stages needed reviewing. This result suggests that too many current inspections are required and therefore a review to reduce the number of notifiable inspections is needed. A majority (70 per cent) of the participants also agreed that the UK risk-based inspection model should be investigated as an alternative to the current building inspection process. This findings also support the first result; participants suggested reducing regulatory intervention but not at the expense of quality. However, a majority of participants (building inspectors (65.20 per cent) and designers (52.50 per

cent)) did not agree that the New Zealand construction industry was ready for current regulatory inspection to be relaxed in favour of a risk-based approach. The result suggests that the industry improves its competencies and training (see literature review, section 2.8.1) and awareness of regulatory policy implementation (see literature review, section 2.12). Table 4.6 provides a summary of the key results pertaining to the risk-based building concept questions.

Table 4.6: Building inspectors' and designers' thoughts on risk-based building concepts

Risk-based concepts	Response % from stakeholders			
	Response	Inspectors	Designers	Average
Current regulatory inspections on a new residential building can number up to 20. Does there need to be a review on the number of inspections?	Yes	71.70%	68.80%	70.25%
The United Kingdom's building controls introduced risk-based building inspection into regulations in 2013. They have reviewed their compulsory building inspections in favour of risk assessment of projects, resulting in reduced building inspections. In your opinion, should New Zealand regulations also look at a risk-assessment approach to building inspections?	Yes	76.10%	67.50%	71.80%
In your opinion, is the New Zealand construction industry ready for current regulatory inspections to be relaxed in favour of a risk-based assessment approach?	No	65.20%	52.50%	58.85%

#### 4.7 The building inspection process (Section D)

The last section in the questionnaire, labelled Section D, covered questions that sought the building inspectors' and designers' views on the current building inspection process for residential buildings. This section is divided into two parts. The first part has specific questions that relate to building inspectors and the second part has specific questions relating to designers. This section firstly seeks building inspectors' knowledge on notifiable inspection failures and the reasons behind those failures. The second part seeks

the designers' knowledge of design work that resulted in building code non-compliance during the inspection stage and the severity of non-compliance. The questions asked in this section relate to achieving the second research objective in determining the current position of building inspections, and the third objective of capturing building inspection bottlenecks.

Table 4.7 provides details of types of buildings that building inspectors carried out in the previous 24 months. The results show that 95 per cent of the participants were involved in carrying out residential house inspections during that period.

Table 4.7: Building inspector inspections carried out in the previous 24 months

Building inspections carried out in the previous 24 months	Response Count	Response Percent
House	41	95.3%
Town house	39	90.7%
Apartment	29	67.4%
Retirement Village	29	67.4%
Out buildings (Barns, Garages etc.)	34	79.1%
Fencing of Swimming pools	14	32.6%
Other (please specify)	16	37.2%
Total	43	

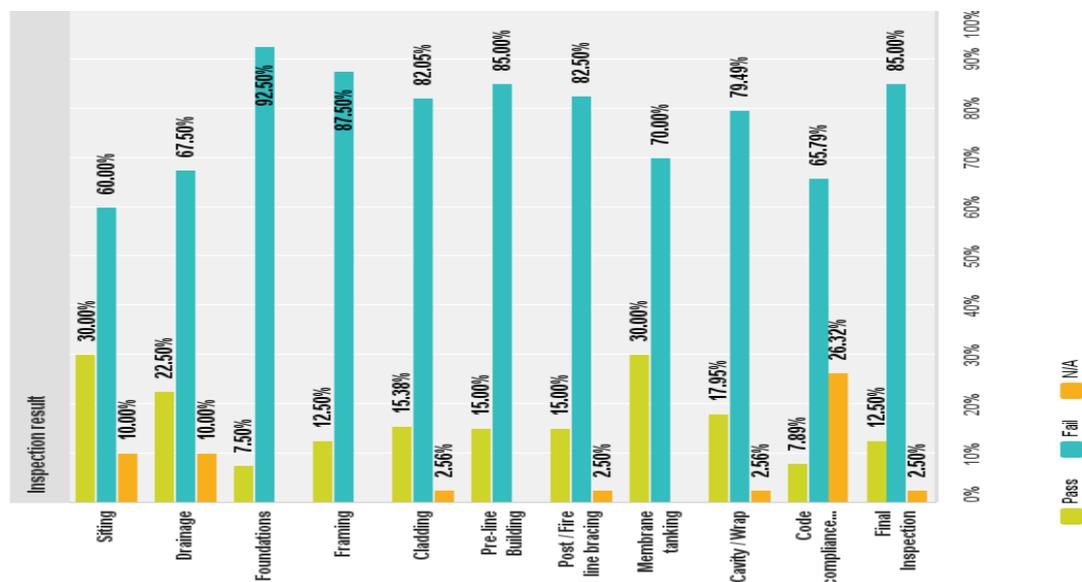


Figure 4.16, shows the outcomes of building inspections carried out over a 24-month period. The 13 notifiable inspections have been reduced to eleven because the blockwork inspection was covered by the foundations and subfloor inspection. Also, at the time of the research, the roof inspection was covered at the framing and final inspections. The results show that all inspections recorded high levels of failures; Foundations (93 per cent), framing (87 per cent), pre-line building (85 per cent) and final inspections (85 per cent) during the 24-month period. The highest pass rate for inspections were of siting (30 per cent), membrane tanking (30 per cent) and drainage (22.50 per cent).

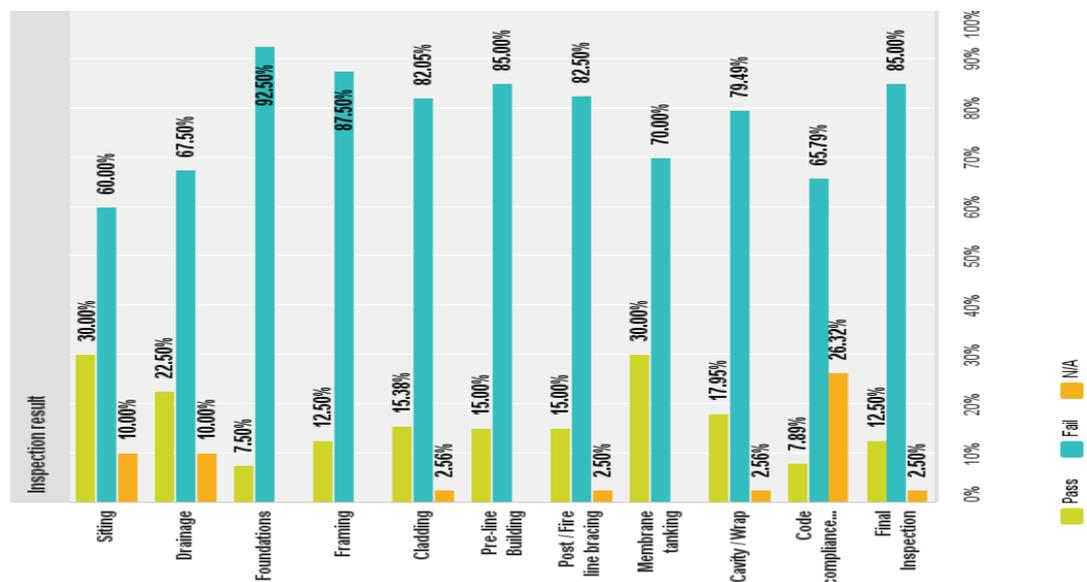


Figure 4.12: Building inspectors' inspection outcomes in the previous 24 months

Figure 4.17 shows a bar chart representing failed notifiable inspections and the cause of regulatory non-compliance. The participants were required to nominate the reason(s) that notifiable inspection had failed. Figure 4.17 clearly shows that between 41 per cent and 84 per cent of regulatory non-compliance was due to errors from either the contractor or owner on site.

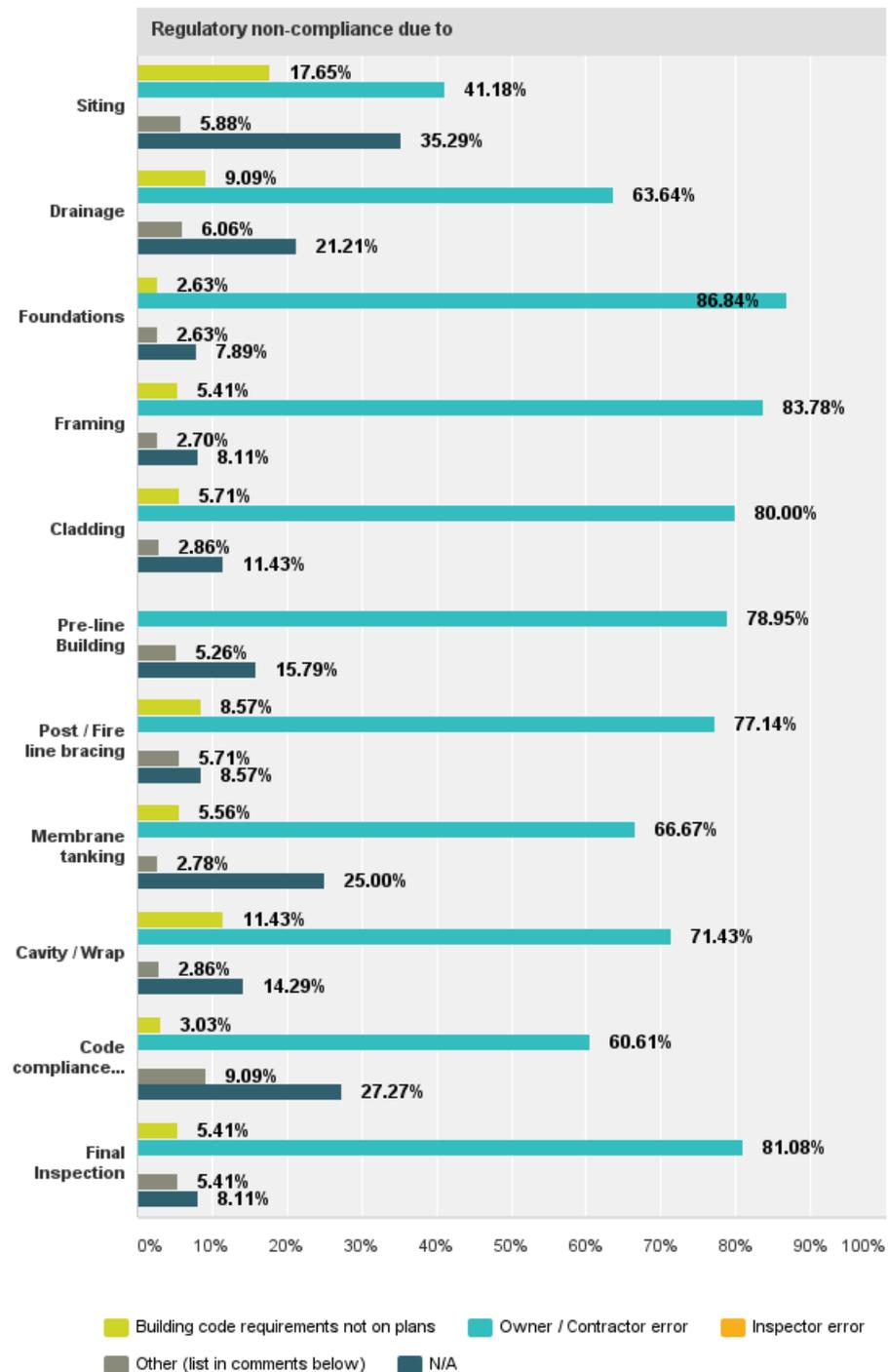


Figure 4.13: Building inspectors' reasons for failure

#### 4.7.1 Designers' views on the building inspection process

In the second part of this section, the research participants were asked if any of their design work resulted in an order to redesign, or stop work or Notice to Fix (NTF) due to non-compliance. The objective of this question was to establish the severity of the non-compliance work from designers when further work was required. Figure 4.18 clearly

shows that designers do have a good understanding of building regulatory compliance as between 74 per cent and 93 per cent of building consent work did not require reworking. A low number (6.41 per cent) of rework required the severe response of an NTF.

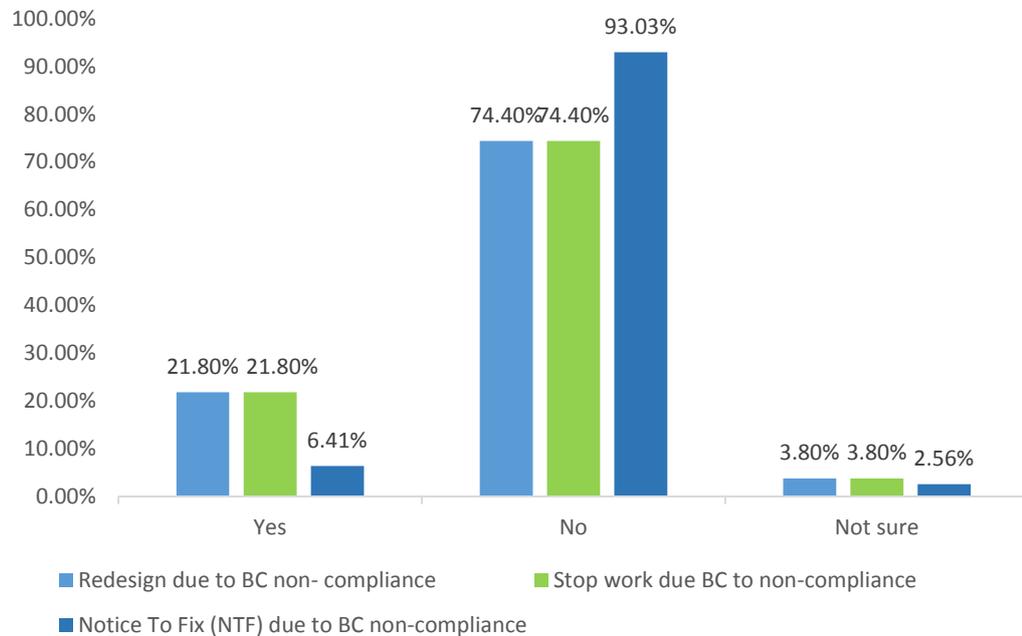


Figure 4.14: Building Code non-compliance actions by designers

#### 4.7.2 Designers' views on carrying out regulatory building inspections

In this section, designers were required to nominate which of the 13 notifiable inspections they considered were capable of being carried out by designers. The purpose of this exercise was to establish which notifiable inspections designers felt comfortable doing in the future, if regulatory inspection were to be relaxed and an alternative body was required to fill the void. The findings in Figure 4.19 show that framing (73 per cent), cavity wrap (73 per cent) cladding (70 per cent), roofing (70 per cent) and were all inspections that designers would be able to conduct to satisfy Building Code compliance. The findings indicate that the four highest-ranking inspections all have a direct relationship to high-risk areas discussed in the Hunn Report (see section 2.5.1) during the leaky home saga. However, the designers' low result for not wanting to inspect drainage (17 per cent), code compliance certificate (32 per cent), membrane tanking (34 per cent) and blockwork (38

per cent) suggests that other professionals were in the best place to determine building compliance. The four inspections noted here can be associated with the fact that drainage is undertaken by registered drain layers, code compliance certificate issuing is governed by the BA04 (for territorial authorities to issue), and membrane tanking and blockwork are covered under the Licenced Building Practitioners scheme.

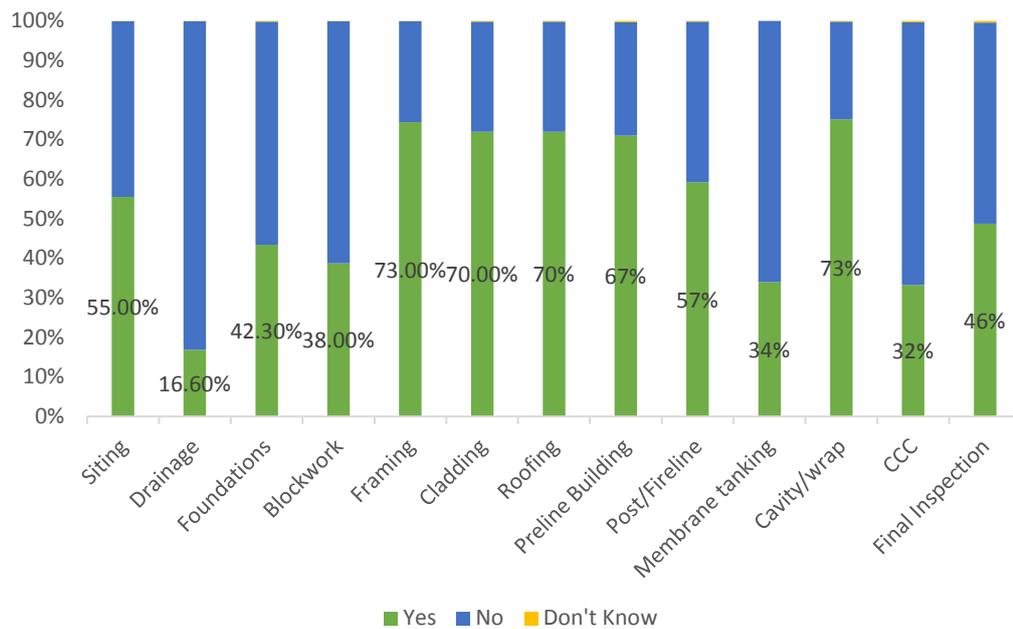


Figure 4.15: Designers' views on carrying out regulatory building inspections

### 4.7.3 Participants' overall opinions of the professionalism and competence of building stakeholders in regard to Building Code compliance

This question required participants to select their overall impressions of stakeholders, in regard to professionalism and competence in building code compliance. The levels of impression were on a scale of 1 to 6 with 1 being 'poor' and 6 being 'outstanding'. Almost all (96 per cent) of the research participants responded to this question. Table 4.8 and Table 4.9 show the results from designers' and building inspectors' opinions on the professionalism and competence of building stakeholders.

Table 4.8 results also show that designers' opinions on their own sector were overall positive (51 per cent). They rated builders and sub-contractors between adequate (30 per

cent) and needing improvement (29 per cent). Building inspectors overall had a good (40 per cent) rating. However, building manufacturers and suppliers received an adequate (31 per cent) rating, and home owners were thought to have a poor (44 per cent) understanding of Building Code compliance.

Table 4.8: Designers' overall opinions on the professionalism and competence of stakeholders

<b>Stakeholder</b>	<b>Outstanding</b>	<b>Good</b>	<b>Adequate</b>	<b>Needs Improvement</b>	<b>Poor</b>	<b>Don't know</b>	<b>Response Count</b>
Designers	3	40	23	10	1	1	78
Builders and Sub-trades	2	19	23	22	8	2	76
Building Inspectors	1	31	21	14	9	2	78
Building Manufactures	1	22	24	18	7	5	77
Owners	0	6	9	17	31	8	71
Totals							78

Building inspectors were presented with the same chart. Table 4.9 shows that building inspectors' opinions towards their own sector was overall positive (55 per cent). The inspectors rated builders, sub-contractors (53 per cent) and designers (47 per cent) as needing improvement overall. Similar to the designers' results, inspectors rated building manufacturers and suppliers adequate (28 per cent), and owners having a poor (37 per cent) understanding of Building Code compliance.

Table 4.9: Building inspectors' overall impressions of the professionalism and competence of stakeholders

Stakeholders	Outstanding	Good	Adequate	Needs Improvement	Poor	Don't know	Response Count
Designers	0	4	17	20	2	0	43
Builders and Sub-trades	0	6	5	23	9	0	43
Building Inspectors	0	24	15	4	0	0	43
Building Manufacturers	1	11	12	11	7	1	43
Owners	0	7	7	11	16	2	43
Total							43

This range of response is insightful. It is clear from the results that both designers and building inspectors are of the similar view that builders and sub-contractors need improvement and that housing owners generally have a poor understanding of building regulations. This supports the findings in the earlier section where building inspectors indicated that the result of building non-compliance on site was due to errors by builders, sub-contractors and owners (see Figure 4.17).

#### 4.8 Descriptive statistics: Notifiable inspections in terms of risk rating

As discussed in earlier chapters, notifiable inspections (see Table 2.1) are phases during construction that require the sign-off from the regulatory building inspector to show that building compliance has been achieved on reasonable grounds. At present, notifiable inspections are treated all the same in regard to risk. This part of the analysis aims to identify how stakeholders rank notifiable inspections, in terms of risk. A list of 13 notifiable inspections was presented to participants in no particular order. The participants had the option of selecting high, medium or low to indicate the risk they thought should be associated to that inspection. A descriptive statistical analysis was conducted on the data; the outputs are presented in Table 4.10. The findings show that stakeholders ranked

membrane tanking (1), cladding (2), foundations (3) and roofing (4) as their four notifiable inspections having high risk of non-compliance. A summary of the analysis is presented in Table 4.10.

Table 4.10: Descriptive statistics – notifiable inspections in terms of risk rating

Inspection type	N	Min.	Max.	Mean (M)	Std. Error	Std. Dev	Rank
Membrane tanking	126	1.00	4.00	2.7063	.05642	.63331	1
Cladding	126	1.00	4.00	2.6270	.05490	.61624	2
Foundations	126	1.00	4.00	2.5635	.05690	.63870	3
Roofing	126	1.00	4.00	2.4365	.06120	.68698	4
Cavity / Wrap	126	1.00	4.00	2.3175	.06537	.73377	5
CCC	126	1.00	4.00	2.3175	.07273	.81634	6
Final Inspection	126	1.00	4.00	2.3175	.07006	.78639	7
Bracing	126	1.00	4.00	2.2937	.06673	.74905	8
Drainage	126	1.00	4.00	2.1349	.06700	.75210	9
Siting	126	1.00	4.00	2.1111	.07578	.85062	10
Block work	126	1.00	4.00	2.1032	.06155	.69085	11
Framing	126	1.00	4.00	2.0794	.06818	.76528	12
Pre-line building	126	1.00	4.00	2.0079	.06424	.72107	13

#### 4.8.1 Descriptive statistics: Notifiable inspections requiring regulatory inspection

Chapter 2, section 2.3.4 discusses all notifiable inspections requiring sign-off of Building Code compliance by a regulatory building inspector, regardless of the kind of inspection. This part of the analysis aims to identify the stakeholders’ opinions on which notifiable inspections require regulatory building inspections. A list of 13 notifiable inspections (see Table 2.1) was presented to the participants; they had the choice of selecting yes, no or don’t know to those inspections requiring a regulatory building inspector to satisfy compliance. A descriptive statistical analysis was conducted on the data; the outputs are presented in Table 4.11. The findings show that stakeholders ranked code compliance

certificate (1), final inspection (2), cladding (3) and drainage (4) as their top four inspections requiring regulatory inspection.

Table 4.11: Descriptive statistics: Notifiable inspections requiring regulatory intervention.

Inspection type	Response	Frequency	Percent	Valid Percent	Cumulative Percent	Rank
Code compliance certificate	Yes	109	56.5	86.5	86.5	1
	No	12	6.2	9.5	96.0	
	Don't Know	5	2.6	4.0	100.0	
Final Inspection	Yes	102	52.8	81.0	81.0	2
	No	19	9.8	15.1	96.0	
	Don't Know	5	2.6	4.0	100.0	
Cladding	Yes	90	46.6	71.4	71.4	3
	No	32	16.6	25.4	96.8	
	Don't Know	4	2.1	3.2	100.0	
Drainage	Yes	87	45.1	69.0	69.0	4
	No	36	18.7	28.6	97.6	
	Don't Know	3	1.6	2.4	100.0	
Foundations and Subfloors	Yes	85	44.0	67.5	67.5	5
	No	37	19.2	29.4	96.8	
	Don't Know	4	2.1	3.2	100.0	
Cavity / Wrap	Yes	83	43.0	65.9	65.9	6
	No	36	18.7	28.6	94.4	
	Don't Know	7	3.6	5.6	100.0	
Pre-line building	Yes	83	43.0	65.9	65.9	7
	No	39	20.2	31.0	96.8	
	Don't Know	4	2.1	3.2	100.0	
Membrane tanking	Yes	82	42.5	65.1	65.1	8
	No	40	20.7	31.7	96.8	
	Don't Know	4	2.1	3.2	100.0	
Post / Fire line bracing	Yes	79	40.9	62.7	62.7	9
	No	40	20.7	31.7	94.4	
	Don't Know	7	3.6	5.6	100.0	

Inspection type	Response	Frequency	Percent	Valid Percent	Cumulative Percent	Rank
Framing	Yes	77	39.9	61.1	61.1	10
	No	44	22.8	34.9	96.0	
	Don't Know	5	2.6	4.0	100.0	
Roofing	Yes	72	37.3	57.1	57.1	11
	No	49	25.4	38.9	96.0	
	Don't Know	5	2.6	4.0	100.0	
Block work	Yes	62	32.1	49.2	49.2	12
	No	58	30.1	46.0	95.2	
	Don't Know	6	3.1	4.8	100.0	
Siting	Yes	59	30.6	46.8	46.8	13
	No	58	30.1	46.0	92.9	
	Don't Know	9	4.7	7.1	100.0	
Total		126	65.3	100.0		

#### 4.8.2 Correlations and T-test of responses to Section 4.7 to 4.9

As a further analysis, correlations and a T-test were conducted on some of the results in Sections 4.7, 4.8 and 4.9 to show the relationships between some of the responses. The objective of these tests was to provide a basic picture of the interrelations between two variables, so that the interactions between them could be understood.

A correlation was undertaken to identify if there was a relationship between notifiable inspections in terms of risk rating and notifiable inspections requiring regulatory inspection. The T-test was conducted to seek what relationship, if any, the two variables had with each another.

Another correlation was conducted on the stakeholders' opinions about the review of the current building inspection and the consideration of adapting a UK risk-assessment approach. The objective of this test was to establish if the stakeholders' opinions were

statistically significant when responding to the two different questions. The findings would indicate whether there was a direct relationship between the two questions.

The same test was conducted for the stakeholders' opinions on relaxation of regulatory inspections in New Zealand and consideration of adapting a United Kingdom risk-assessment approach.

An independent-samples T-test was conducted to compare the understanding of risk-based inspection scores between designers and building inspectors. The purpose of this test was to establish if the designers' and building inspectors' opinions were in unison when providing their answers in representing stakeholders.

T-tests were also run in the same manner for notifiable inspections, in terms of risk-rating scores between designers and building inspectors, and notifiable inspections requiring regulatory involvement scores between designers and building inspectors. The objective of these tests were to support the ranking output of notifiable inspections in terms of risk ratings (see Table 4.10) and notifiable inspections requiring regulatory inspection (see Table 4.11).

### **4.8.3 Participants' ranking of membrane tanking as high risk, and the requirement of regulatory inspections**

As shown in Table 4.10, stakeholders ranked membrane tanking as their highest risk in terms of notifiable inspection. Membrane tanking also ranked high for requiring regulatory inspection by stakeholders, as shown in Table 4.11. A correlation calculation (using SPSS) was conducted to establish if there was a relationship between the two results. From the correlation table, there appears to be a strong negative and significant correlation between these two variables ( $R^2 = -0.274$ ). The correlation value obtained suggests that the higher the risk of the notifiable inspection, the more likely regulatory inspection was required. The negative correlation indicates that a decrease in risk would

also decrease the requirement of regulatory intervention,  $r(N=124) = -.274, p=.002$ . The findings would provide the assumption that the higher the risk of a notifiable inspection, the more likely that a regulatory building inspection would be required and vice versa, i.e. the lower the risk, the less requirement for regulatory intervention.

**Correlations**

		Membrane tanking - Risk Association	Membrane tanking - Regulatory Inspection involvement
Membrane tanking - Risk Association	Pearson Correlation	1	-.274**
	Sig. (2-tailed)		.002
	N	126	126
Membrane tanking - Regulatory Inspection involvement	Pearson Correlation	-.274**	1
	Sig. (2-tailed)	.002	
	N	126	126

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Figure 4.16: Correlation table

#### 4.8.4 Review of current building inspections and consideration of implementing a UK risk-assessment approach

The correlation calculations (using SPSS) for reviewing current regulatory inspections and looking at an alternative risk-assessment approach like that of the United Kingdom model is given in Figure 4.21. From the correlation table, there appears to be a strong positive and significant correlation between these two variables ( $R^2 = 0.395$ ). The correlation value obtained suggests that the participants who wanted a review in the current building inspection process also wanted to look at the UK building-inspection model,  $r(N=124) = .395, p=.001$

		Review on current regulatory inspections	United Kingdom model
Review on current regulatory inspections	Pearson Correlation	1	.395**
	Sig. (2-tailed)		.000
	N	126	126
United Kingdom model	Pearson Correlation	.395**	1
	Sig. (2-tailed)	.000	
	N	126	126

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Figure 4.17: Correlation table

#### 4.8.5 Relaxation of regulatory inspections in New Zealand and consideration of a UK risk-assessment approach

The correlation calculations (using SPSS), for relaxing the current regulatory inspections and considering that of the United Kingdom model, is given in Figure 4.22. From the correlation table, there appears to be a strong, positive and significant correlation between these two variables ( $R^2 = 0.234$ ). The correlation value obtained suggests that the participants who wanted a review of the current building inspection process also suggested the adoption of the UK building-inspection model,  $r(N=124) = .234, p=.008$

		Relaxation of regulatory inspections in New Zealand	United Kingdom model
Relaxation of regulatory inspections in New Zealand	Pearson Correlation	1	.234**
	Sig. (2-tailed)		.008
	N	126	126
United Kingdom model	Pearson Correlation	.234**	1
	Sig. (2-tailed)	.008	
	N	126	126

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Figure 4.18: Correlation table

#### 4.8.6 Risk-based inspection scores of designers and building inspectors (T-test)

An independent-sample T-test was conducted to compare the understanding of risk-based inspection scores of designers and building inspectors. There was significant difference in scores for designers ( $M= 3.650, SD=.994$ ) and building inspectors ( $M=2.739, SD=1.06; t(124) = 4.825, p = .00, two-tailed$ ). However, it is noteworthy that the means

were quite low, given the scale ranged from 0 to 7. (Korsgarrd, Robertson, & Rymph, 1988, pp.734 – 735).Table 4.12 show the results.

Table 4.12: T-test on understanding risk-based inspection

	Profession	N	Mean	Std. Deviation	Std. Error Mean
What is your understanding of risk-based building inspection?	Designer	80	3.6500	.99492	.11124
	Building inspector	46	2.7391	1.06322	.15676

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
What is your understanding of risk-based building inspections?	Equal variances assumed	.333	.565	4.825	124	.000	.91087	.18878	.53722	1.28452
	Equal variances not assumed			4.739	88.887	.000	.91087	.19222	.52893	1.29281

Figure 4.19: Independent sample test on understanding risk-based inspection

#### 4.8.7 Comparing notifiable inspections in terms of risk-rating scores between designers and building inspectors (T-test)

The independent-sample T-test was conducted to compare the risk association of notifiable inspection scores between designers and building inspectors. The purpose of the T-test was to establish if the designers’ and building inspectors’ results were consistent with each other’s population, or if one population was more dominant. The top four ranked inspection types were tested in accordance with the ranking provided by building inspectors and designers (See Table 4.10). Tables 4.17 and table 4.18 show the results.

##### 1. Membrane tanking

There was significant difference in the scores for designers (M= 2.863, SD=.497) and building inspectors (M=2.434, SD=.749; t (124) = 3.457, p = .001, two-tailed). Thus, the hypothesis, that more designers ranked membrane tanking as their riskiest inspection, can be supported. However, it is noteworthy that the means in both conditions were quite low,

given the scale ranging from 0 to 7. (Korsgarrd, Robertson, & Rymph, 1988, pp.734 – 735)

## **2. Cladding**

There was no significant difference in the scores for designers ( $M= 2.367$ ,  $SD=.621$ ) and building inspectors ( $M=2.608$ ,  $SD=.613$ ;  $t(124) = .252$ ,  $p = .960$ , two-tailed). The magnitude of the differences in the means (mean difference =  $.02880$ , 95% CI:  $-.197$  to  $.255$ ) was very small (eta squared =  $.0005$ ). Thus, the hypothesis can be established that both designers and building inspectors both agreed that the cladding inspection was very risky.

## **3. Foundations and subfloors**

There was no significant difference in the scores for designers ( $M= 2.587$ ,  $SD=.609$ ) and building inspectors ( $M=2.521$ ,  $SD=.690$ ;  $t(124) = .555$ ,  $p = .309$ , two-tailed). The magnitude of the differences in the means (mean difference =  $.06576$ , 95% CI:  $-.168$  to  $.300$ ) was very small (eta squared =  $.0005$ ). Thus, the hypothesis can be established that designers and building inspectors both agreed that the inspection of foundations and subfloor was risky.

## **4. Roofing**

There was significant difference between the scores for designers ( $M= 2.550$ ,  $SD=.654$ ) and building inspectors ( $M=2.239$ ,  $SD=.7050$ ;  $t(124) = 2.496$ ,  $p = .014$ , two-tailed). Thus, the hypothesis is that more designers ranked roofing as a high-risk inspection compared with how building inspectors ranked it.

Table 4.13: T-test on the top four risk associations of notifiable inspection scores between designers and building inspectors

Group Statistics					
	Profession	N	Mean	Std. Deviation	Std. Error Mean
Membrane tanking – Risk Association	Designer	80	2.8625	.49667	.05553
	Building inspector	46	2.4348	.74988	.11056
Cladding – Risk Association	Designer	80	2.6375	.62122	.06945
	Building inspector	46	2.6087	.61385	.09051
Foundations and Subfloors – Risk Association	Designer	80	2.5875	.60991	.06819
	Building inspector	46	2.5217	.69087	.10186
Roofing – Risk Association	Designer	80	2.5500	.65410	.07313
	Building inspector	46	2.2391	.70505	.10395

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Membrane tanking - Risk Association	Equal variances assumed	28.317	.000	3.846	124	.000	.42772	.11121	.20760	.64784
	Equal variances not assumed			3.457	68.097	.001	.42772	.12372	.18084	.67460
Cladding - Risk Association	Equal variances assumed	.003	.960	.252	124	.802	.02880	.11446	-.19774	.25535
	Equal variances not assumed			.252	94.866	.801	.02880	.11409	-.19769	.25530
Foundations and Subfloors - Risk Association	Equal variances assumed	1.043	.309	.555	124	.580	.06576	.11851	-.16881	.30033
	Equal variances not assumed			.536	84.683	.593	.06576	.12258	-.17797	.30950
Roofing - Risk Association	Equal variances assumed	.077	.781	2.496	124	.014	.31087	.12454	.06437	.55736
	Equal variances not assumed			2.446	88.250	.016	.31087	.12710	.05829	.56345

Figure 4.20: Independent sample on the top four risk associations of notifiable inspection: scores of designers and building inspectors

#### 4.8.8 Comparing notifiable inspections requiring regulatory involvement scores between designers and building inspectors (T-test)

An independent-sample T-test was conducted to compare notifiable inspections requiring regulatory involvement scores between designers and building inspectors. The top four ranked inspections were tested in accordance with the ranking provided by building inspectors and designers (See Table 4.11). Table 4.13 and Figure 4.24 show the results.

### **1. Code Compliance Certificate**

There was no significant difference in the scores for designers ( $M= 1.125$ ,  $SD=.401$ ) and building inspectors ( $M=1.261$ ,  $SD=.575$ ;  $t(70.7) = -1.416$ ,  $p = .161$ , two-tailed). The magnitude of the differences in the means (mean difference =  $-.13587$ , 95% CI:  $-.3274$  to  $.05541$ ) was very small (eta squared\* =  $.001$ ). Thus, the hypothesis can be established that designers and building inspectors both agreed the code of compliance certificate stage required regulatory building inspection intervention.

\*Eta squared can be calculated manually by using the information provided in the output (Pallant, 2016).

### **2. Final inspection**

With regard to the final inspection, there was significant difference in the scores for designers ( $M= 1.300$ ,  $SD=.537$ ) and building inspectors ( $M=1.109$ ,  $SD=.434$ ;  $t(110) = 2.181$ ,  $p = .031$ , two-tailed). Thus, the hypothesis that more designers than building inspectors ranked final inspection stage as requiring regulatory intervention can be supported. However, it is noteworthy that the means were quite low, given the scale which ranged from 0 to 7. (Korsgaard, Robertson, & Rymph, 1988, pp.734 – 735)

### **3. Cladding**

There was no significant difference in the scores for designers ( $M= 1.375$ ,  $SD=.560$ ) and building inspectors ( $M=1.217$ ,  $SD=.467$ ;  $t(108) = 1.693$ ,  $p = .093$ , two-tailed). The magnitude of the differences in the means (mean difference =  $.15761$ , 95% CI:  $-.02688$  to  $.34210$ ) was very small (eta squared =  $.002$ ). Thus, the hypothesis can be established that the designers and building inspectors both agreed that the cladding stage required regulatory building inspection intervention.

#### 4. Drainage

There was no significant difference in the scores for designers (M= 1.350, SD=.5301) and building inspectors (M=1.304, SD=.5101;  $t(124) = .472, p = .638$ , two-tailed). The magnitude of the differences in the means (mean difference = .04565, 95% CI: -.1460 to .2374) was very small (eta squared = .002). Thus, the hypothesis can be established that both designers and building inspectors agreed that the drainage stage required regulatory building inspection intervention.

Table 4.14: T-test on the top four notifiable inspections requiring regulatory involvement: scores of designers and building inspectors.

	Profession	N	Mean	Std. Deviation	Std. Error Mean
Code Compliance Certificate - Regulatory Inspection involvement	Designer	80	1.1250	.40174	.04492
	Building inspector	46	1.2609	.57483	.08475
Final Inspection - Regulatory Inspection involvement	Designer	80	1.3000	.53722	.06006
	Building inspector	46	1.1087	.43350	.06392
Cladding - Regulatory Inspection involvement	Designer	80	1.3750	.55972	.06258
	Building inspector	46	1.2174	.46729	.06890
Drainage - Regulatory Inspection involvement	Designer	80	1.3500	.53011	.05927
	Building inspector	46	1.3043	.51075	.07531

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Code compliance certificate - Regulatory Inspection involvement	Equal variances assumed	8.872	.003	-1.556	124	.122	-.13587	.08733	-.30872	.03698
	Equal variances not assumed			-1.416	70.651	.161	-.13587	.09592	-.32715	.05541
Final Inspection - Regulatory Inspection involvement	Equal variances assumed	15.144	.000	2.059	124	.042	.19130	.09290	.00743	.37518
	Equal variances not assumed			2.181	110.489	.031	.19130	.08771	.01749	.36511
Cladding - Regulatory Inspection involvement	Equal variances assumed	8.525	.004	1.613	124	.109	.15761	.09771	-.03579	.35100
	Equal variances not assumed			1.693	108.004	.093	.15761	.09308	-.02688	.34210
Drainage - Regulatory Inspection involvement	Equal variances assumed	.636	.427	.472	124	.638	.04565	.09681	-.14595	.23726
	Equal variances not assumed			.476	96.846	.635	.04565	.09583	-.14455	.23586

Figure 4.21: The independent sample test on the top four notifiable inspections requiring regulatory involvement. Scores of the designers and building inspectors.

#### **4.8.9 Overall summary of correlations and T-test**

The results from the correlations and T-test from designers and building inspectors support the ranking orders of notifiable inspections in terms of risk rating (see Table 4.10) and notifiable inspections requiring regulatory inspection (Table 4.11).

The results of notifiable inspections in terms of risk rating and notifiable inspections requiring regulatory inspection from construction stakeholders have now established a ranking system which determines the order of notifiable inspection by risk and when regulatory resourcing is required.

#### **4.9 General comments extracted from the open-ended questions**

The last section of the questionnaire was a series of open-ended questions requiring participants to provide commentaries. These questions were presented to the participants in the anticipation of supplementary information about New Zealand's building regulations and the risk-based inspections system. This was an opportunity for the participants to provide further information that could expand on their responses in other sections of the survey. These responses were condensed into seven cogent themes. The seven themes are:

1. Skill level in the housing construction industry
2. Risk-based models in the construction industry
3. Responsibility balance in the construction industry
4. Quality control in the construction industry
5. Licenced building practitioners
6. Education in the construction industry
7. Building inspectors

The following sub-sections provide details of the study participants' responses. Each sub-section includes transcripts using the qualitative analytical method (thematic analysis) as described in the methodology chapter (section 3.14.6). 55 per cent (70) of the total research participants (126) responded to this part of the questionnaire. For ease of presentation, the transcripts of the responses relating to each theme are collated in a tabulated format (see Table 4.15 to 4.21). The participants' identities have been protected to guarantee anonymity, and their responses are coded as described in section 3.10.5. The codes are shown in the first column. The following sub-sections cover the seven themes that emerged from the open-ended questions.

#### **4.9.1 Theme 1: Lack of skills and understanding in the construction industry**

The first theme that emerged from the analysis of the open-ended questions related to skill levels within the construction industry. Regulatory building inspectors and building designers indicated that they have great concerns with the lack of construction stakeholders' skills, including those in their own organisations. The responses particularly targeted licenced building practitioners (LBPs) for their lack of competence and the need for LBPs to upskill. Research participants noted that the LBPs' skill level needed to improve and that further training was required to lift operating / performance standards within the industry. These participants felt that the LBP system was not robust enough for the licencing and grading of its members. Participant D068 suggested that a builder is no longer the head contractor for a construction project' the project manager / housing director now takes on this role and employs different subcontractors to complete different stages of the build. This opinion is supported by the literature review, with modern homebuilding becoming more of a collaborative effort; general contractors employ a range of subcontractors specialising in different phases of the construction process (Rotimi, 2013).

Participant D114 was of the opinion that building inspectors and architects have a good understanding of building regulatory compliance whereas non-professional, unqualified designers, tradespeople and homeowners have a poor understanding; many of them have little experience with the entire building consent process (see section 2.3.4). This finding is supported by Baiche et al (2006) who suggested that building inspectors believe tradesmen do not know the building regulations. However, the inspectors agree that tradesmen who are well-trained and educated make a lot of difference to building regulation compliance (Baiche et al, 2006).

Responses relating to the lack of skill and understanding in the residential construction industry demonstrate the need for further training and upskilling from construction stakeholders. Confidence is low which makes it difficult for the key stakeholders to uphold regulatory compliance.

This means that customer confidence is also low. Yau (2009) suggested that it is necessary to boost the confidence of the general public in a regulatory regime. Public confidence is a matter of public education and understanding of the regulatory regime (Yau, 2009). As numerous participants alluded to the fact that confidence is already low among construction stakeholders, with the constant legalities from the leaky-home saga (see section 2.5.1). Table 4.15 presents participants' transcripts on skill levels in the housing construction process.

Table 4.15: Transcripts about skill levels in the housing construction process

Participant's coding	Commentary provided by participants
D114	Architects and Council building inspectors generally tend to have a good understanding of building code compliance requirements ... Building owners are generally quite unaware of building code compliance requirements.
D015	The process is very poorly understood.
D018	I still see lots of building work not carried out to drawing detail. More involvement by consultants in the construction phase in observing work is the key.
D042	The level of skills is not there yet, hence the risk involved in implementing the scheme will be high.
D047	Quality of both design and build is often very low.
D050	The quality of the builders is improving but [we are] not there yet.
D052	Provided the performance standards of LBPs are adequate.
D059	Until licensing of builders is graded and has meaning, self-assessment as done by electricians and gas fitters is inappropriate.
D068	General low skill base for most trades. Not enough LBPs actually at the coal face. Too many developer scenarios where work is all sub-let and [there is] poor coordination.
D078	There is still a lot of incompetence in the construction industry in New Zealand. It should also be considered that in the UK there is a completely different system of building surveying than there is in NZ.
D083	Requires increased upskilling of tradespeople.
D100	Large amounts of training would be required.
D114	There still exists a general lack of understanding of building controls, code compliance requirements and good practice amongst many on-site tradespeople. There is a major requirement for up-skilling and increased knowledge and understanding in these areas for many tradespeople.

#### 4.9.2 Theme 2: Risk-based models in the construction industry

The second theme that emerged from the analysis of the open-ended questions relate to risk-based models. Overall, the participants expressed their concerns about the professionalism and poor quality of workmanship identified by failed inspections. The reduction of regulatory inspection would only cause more issues. Participant (D16) suggested that councils have embarked on a risk-averse approach in which they were insisting on mountains of paperwork to satisfy building compliance. The participant added that this exercise was a waste of time because history suggests that council will

always be held liable for any issues during the building consent process. This referencing that BCAs are circumventing the risk-based modelling by reducing building inspection onsite, in turn, requiring excessive amounts of paperwork to show building compliance, which again contributes to cost and time.

Other participants suggested that the reduction of building inspection from regulatory control was possible but there was still a need for a third party to carry out compulsory inspections at key stages of construction. Examples of third parties suggested by participants included: architects, IPENZ members and LBPs. Mulgan (2000) supported this suggestion; contracting out, which is often seen as implying a watering down of public accountability, could also be a means of strengthening accountability in the private sector by moving it more closely to public sector practices.

One participant (D27) indicated that councils were not coping with the current arrangement of building inspection as the wait time for inspectors to attend their jobs was creating bottlenecks in their construction programme. This was evident in previous studies (see Section 2.3.4) where building inspection resources were being stretched in major New Zealand cities due to the supply and demand of residential housing stock. Table 4.16 collates the opinions of building inspectors and designers on risk-based models in the construction sector.

Table 4.16: Transcripts of designers talking about risk-based models in the construction sector

Participant's coding	Commentary provided by participants
D05	We have big quality and professionalism shortfalls (although quality levels are variable; some participants are excellent).
D16	Councils have embarked on a risk-minimising-to-themselves exercise by a paperwork exercise of preposterous proportions that is counterproductive, highly wasteful and materially makes no building more weatherproof than if it were built from all the stacks of paper required by BCAs!
D36	It is important to promote risk adoption by those best placed to manage it e.g. structural inspections and sign-off by the structural engineer. not the local authority inspector
D15	The process is very poorly understood.
D21	Risk-based inspections entirely miss the need to protect the interests of the owner who pays for the work being done. The average owner will have no knowledge about construction, so someone needs to protect his interests and ensure that adequate standards are maintained. What is the point of having no inspections on a low-risk project if it ends up poorly built?
D21	If the purpose of risk-based inspections is for the councils to drop out of inspecting low-risk buildings, there still needs to be a regime in place for some independent, qualified person to carry out compulsory inspections at certain stages of the work.
D21	I believe it is OK for an independent LBP to do these inspections.
D27	Can't really cope with the current arrangements.
D34	Serious lack of knowledge / skills across the industry with no real accountability.
D37	Additional IPENZ or architect involvement might be necessary if these are relaxed.
D57	If the council is at more risk to the consultants and contractors, then the time and cost need to be reduced and much more responsibility passed to the consultants.
D78	There is still a lot of incompetence in the construction industry in New Zealand.
D115	A better system is to pass responsibility for the building compliance to those that actually do the work.
BI023	The building industry has a long way to go before regulation is relaxed.

### 4.9.3 Theme 3: Responsibility balance in the construction industry

The third theme stems from the participants' views on the many phases associated with the construction of residential housing. Some phases required additional professional input and sometimes the crossover of trades was needed to complete work. One designer

(D07), who deals with high-risk buildings, was happy to take on the responsibility for self-certifying their design in lieu of regulatory building inspection. The participant commented further that certain kinds of work would be outside the scope of building inspectors. Another participant (D61) was of the opinion that shifting the liability to another professional wouldn't save any money and could, in fact, increase fees as in the case of an architect. It was compulsory for them to carry professional indemnity insurance and this added responsibility would surely increase cost. This concern is supported by Gouldson (2009) regarding the uncertainty about transaction costs and risk, as it is clear that basing aspects of the regulatory process on complex relationships between regulators and a potentially wide range of private players would not be any cheaper or more reliable than the current regulatory system.

Another comment, from D111, that responsibility needed to sit heavily with contractors, and if designers were to perform regulatory inspections in place of council inspectors then that should become a statutory requirement in order to appropriate fees prior to the building consent process. D103 agreed that homeowners would like the idea of reduced building costs but would be sceptical of any government changes to reduce BCA intervention as a trade-off. Yau (2009) and Spence (2004) supported the practice of lower fees for new systems more than the conventional approach as this would encourage people to use the new system. Table 4.17 collates the opinions of building inspectors and designers on risk-based models in the construction sector.

Table 4.17: Transcripts by designers, regarding responsibility balance in the construction industry

Participant's coding	Commentary provided by participants
D07	I do high risk buildings e.g. straw bale walls, earth ships, and am quite happy to take responsibility for these all the way through. The regulatory inspectors have next-to-no idea anyway but there are a lot of builders and owners whose approach is simply wanting to know what they can get away with.
D61	Getting the architect to do all those inspections probably wouldn't save any money. And it would cost the architect more in Public Liability Insurance. It's just shifting liability.
D83	Inspections to be carried out by registered structural or building services engineers, as required, where the work is beyond the architects' capabilities.
D07	Registered architects or chartered engineers should be able to assume all responsibility if they wish to.
D18	I still see lots of building work not carried out to drawing detail. More involvement by consultants in the construction phase, in observing work, is the key as they still get hit by litigation if there is a failure, whether they have been to the site or not.
D29	Needs to be more sharing of risk.
D34	Serious lack of knowledge / skills across the industry with no real accountability. There is a reliance on BCAs to take on QA level inspections as they are the last man standing.
D37	Additional IPENZ or architect involvement might be necessary if these are relaxed.
D103	Although I agree [that] building owners will like the possibility of reduced costs, I am uncertain the building industry will respond well to yet another change in the system.
D111	I think the responsibility needs to sit much more heavily on the contractors/builders, and if inspections performed by designers are to be relied upon, in place of council inspections, then that should become a statutory requirement, in order that appropriate fees may be agreed prior to the building consent process.

#### 4.9.4 Theme 4: Quality control in the construction industry

The fourth theme that emanated from the analysis of the open-ended questions is quality control in the residential construction sector. Participants had been alerted to the low levels of quality assurance on many projects. They said that more prescriptive checks are required more now than ever to catch out incompetent contractors. One participant (D005) commented that the construction industry has very poor standards of quality on projects and the industry is far from ready for a less rigorous inspection regime. Another comment

from this participant was that consumers needed more quality assurance, even on relatively simple projects.

One participant (D047) suggested that multiple failures by all stakeholders on the same project is due to the exacerbated current pressures on the building industry and the large number of relatively inexperienced stakeholders. This is further confirmation of the findings from the previous theme, regarding council currently not coping with the pressure of building inspections. The regulatory regime in New Zealand, according to participant D028, has changed substantially during his career and has added enormous cost to buildings. The participant added that the attributing building risk to councils is an inappropriate way to control quality. He said it is a disincentive to good trade practice, and it has had a significant negative impact on productivity. Table 4.18 provides transcripts relating to this theme.

Table 4.18: Transcripts about quality control in the construction industry

Participant's coding	Commentary provided by participants
D005	We have big quality and professionalism shortfalls (although quality levels are variable, some participants are excellent). Sadly, a more prescriptive and check- based approach is needed more than ever to catch those who are ignorant or careless.
D028	The regulatory regime in NZ has changed substantially during my career and has added enormous cost to building. Attributing building risk to councils is an inappropriate way to control quality; it is a disincentive to good trade practices, and it has had a significant negative impact on productivity.
D047	I have experienced a wide range of competence levels in all building stakeholders from very competent to incompetent. At times there have been multiple failures by all stakeholders on the same project with very poor results. This is exacerbated by current pressures on the building industry and the large number of relatively inexperienced stakeholders.
D005	We have a proven, very poor standard of quality on many projects. The industry is far from ready for a less rigorous inspection regime. Consumers need more quality assurance, even on relatively simple projects.
D021	If the purpose of risk-based inspections is for the councils to drop out of inspecting low-risk buildings, there still needs to be a regime in place for some independent, qualified person to carry out compulsory inspections at certain stages of the work. I believe it is OK for an independent LBP to do these inspections.
D047	Quality of both design and build is often very low.
D050	The quality of the builders is improving but not there yet.
D088	...too much shoddy work.
D109	There are still too many cowboy builders around.
BI006	Most problems stem from design.
BI016	The quality of workmanship is very poor across all trades, including designers.

#### 4.9.5 Theme 5: Licenced building practitioners

The introduction of the Licenced Building Practitioner Scheme (see section 2.5.6) provided a lot of interest among the interview participants. Participants indicated that they have concerns with the LBP scheme and its members. The participants pointed out that there were still too many incompetent builders in the industry and the industry required major upskilling. Participant D61 commented that LBPs were not getting projects right the first time and many tradespeople seemed unaware of the requirements of other trades; this was causing issues and regulatory non-compliance. Similarly, participant D68

suggested that the issues were being caused by a lack of collaboration and knowledge of one another's trade requirements. Participant D59 suggested that until licencing of LBPs is more robust, like that of the electrical trade, the current LBP scheme will not be effective. Table 4.19 provides transcripts relating to this theme.

Table 4.19: Transcripts of licenced building inspectors

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<b>Participant's coding</b>	<b>Commentary provided by participants</b>
D59	Until the licensing of builders is graded and has meaning, self-assessment, as done by electricians and gas fitters, is inappropriate.
D61	Even LBPs don't seem to get it right. And many tradespeople seem unaware of requirements for other trades work, so this causes problems for other trades.
D62	Of great concern are the owner and builders who are not regulated.
D68	General low skills base for most trades. Not enough LBPs actually at the coal face. Too many developer scenarios where work is all sub-let and poor coordination.
D89	Better training required for builders.
D109	There are still too many cowboy builders around.
BI049	The LBP scheme has not been a panacea for skilled work.
BI003	Not all builders. Franchise holders and developers sometimes come from outside the building industry and view the building in the short term speed and profit. Contract law is the best way to deal with this.

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#### **4.9.6 Theme 6: Education in the construction industry**

Education and the upskilling of stakeholders is a significant theme from the open-ended questions. Participants pointed out that the whole construction industry requires on-going education; they suggested a minimum qualification for the sector. As discussed in the literature review (see section 2.8.1), designers are of the opinion that there is a lack of good training in the practical aspects of building code compliance within their own institute, which makes it difficult for their younger designers to make competent assessments. One participant suggested that the lack of knowledge and skills across the industry is due to the reliance on BCAs taking on a quality assurance level inspection as

part of their risk-averse approach. Participant D114 suggested that the building regulations were being changed to suit the BCAs and suggested that future amendments be carried out by independent qualified experts and not that of the BCAs. Participants' opinions relating to this theme are collated in Table 4.20.

Table 4.20: Transcripts about education in the construction industry

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<b>Participant's coding</b>	<b>Commentary provided by participants</b>
D004	More education for all parties is needed around what needs to be inspected, what is important to be inspected and what falls outside or within that spectrum.
D046	Yes, as long as it is by minimum qualification e.g. registered architect.
D060	For projects where qualified professionals are independent of the contractor and are engaged for observation.
D089	Better training required for builders.
D114	There still exists a general lack of understanding of building controls, code compliance requirements and good practice amongst many onsite tradespeople. There is a major requirement for upskilling and increased knowledge and understanding in these areas for many tradespeople.

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#### **4.9.7 Theme 7: Building inspectors**

The final theme to emerge from interviewees are opinions concerning regulatory building inspectors. The participants expressed that some building inspectors have a lack of understanding of the building process and are not well trained in the methodology of building construction. One participant (D094) suggested that BCAs should only be responsible for the quality control of documentation; the correct paperwork for construction could be submitted and signed off by the appropriate parties. Similarly, participant D046 added that architects should be given responsibility for consenting work and also have the authority to sign off work with peer reviews on complex projects or difficult detailing. This concept was also supported by participant D036, who said it was important to promote risk adoption by those best placed to manage it. D036 provided an example of structural inspection being signed off by a structural engineer and not the

regulatory authority inspector. Two participants (D101 and D114) indicated that regulatory building Inspectors generally tend to have a good understanding of building code compliance requirements and, based on observation, those practitioners that complain about the council's performance are generally identifying their own inadequacies.

Responses relating to regulatory building inspection demonstrated that the BCAs have been having difficulty in recruiting sufficiently qualified, competent or experienced staff. This is a resourcing issue for processing and inspections building consent work. The increase in workload has also put a strain on staff to make quick decisions when reviewing and inspecting consents; some participants suggested the BCAs have adopted a risk-averse approach. The participants' opinions are collated in Table 4.21.

Table 4.21: Transcripts about regulatory building inspectors

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<b>Participant's coding</b>	<b>Commentary provided by participants</b>
D036	I think it is important to promote risk adoption by those best placed to manage it, e.g. structural inspections and sign-off by the structural engineer not local authority inspector.
D046	Councils have not been able to attract sufficiently qualified, competent or experienced staff who are able to understand drawings, building methods or interpret codes and standards. Therefore their role should be one of only policing when the documentation is lodged and signed off by the appropriate parties. Architects should be given responsibility for, and authority to, sign off work with peer reviews where crucial or non-standard work occurs. Areas of relevant responsibilities in various building types need to be clarified with urgency and a framework established for the industry to operate with clarity. (e.g. The 'Architect of Record' system as used in the USA). The building industry currently is effectively dysfunctional.
D057	We have been continually held up by council's processing time. They are black and white, with little competence to assess the situation from a practical, intelligent viewpoint, where some grey is necessary. Only through pressure from their superiors have we had answers, which we suspect the inspectors were sitting on for some time because they didn't want to be blamed for making an independent logical decision. The inspectors need more authority or else [they should] pass the whole process to architects.
D059	Based on observation, those practitioners that complain about Council performance are generally identifying their own inadequacies.
D094	Council inspectors need to understand process and time frames.
D114	From our observations, architects and Council building inspectors generally tend to have a good understanding of building code compliance requirements.
D101	Building inspectors generally have insufficient knowledge to effectively inspect buildings. Not well trained.

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#### **4.10 Summary**

This chapter has presented the analysis and results of the questionnaire survey and data collected from building inspectors and designers across New Zealand. The chapter began by outlining the research objectives and questions, and proceeded with data analysis and presentation of results from the questionnaire transcripts.

Interpretive statistics, with the use of charts and correlations, were adopted for most of the analysis, while qualitative methods were used for the open-ended questions. These

approaches were conducted to achieve the research objectives and questions outlined in sections 1.4 and 1.5 of this study.

It is apparent from the results that building inspectors and designers have not fully grasped the concept of risk-based regulations. Building inspectors and designers both agreed that there was a need to review the current building inspection process and risk assessment of projects, as carried out in the United Kingdom. They were largely in favour of a model to follow. However two stakeholders agreed that the New Zealand construction industry is not ready for regulatory building inspection to be reduced in favour of risk-based assessment approach at present.

The results of notifiable inspections in terms of risk rating and notifiable inspections requiring regulatory inspection from construction stakeholders have now been established as a ranking system. This ranking system determines the order of notifiable inspection by risk and indicates when regulatory resourcing is required.

The survey has found that high-risk inspections are those are covered up or hard to see when construction is complete. These inspections also relate to having regulatory intervention associated with them. From the analyses, it was observed that designers were happy to carry out certain inspections but did not feel the need to inspect stages that had registered trades or LBPs carrying out the work.

Finally, seven key themes that are significant to the building consenting process and risk-based inspections have emerged from the survey. These themes are: skill level in the housing construction industry, risk-based building regulations in the construction industry, responsibility balance in the construction industry, quality control in the construction industry, licenced building practitioners, education in the construction industry and regulatory building inspectors. Addressing these themes could encourage

the full implementation and use of risk-based inspection as a BCA tool within the residential sector.

The following chapter presents the results of further investigations into building consenting practices through face-to-face interviews with housing developers. The information obtained from the house developer interviews are analysed in line with the objectives of this research.

## **Chapter 5 Analysis and Presentation of Interview Findings**

The qualitative stage of this study (Interviews) was run in tandem with the quantitative stage (online-survey). This interview stage consisted of fieldwork investigations in which data was obtained through face- to-face interviews with residential housing developers. Oppenheim (1992) explained that interviewers come into their own when the need to ask numerous open-ended questions, or open-ended probes, and where the interviewer has to record, word for word, the answers given by the respondents.

Recordings of the interviews were later transcribed for ease of analysis. Open-ended questions allowed respondents to provide their opinions with greater richness and spontaneity. The reason a qualitative analytical method (thematic analysis) approach was administered to the housing developers was that they were able to provide in-depth perspectives and comments about the past and current regulatory building regime. In New Zealand, housing developers, more frequently, have contact with designers, builders and building inspectors during the housing construction phase.

As earlier discussed in chapter three (see section 3.10), ethical consideration for in-depth interviews was established during the face-to-face interviews. Guest, Namey & Mitchell (2013) and Whiteford & Trotter (2008) suggested that researchers must accomplish four basic actions when they conduct ethical research: (1) ensure voluntary participation, (2) ensure the participants recruited for the study are competent, (3) preserve confidentiality regarding the participants, and (4) provide a thorough and accurate informed consent process. Ethical consideration for this current study was addressed for action (1) through the AUT Participation Information Sheet. See Appendix A2, (2) Table 7.1 Demographic information of interviewees, (3) in section 3.10.5 Privacy and confidentiality, and (4) through the AUT consent form in Appendix A3.

## **5.1 Analysis of interviews**

Data was collected from large, medium and small organisations involved in multi-housing development. The 10 participants were purposively sampled, following their geographic location and the number of dwellings they produced each year. Creswell (2003) recommended that, when conducting interviews, a sample size of at least 10 is significant. The objective, when interviewing housing developers, was to extract their experience of and thoughts about regulatory stakeholders; in particular, building inspectors, licensed building practitioners and subcontractors. Housing developers were considered to be in the best position to provide this data as they are in frequent contact with the stakeholders at various stages of the building consenting process.

The interview questions were structured in four main categories: regulatory balance in New Zealand, the current building inspection process, risk-based inspection and other stakeholders in the construction industry. All these categories are in line with the research framework.

## **5.2 Demographic information about the interviewees**

The interview commenced with research participants providing a brief background of themselves and then of the company they worked in. This was, firstly, an icebreaker and it also built rapport with the interviewees. The initial aim was to get an idea of their educational background and construction experience so the interview questions could be subsequently built on, in the anticipation of further emergent themes.

Table 5.1 provides demographic information about the interviewees. The analysis of the data provided shows that all housing developers have some sort of tertiary qualification, and all but one (who has a business degree) have a building construction qualification. The majority (nine out of 10) of the participants have over 10 years' experience in construction, with four having more than 30 years. All participants hold a senior position

in their company, with seven holding a designation of company or managing director. Therefore, the demographic information obtained from the participants shows that their opinions and experience in this study are dependable and reliable.

Table 5.1: Demographic information about the interviewees

<b>House Developer's</b>	<b>No. of years in construction</b>	<b>No. of years with company</b>	<b>Qualifications in construction</b>	<b>Participant's designation</b>
HD01	30+	10+	Building / Carpentry	Company Director
HD02	30+	4	B. Engineering	Company Director
HD03	8	5	B. Business	Company Director
HD04	15+	1	Reg. Electrician	Managing Director
HD05	30+	10+	NZCE	General Manager
HD06	10+	6	Project management	Managing Director
HD07	10+	7	Architectural	Company Director
HD08	15+	10+	Architectural	Company Director
HD09	10+	5	Project management	Project Manager
HD10	30+	9	Building / Carpentry	General Manager

On completion of each of the interviews, the transcribed information was transferred into the NVivo software program which helps store, and organise qualitative data. The data was then sorted into common passages or segments that were then assigned to common themes and subthemes, ultimately providing the researcher with a list of cogent themes. Appendix E provides the formation of the emergent themes using NVivo.

The responses from the housing developer interviews provided six cogent emergent themes. These six themes included the building consenting stage, regulatory inspections, risk-based inspections, Licensed Building Practitioners, manufacturers, suppliers and homeowners, and building inspection improvements. Extracts of the transcripts are presented to support the discussion. The key themes that emerged from the interviews are represented in Table 5.2.

Table 5.2: Key themes from interviews

No.	Themes	Table No.
1.	Building consenting process	7.2
2.	Building inspections	7.3
3.	Risk-based building inspections	7.4
4.	Licensed Building Practitioner	7.5
5.	Manufacturers, suppliers and homeowners	7.6
6.	Building inspection improvements	7.7

The next section presents the findings from the semi-structured interviews, in accordance with the main themes outlined in Chapter 1 of the study.

### 5.3 Theme 1: Building consenting process

The New Zealand building consenting process, as discussed in the literature review chapter and shown in Figure 2.3, looks at the lodgement of the building plans, the processing of plans for regulatory compliance, building inspections and final certification, when the Code Compliance Certificate (CCC) is issued by the BCA. The BCA seeks to understand, from individual developers their experiences with the consenting process. A wide range of responses was received from the housing developers during the interviews. Some of the transcripts of the interviews are included to support the discussion.

All the housing developers interviewed indicated that they had issues with the building consenting process, at various points through the process. One of the organisations on the application lodgement process for building consents believes that the BCAs are very vigilant and, at times, over the top regarding what is required in getting building plans consented.

*They are overzealous, especially in terms of that front end, the actual permitting part of it, the process before it actually gets to inspection stage. They are being very, very pedantic as to what's required and what's not (HD02).*

HD02 has alluded to the overzealous approach from BCAs with respect to accepting building plans at the lodgement stage. This was identified in the literature review where BCAs have adopted a risk-averse approach to protecting consumers from defective building work, even when the risk and consequences of failure are low (see Section 2.3.4). The risk-averse stance of BCAs indicates that because councils are asking for more information, the cost of buildings increases as developers pass the extra expense onto their clients.

*Most of the things they are doing are overkill... they want to be on the safer side which is good but this all adds cost to the client .... It doesn't cost us because we pass on that cost (HD09).*

Further, HD05 suggests that Government has a monopoly on the building consenting process. Other professionals are not questioning further requirements from BCA as they benefit by further charging for their services. It is also suggested that BCAs double-check specialist reports, further increasing the cost and time on a building consent.

*Government's got a monopoly and professionals are all peeing in each other's pockets... [we were] building a house and we infringed the neighbour's property.... you get a specialist to do the report and then it goes into Council and then Council do their report on it. You're about \$3,500 plus all the delays (HD05).*

Housing developer HD08 justifies the BCA's position of requesting further information from designers, as most plans are in a one-dimensional format and Council processors request further details to clarify a design that may not be obvious in submitted plans. HD08 adds that frustration occurs when the same design is submitted in different areas and the supporting evidence required is inconsistent.

All housing developers interviewed agreed that the front end of the building consent stage provides a lot of uncertainty as the requirements from BCA can be ambiguous. This is particularly so at the lodgement stage. Further expenses are incurred when engaging other

professionals, in order to show compliance. The risk-averse approach adopted by BCAs not only frustrates housing developers, due to inconsistent requirements, but also increases time and cost on the building consent process.

Further scrutiny of the opinions from the housing developers under this theme revealed two related issues: the increase in NZ's residential housing and the manner in which building inspections are booked. Further sub-themes applicable within this theme are provided in Table 5.3.

Table 5.3: Theme 1 and sub themes

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<b>Theme 1.</b>	<b>Sub-themes</b>
Building Consenting stage	Notifiable increase in residential housing Booking of inspections

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### **5.3.1 Notifiable increase in residential housing**

In this sub-theme, respondents indicated that there had been a significant increase in residential buildings throughout New Zealand; this could impact on the building consenting process. Housing developers discussed how there was a spike in the number of houses being produced as a result of demand occasioned by migration, economic growth and the lack of housing supply in the larger cities. The demand for housing has been evident for some time, with the majority of housing developer confirming that they had doubled turnover year after year; they have been actively employing new staff to cope with the workload. This view was supported by the following comments.

*We've almost doubled turnover year on year... We just employed another junior project manager last Wednesday, with a view to next year's workload. We've still got enough homes that the boss is happy for next year already. (HD06).*

*Definitely the last two years. There has been a huge influx in building activity in this area. Both East and Counties have experienced considerable growth and activity (HD02).*

*Our volume going through has doubled .... Yes, definitely in Auckland, but even Hamilton and Tauranga. Tauranga has done really well (HD07).*

Similarly, participants HD01 and HD09 commented that the entire construction industry was busy. The roll-on effect of the pick-up in work was that there was more pressure in completing jobs. Good sub-contractors were also busy and had to be booked in advance for availability.

*Obviously all the different tradespeople are subcontractors, so for us it's not a matter of employing more people; it's just getting more people to do work as it comes along (HD01).*

*Employing more staff. [There's] a lot of pressure to finish projects. A lot of contractors are very busy so we have to book them in advance. So, [being] management, you have to be more on to it, because everyone is so busy; if you miss them they might not be available for two or three weeks (HD09).*

HD08 is known as a volume residential builder. They have noticed the increase in their building programmes and other areas of their business, which have included large renovations, design and build, middle- to upper-market spec homes, have doubled from the previous years. They already forecasted an increase in their project for the upcoming years.

The increase in work has also provided one housing developer (HD05) to be selective regarding which projects they will take on. They have had the capacity to turn away the more difficult projects, mostly ones that involved leaky housing.

Therefore, the responses suggest that participants agree there is an increase in residential building work in their areas and this has stimulated other areas of the construction field to be more vibrant. In particular, designers, builders and sub-contractors are busier. The employment of new staff and sub-contractors, and the approval of work forecast for the following year, is evidence that residential home construction is on the increase.

Housing developers also pointed out that the increase in residential building work has also put a demand on BCA's resources, including the booking of building inspections, which is discussed in the next section.

### **5.3.2 Booking building inspections**

The second sub-theme that emerged from the interviews was the process of booking inspections. This is a crucial stage in the consenting process, as the BCA needs to have enough resources to allocate inspectors to the inspections booked. The current building consent process requires owners / agents, once they have obtained their consented building plans, to be responsible for booking inspections at notifiable stages during the construction project (see chapter 2, Table 2.2). This is required so that the BCA is satisfied, on reasonable grounds that the constructed work was carried out in accordance with the building consent and Building Code.

The analysis of the transcripts shows that the participants who were interviewed indicated that the actual method for booking inspections needed to be improved. The process of picking up a phone and organising an inspection is time-consuming, according to HD03. HD04 added that booking with different councils is frustrating, as each is different in terms of how far in advance you need to book. This has an impact on workflow.

It also became apparent from interviewees that once inspections had been booked that there were major delays in having inspectors arrive on site within 24 to 48 hours (see section 2.4). Majority of housing developers agreed that the phoning system is outdated. With technology, there may be better ways to book inspections. The following transcripts from the interviews explain their concerns.

*What you tend to find with building inspectors is that you ring the council and they say, "Oh well, we can have an inspector there in two weeks, sometime in the morning. And you're expected to be there. I mean two weeks away, it's kind of hard to plan that far ahead (HD04).*

*Maybe booking the inspections, they can work on a better way. Maybe it's an email system (HD03).*

Significantly, one participant noted that they were circumventing the system to benefit their projects as the delay encroached on their build times. So this developer was booking dummy inspections in order to have inspectors ready during their build. This action may be contributing to the overloading of building inspection rosters in which genuine inspections are being rescheduled for the following days. HD06 would book an inspection before construction was completed and cancel if they were not ready to keep their building timeframes on target.

*We can be up to five days before they'll take a booking which hurts...To correct that, we'll put in dummy bookings which will bottleneck the system even more, but it works for us. We shouldn't have to; it's not good to do that. But that's a workaround that we use, right or wrong, to keep our building process going (HD06).*

In spite of one housing developer's frustration with the booking inspection process, one participant was happy to shoulder the blame for poor planning.

*It only causes a bottleneck when we fail to book the meeting and the inspector can't get there for whatever reason.... It's not the council's fault if they can't make it. It's our fault for poor planning (HD03).*

Further, HD05 offered a solution to the booking system. If building inspectors were not available, a private consultant could then be contracted to carry out the inspection with a later reimbursement from council for the service. HD06 also suggested having window bookings available where one is able to book 24 hours ahead for a two-hour window of inspections. This assumes that the BCA had the resources to cope with this booking arrangement.

The booking of notifiable inspections, and the unavailability of building inspectors, is thus a major concern with housing developers. Interviewees' comments confirm that the booking of inspections has a bottleneck in their building progress schedule, which then

translates to financial increases and workflow disruptions. These findings confirmed responses from the previous literature review regarding the outdated booking service and the recommendations for developing modern technology to allow builders to transmit requests for inspections.

#### **5.4 Theme 2: Building inspection**

The second theme deals with building inspection in the building consent process. The study endeavoured to introduce an alternative tool to the current building inspection model. This is fundamental to the building consent process. The interviews were designed to identify the housing developers' attitudes towards the current building inspection process, and their views on building inspectors in general. Importantly, their opinions could indicate improvements housing developers could make to increase productivity in the building inspection process. Further, the interviews facilitated an understanding of the role of council and independent building inspections in the building consenting process.

The participants indicated that the majority of regulatory inspectors were doing a good job with a practical approach, and that there had been noticeable positive change in attitude by inspectors over the years. The relationship between builders and inspectors has improved. Building inspectors were once seen as providing a supportive role, offering solutions and suggestions to problems, then historically coming down with a heavy hand. One participant supported this view with his comments that inspectors are now providing his builders with an opportunity for minor works which did not initially pass the physical site inspection but were able to be remedied. Photos could be taken of rework that was ultimately compliant. Another participant provided a view that if the builders are competent and do a good job, a good relationship can be formed with the inspectors but also the reciprocal can also easily occur. This behaviour is in line with Heijden's (2009) description of building inspectors being flexible and lenient on the one hand but able to

deal with violators on the other (see section 2.4.2). Examples provided included inspectors who were more approachable and flexible in their decision-making and are only difficult to deal with when compliance has not been met on purpose.

*On the whole you do get 70% of them that are very practical. They just take a practical approach and understand that if you're there to do a good job, you're there to do a good job, no matter what. And they pick on the guys that are not there to do a good job because you can see it. Once they get to know you, then you can work with them really well. (HD07).*

An apparent issue that emerged among the participants was their frustration with regulatory inspections in that inspectors lacked consistency in the decision-making process. Participants said that because the council was such a large organisation, different inspectors would show up on jobs and interpret compliance in different ways. Builders would form an understanding and relationship with one inspector and then a new inspector would show up with no previous knowledge of the past discussions.

*The council is such a big organisation that a different inspector will come each time and he'll have no background of the job. So there is something you've explained to someone "this is why we've done (something)" and that other inspector was fine with it". Then another inspector will come in and go, "Oh no, you can't do that". (HD01).*

*One inspector will pass [the inspection] and another one won't. You think what the heck. It would be nice if it was consistent. (HD07).*

One participant suggested that the inconsistency with inspectors is due to not having enough practical knowledge of buildings, as they had only been trained in a classroom, so their knowledge was mainly theoretical.

*Some of the council inspectors are too much by the book and probably haven't been on the tools themselves. That is something that the council needs to sort out a bit, because you do want someone familiar with what they're inspecting to make sure that what they are inspecting is correct and achievable, and that a builder can actually achieve what they want (HD03).*

Similarly, one participant identified that the council has its fair share of incompetent people working in their ranks, as in any other industry. Another participant suggested that some building inspectors do not have the right attitude, in that they do not want to share their knowledge and are not attentive because they are always in a rush. Participants agreed that there needs to be an alternative other than that of relying on the building consent authority as the sole inspection unit.

The participants suggested that a competition model would be worthwhile, and that it is long overdue. Regarding the introduction of the licensed building practitioner scheme, there should be less reliance on council inspectors. Participant HD06 also suggested having a third party in the form of a registered consultant inspecting work for compliance. Then there would be no reason to have a regulatory inspector doing the same job. HD03 also added that the early intervention of a professional third party would detect non-compliant work earlier in the construction phase.

*Some of the inspectors don't have the right attitude. There is an issue in the industry, actually. They are more bothered about their time on site. They don't want to share their knowledge. (HD09).*

*Maybe there is competition with Auckland Council. Maybe there is a second council body that does inspections and does consents and you don't have to just go to one company (HD03).*

*If I'm getting an engineer to certify an engineering component, as in a slab that they've designed, or a retaining wall they've designed, I don't need an inspector to look at it. And most inspectors will agree with that point (HD06).*

*If you had that third party look at it, at the least the major aspects, it's pretty obvious on one of our builds if something is wrong. It doesn't need seven or eight inspections to figure out that things aren't going quite right (HD03).*

From the transcripts above, it is apparent that there is a lot of frustration with participants. There is no consistency from building inspectors, either through having different

inspectors showing up on projects or different interpretations of building compliance. It was also suggested that competition in the delivery of building inspections could be an alternative to building control authorities' oversight.

Housing developers were open to the use of third-party inspectors or building consultants that were contracted to council. HD01 recalls the previous use of private certifiers and the convenience of building a relationship with them and knowing which inspector was going to show up on their jobs.

*There was a point, eight or 10 years ago, when there were private certifiers. There's a couple around now but there used to be quite a lot of them around and it used to be a lot better being able to not shop around. We had someone we were comfortable with that we used all the time. The same inspector always came to the site, so you got to know him (HD01).*

In contrast, participants HD02 and HD06 added that the council is already utilising the services of private certifiers. HD06 gave an example of work he had submitted through a local BCA. The work ended up being processed by an external contractor due to capacity issues. The consultant, having a point to prove, became more pedantic, adding minor issues to the process, which again added cost, time and frustration to the applicant.

*Well, Council, in my opinion, is certainly trying to put that off to a third party. So we're finding we're putting consents through Council and they're ending up on the desk of independent companies like Manukau Building Consultants who we also do work with. So, for instance, I've got examples where I've done odd builds, one on the North Shore through the North Shore District Council and it's ended up... basically they obviously haven't got the capacity so they've forwarded it on to other providers. (HD02).*

*I know that Manukau Building Consultants would also go down and help Papakura Council at some stage when they had overflow. So if they amalgamated and got one whole thing they should be able to level that out (HD06).*

Similarly, HD04 found that when dealing with private certifiers they were more organised. When services were required they were more likely to be available. The

familiarity with the inspector and the company's project were also advantageous to the developers.

It is evident from the participants' feedback that they view third-party consultants as a benefit to the consenting process, and that the relationship they are able to build with consultants is invaluable to their projects' productivity. This kind of relationship tends to be lacking with Council BCAs. The participants also note that BCA resources are stretched and work is being distributed to other Council BCAs, in turn; when they are also at capacity the BCAs will utilise the services of external consultants.

### **5.5 Theme 3: Risk-based inspections**

The third key theme to arise from the interviews with participants is their perception of risk-based inspections as a building consent authority tool. This theme is important to the current study because it provides an overview of the stakeholders' understanding, or lack of it, towards risk-based inspections.

Risk-based inspection is an alternative tool to the current model in which "resources are allocated in proportion to risk" (Rothstein et al., 2006). In the case of New Zealand's building regulations, the Building Amendment Act 2012 identifies certain risk groups as low-risk: simple, standard and commercial (see section 2.5.5). These risk groups are identified in the Building Amendment Act 2012; three of the participants did not have an understanding of risk-based inspection or were not familiar with the concept as provided in the following correspondence.

*I don't have much of an understanding of what a risk-based assessment is. It's not terminology that I know (HD02).*

*I'm not quite understanding what you mean, risk-based inspections? (HD04).*

*I don't have a lot [of information]; just what you're explaining to me now (HD06).*

All of the remaining participants had a fair idea of the concept. A significant number of the participants (five out of 10) supported the idea of implementing risk-based inspection as an alternative to the current building inspection process. One participant suggested that the framework should be linked to the existing E2 External Moisture Matrix (NZBC, 2001), as the risk for building can be calculated and the requirement of regulatory inspection can be established to suit. Another participant suggested that current building inspection notification stages were still warranted on some buildings that were architecturally designed or high risk, in terms of construction, and that risk-based inspections would also be suited for low-risk construction.

*We should link it to the risk matrix because, at the moment, we do a risk matrix. So we should go right, risk matrix, if it's a five then, yeah, it needs multiple inspections all the time. If it's a one, it's like, yeah, well, you can miss that one and you can miss that one, and all you need to do is take a couple of photos as evidence and then it has to go in with your submission with your Code of Compliance that you can prove by photographic evidence or something that has been okayed (HD05).*

*There are still buildings - architectural buildings - and more complex buildings that do still need, I guess, some sort of standard to be kept up a bit more strictly by the council but with these, here, they are such a low risk... a design that's been around for years (HD03).*

*I would think that is something that could come in conjunction with the self-certifying. If it's a standard box with no real architectural features and a low-risk thing, well then, maybe most builders can just certify that themselves (HD04).*

The example above indicates the support from housing developers for the concept of risk-based inspection as a BCA tool. In contrast, the majority (eight out of 10) were apprehensive about implementing risk-based inspections in that the construction industry was not ready and that certain stakeholders had to upskill about the stringent regulations introduced to safeguard consumers. The participants mentioned that the construction

sector, in particular the LBPs, needed further training and experience, as their role in the building consent process will dramatically change due to the lack of knowledge about building compliance.

Participants HD03 and HD04 suggested that other key stakeholders had to be fully regulated and operational for risk-based inspection to be fully implemented. The suggestion is that LBPs will self-certify their own work and the safeguard of the building inspector will diminish over time. The following transcripts provide participants' views on this issue. One participant believed that the public would be in key opposition as the leaky-home saga, which was also a government initiative, turned out to be disastrous.

*It's getting that framework in place. Maybe it is not just an LBP that can sign it off. Maybe you need to do a bit more training. The builder himself [could] do a little bit more training to be able to sign off. Maybe you'll have builders that can sign off that part and builders that can't and they'll still need the council (HD01).*

*There are certainly good operators out there that can do that but it's just that there are so many operators out there that I think have come into the industry very, very recently, [and they] don't have the expertise to basically do that. I would be reluctant to do it without any safeguards on it because I think there is a lack of experience in terms of contractors on site (HD02).*

*The industry could do it. I don't think the public would be ready because this leaky-building thing is really fresh in their minds and everyone is going to go, "What's this going to lead to?" That's why there still needs to be some sort of regulation around it as to who can do it. And maybe they [could] have spot checks (HD01).*

*The LBP side of it needs to be 100% ready. I don't think it's quite ready yet. There's some talk of reviews and changing slightly how things are done. So that needs to be sorted first, before you start putting any responsibility on the builder to take those inspections out. But in saying that, I think it should be done but it just needs to be done in the right order (HD03).*

One participant explained that risk-based inspection should not be applied to a franchise and that only individual builders should be able to qualify for these privileges. Another

participant supported this idea by saying “Anybody with some money can purchase a franchise and take advantage of it for their own benefit” (HD05).

HD07 explained that risk-based inspection has not been taken on by their company because the cost savings of not carrying out the extra inspections outweighs the extra personal liability that the company would need to take on. The checking of projects, and new builders they may have on site, from regulatory inspectors is a reassurance for the company that a second pair of eyes is looking over things.

Further, HD08 believed that risk-based inspection is more suited to a particular building. HD08 had used the tool already. The interviewee explained that just because risk-based inspection had been adapted from a regulatory body did not mean that contactors would stop checking critical stages in construction altogether. The inspection identified who would be checking those areas, if it was not council doing it.

It is clear from the commentaries above that risk-based inspection does have a place in the New Zealand building consenting process but the housing developer participants require construction stakeholders to be upskilled. Further, they want robust regulations protecting consumers to be introduced. The scheme should be offered to individuals and not franchisees.

In addition, four sub-themes are evident from the interviews under this main theme. These include reduced regulatory inspections, self-regulation, the leaky-home saga and quality control (see Table 5.4).

Table 5.4: Theme 3 and sub-themes

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<b>Theme 3</b>	<b>Sub-themes</b>
Risk-based inspections	Reduced regulatory inspections Self-regulation Leaky-home saga Quality control

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### **5.5.1 Reduced regulatory inspections**

The first sub-theme, in relation to risk-based inspection, was the reduction of regulatory inspections from the current notifiable inspections. The reduction of inspection was due to the fact that BCAs would be focusing their resources on more complex construction. The question was posed to participants in regard to the current number of notifiable inspections, seeking their opinion on the reduction of inspection as part of the risk-based inspection concept.

One participant indicated that, in the past, there were a lot less inspections and then we had the whole leaky-building saga. The participant added that the current number of inspections was acceptable and the BCAs had crunched the numbers and got the sequence right. A couple of the housing developers were under the same impression that the number of current regulatory inspections was reasonable and that the inspections provided a second pair of eyes when their companies were too busy to oversee their builders. Overall, the participants were satisfied with the number of current building inspections and believed that the stages of notifiable inspections were correct. These housing developers were aware their clients still have concerns with ‘bad’ builders; having an independent regulatory check provided them with peace of mind. The following transcripts, from HD02, HD03 and HD08 provide supporting commentary to this issue.

*My opinion is: there seems to be a reasonable number of inspections. From a client perspective, clients certainly are very aware of shoddy building work. There is certainly a sales and marketing component...*

*to know that clients have that surety or trust that there have been a lot of inspections and that there isn't stuff that's been missed. (HD02).*

*I'm happy with the number of inspections. At the end of the day, I use those... we still do a quality inspection at the same time as the build but, to be honest, when my project manager is too busy and he can't get round I use those inspections as a quality inspection from the council (HD03).*

*I think most of the inspections are founded. The inspection points have been established based on them being critical to building success. Again, I think the inspections themselves, generally they've been well thought out. Whether council do them or someone else checks them is..... I'd just reiterate, I think the current system is, by and large, producing good houses and I don't personally want to see a set of changes made to facilitate volume that allows poor quality practices to become widespread (HD08).*

It is clear from these transcripts that the majority of the housing developers were satisfied with the current number of notifiable inspections required during the construction process, and were not in favour of reduced regulatory inspections. The philosophy behind the staged inspection was founded on past experiences but who alternatively carries out the notifiable inspection, as an alternative to the BCAs, must be considered. The perception of owners, about reduced regulatory inspection due to the leaky-home saga, may be opposition to the risk-based inspection concept. The buy-in from the public has also been addressed under the main theme of this section.

### **5.5.2 Self-regulation**

The second sub-theme from this section involved the self-regulation of construction stakeholders; contractors would be allowed to certify and sign off their own work. Self-regulation plays a major role in risk-based inspection, as it requires certain consented construction work to be signed off by other construction stakeholders other than the BCA. Other trades (gas, plumbing and drainage, electrical) in the New Zealand construction sector are operating and certifying their own work.

HD04 and HD03 acknowledged that self-regulation would be a good move but emphasised that a more rigorous qualifying system or governing body needed to be in place for it to prosper. One participant expressed their approval of how their company participated. This developer was still involved in a five-day turn-around consenting programme with Council. The programme involved building consent being processed in five days or less, reduced inspections and a robust quality assurance programme which was agreed upon by the BCA before the commencement of construction work. A key aspect about the programme was that it was not widely advertised to the public and was an invitation-only selection process.

Another participant argued that self-regulation would not work and an independent party would still be required to sign off on regulatory functions. The interviewee added that some building companies did not have good building practices and would only attract non-competent workers to the sector.

*If they were given the responsibility of regulating themselves, that would be horrendous. I know some building companies out there that have horrendous building practices and, no, they need to be regulated. And I want my guys regulated, as well, from someone external. I don't want my builder making the assessment that they know what's best. I want someone external saying whether they've followed best practice or not (HD02).*

The mixed responses from the interviewees indicate that self-regulation does have a place in the residential construction sector but must be government regulated to safeguard consumers. Self-regulation can attract corruption in that some contractors would be enticed to cut corners during construction.

### **5.5.3 The leaky-home saga**

The leaky-home saga was still in the minds of the housing developers interviewed, as many of them had been involved in some aspect of the issue throughout their careers. The leaky-home saga is a stark reminder that with a change in regulation, in this case

'performance based regulation', disastrous outcomes can be unforeseen. Participant HD02 said that clients often bring up the fact that the leaky-home saga also took place under a regulatory environment. A number of major stakeholders were exposed and it is ironic that one of the major product manufacturers that was heavily involved had never been held accountable. This view was supported by participants HD01 and HD08; the public perception of the leaky home was still fresh in their minds. Reducing regulatory inspections mimicked the pre-leaky-home building inspection regime.

*That's why there still needs to be some sort of regulation around it, as to who can do it. And maybe they [could] have spot checks as well, I don't know.....There used to be a lot less inspections and then we had the whole leaky-house thing (HD01).*

*So if we took the councils back out, because the councils increasingly do understand quality management, not only as inspectors but as a science and a methodology and a philosophy, I think we'd just have another pile of leaky homes. It would manifest itself differently (HD08).*

The majority of stakeholders are aware that the introduction of another regulatory tool would be detrimental to consumers who were affected by the leaky-home saga in the late 1990s. The shift of responsibility for regulation approval from BCAs to an alternative source would also not sit well with consumers. The housing developers emphasised that regulatory intervention will still be required, perhaps in the form of a spot check or random audit.

#### **5.5.4 Quality control**

The final sub-theme for this section involves quality control. As discussed in the literature review (see section 2.8.2), quality control is an important component in risk-based inspection. The relinquishing of regulatory inspection to other parties requires that quality control processes are put into place and are robust. The housing developers' association with builders and their contractors under risk-based inspection is vital. Most of the

participants agreed that the implementation of risk-based inspection would require a robust quality assurance programme for overseeing self-certified work.

Participants HD05 and HD07 already had quality control measures in place and said that the process had helped them in the past when they had been distracted during construction. A second pair of eyes had picked up incomplete work.

*Because ultimately I don't want to be in court in five years' time or 10 years' time with a leaky house because we've done something, not on purpose, it's just been a mistake. Because the phone can go, you pick up your phone and it's like, "You haven't finished off that flashing". And you go, where I was up to, oh yeah, start the next flashing. It's like, "Shivers, I haven't finished that one [yet]". (HD05).*

*You've got to have someone looking at it with fresh eyes to double check it. When you are doing a job it's completely different to checking a job. Because when you're doing it, it's like, "Oh yeah, I did that". And then you forget about doing it and carry on. But then, when someone comes in looking at it and checking it, they're going, "Oh, it's not done". It's sort of like they are two completely different functions. (HD07).*

One participant suggested having a quality assurance person in the form of a project manager. This would be an alternative to a building inspector. It was also suggested by participant HD02 that product manufacturers should be able to sign off on their product installation, as they would be in the best position to do so and would also give clients peace of mind that an external third party was providing an independent check. Similarly, HD07 suggested that the quality assurance person could do random audits, not only checking on building compliance issues but also providing a check on material that was being used on site.

*They could either turn up at those stages, like any stage during the build, and then come through and also audit all the material just to double check it. (HD07).*

Participant HD08 emphasised that caution should be taken as the residential construction sector has a history of attracting opportunists in unregulated markets.

*So, not only does the residential building industry in New Zealand have no idea about quality management, there have been far too many people attracted to an unregulated environment and ripping off their customers. I've watched real estate and other industries. Anybody who says we can police it ourselves, they're the ones to watch out for. Unregulated environments attract cowboys. They're a magnet for cowboys (HD08).*

Quality assurance is a major issue with housing developers in that the majority insist that for any risk-based inspection scheme or self-regulation to take place, a robust quality assurance programme must be in place. Participants also noted that the quality assurance checks needed to be undertaken by an independent party, and suggested project managers or building product manufacturers as alternatives to the BCA. The majority of participants are aware that a second pair of eyes was beneficial to all parties as non-compliance was, in many cases, not done on purpose.

#### **5.6 Theme 4: Licensed Building Practitioners (LBP)**

The Licensed Building Practitioner Scheme (LBPS) is significant to the implementation of risk-based inspection. The reduction of regulatory building inspection should provide the Licensed Building Practitioners with the opportunity to self-certify and stand by their work. The LBPS is linked with restricted building work (RBW) which provides a competency framework for practitioners to work, within the scope of their limitations.

The purpose of this theme is to establish, from the interviewees, their opinions on the Licenced Building Practitioners scheme and the effect on risk-based inspections. A significant number of the participants (six out of 10) are of the opinion that the LBPS is a step in the right direction and well overdue, as the industry needs to be regulated. Participants added that experienced contractors needed to stand by their work; in the public eye, it was keeping them honest being registered to a licencing regime.

*It keeps the builders honest. And, basically, they are taking more responsibility on site because they are signing something which they*

*are liable for in the long run... So I think it's quite important, actually, this LBP scheme. I think it was long overdue (HD09).*

In contrast, four participants were adamant that the LBP Scheme added no value, and that the government incentive was not robust enough about allowing who could obtain the LBP status. One participant explained the LBPS had not made a difference in that no one is better than they were before. It has not suddenly brought super-intelligent people to the front. They are still doing the same. If they were good before, they are still good now. Another housing developer suggested that some LBP members were taking advantage of the system and using their license for multiple jobs, for financial gain. Once it had been discovered, the LBP would have left the country and left any accountability behind. HD05 and HD07 provide examples in the following transcripts.

*Well that's the biggest rort out. I mean, it's a joke. You go and talk to PBC, Professional Building Certifiers and there's this \*\*\*\*\* dude who gets paid five grand a house and his name is on about 20 to 30 consents at any one stage. So he's making 30 consents times five, which is 150 grand. He's been doing it for about five years, so 150 times five, what's that, 750 grand. And when it's all over and they all start leaking, where does he go? Buggers off back to \*\*\*\*\*.....He's gone, you know, and he's laughing at New Zealand, going, "Look at those idiots in New Zealand. They've got this scheme which we can make a rort out of." (HD05).*

Further, HD02 provided details of utilising the LBP scheme. One of his ex-builders had withheld certification, as a means of financial redress, in situations where he thought he had a financial grievance. The housing developer thought the system for identifying and prosecuting the misuse was not fast and not user-friendly. The LBP system, in his opinion, was too cumbersome.

Similarly, HD03 questioned the licencing of builders through the LBPS. This participant had employed an LBP in carpentry but he failed the majority of his building inspections. HD03 questioned how this carpenter had even got his license.

Participants were asked their opinions about designers, who could be in the form of registered architects, licensed architectural designers or registered engineers, as an alternative to signing off building compliance. Designers are one of the key stakeholders in the consenting process and are responsible for the design of a project. One participant suggested this would be a very expensive process and would not promote cost savings to the construction project. Participant HD03 believed that the additional responsibility of designers signing off building construction would only shift the resourcing issue to another stakeholder which, in the long run, would create a shortage of designers drawing up plans. Another issue that participants were concerned about was that designers were more theory based; many of them did not have a practical aptitude for building inspections, as described by interviewees HD01, HD04 and HD05.

*I don't know how practical they are, those guys. Some of them are practical but a lot of them are just stuck in their office and they make it so that it looks really nice but does it actually work (HD01).*

*Architects and designers generally have got a lot of theory but an awful lot of them don't actually have practical knowledge (HD04).*

*Look, architects are very creative people and therefore their head is often not very practical and they're up in the clouds with the fairies. They produce wonderful imagery and beautiful houses. (HD05).*

In addition to the participants' views above, HD08 explained that designers attended architectural schools that focused more on theory and less on practical methodology.

*I mean the percentage of them that are architects which you would call trade qualified is quite small. And, even then, the architecture schools have tended to focus on design at the expense of building methodology. So a lot of architects aren't particularly good with building methodology (HD08).*

On the other hand, some other participants believed designers signing off building construction was a good idea, as designers were more qualified than building inspectors and they should be responsible for signing off their own designs. HD10 explained that

designers are aligned to a professional practice and so would be more careful about what they were signing off.

*I hold engineers and architects quite highly because they are qualified and they do have a practice, so they'll be qualified. So they'll be very careful about what they're signing off (HD10).*

The overwhelming majority of housing developers suggested that designers signing off on a regulatory function would be a costly exercise, and would also put pressure on their own design sector. Designers are seen by housing developers as more theory based; the developers suggested that designers would struggle with the practicality of onsite construction.

Participants were also asked their opinions of LBPs in the form of carpenters, as an alternative to signing off building compliance. Naturally, builders are one of the key stakeholders in the consenting process and are responsible for the construction of a building project. The signing off of consented building work by builders was not well received. Seven out of the 10 housing developers did not agree with the idea. The common thoughts from the housing developers were that builders were not mature enough to take on the responsibility; the developers were still content having the council's oversight during construction. The following transcripts from HD08 and HD09 show their shared views regarding reliance on council input.

*You talk about plumbers and electricians, and this is where I'm not sure the LPB environment quite took the right approach. The electrician who signs off the work, he knows he's putting his name there and he checks that his guys have done the right stuff. Your average carpenter doesn't really check his own work. It's not in his head. It's a cultural thing; he's never had to. That's what council does (HD08).*

*I don't want him to sign other people's work, you know? Code of Compliance covers everything: plumber, electrician... and it [if] there's a special kind of cladding. He has done just the framing part. So [you] basically want council still to check it and other contractors to give their producer statements (HD09).*

One participant commented that builders did not have the technical level of competency like other professional stakeholders, so it would not be a good idea. The findings are in line with the competency and training section (see section 2.8.1) which shows that tradesmen seriously lack knowledge about building regulations.

*They don't understand... So there's just not that level of understanding of materials and products and the overall system. They know how to put a nail in, how to put things together, but they don't have that extra knowledge that engineers and architects and a lot of those people who are operating at a slightly higher level than them. So no, I disagree with that. It's not a good idea (HD05).*

Participants provided examples of situations where things went wrong and where those people that were meant to be held accountable were no longer in business. Once again, the experiences of the leaky-home saga and the ratepayers, through the BCAs being the last man standing, were left with the financial burden.

*We know that as soon as these people start signing off CCC they're going to fold up the company. As soon as something comes, raises its head.... There are too many of the wrong type of people in the industry; people will take short cuts and they will cut dollars and we're going to end up with the same bloody problems (HD10).*

*The fact is that if you look at the stats, the builders of say 10 years ago, how many of them are still building companies or operating now? So what happens if those builders aren't there anymore or they've gone overseas or skipped? It's pretty meaningless if a builder basically signs off on something that no one can be held accountable for because they've closed the business down. This is a typical business model of builders... they go belly up and then they set up a new company with the same address, same... whatever. (HD02).*

## **5.7 Theme 5: Product manufacturers, suppliers and homeowners**

Product manufacturers, suppliers and homeowners are all important stakeholders in the building inspection process. The manufacturers and suppliers have a responsibility that all products are code compliant and used in the correct manner. The homeowner receives the final product which should be fit for purpose. The purpose of this theme is to establish,

from the interviewees, their opinions of these key stakeholders in the building inspection process and potential roles in risk-based inspections.

The majority of housing developers in the study agreed that support from manufacturers was dependent on the size of the company, in that the larger the company the more support and interest one would receive. The participants also agreed that manufacturers/suppliers were, most of the time, pro-active. When new products came onto the market, the manufacturers and suppliers would be available for training and guidance.

*We're one of the bigger companies, so they're keen for our business. But if you're an individual builder that's out doing jobbing work or the one or two houses a year sort of thing, no, they don't give you a lot of support (HD04).*

*It depends on the size of the company. When you've got a monopoly, like the gib board supplier, or Firth concrete, any one of those larger companies, you know, go fish, bad luck (HD06).*

*They are mostly very pro-active and helpful. You get a new product, they'll come and give you training. They'll give you samples. As a new product is being used on site, their reps will come around and just nut out any problems you might be having (HD01).*

*They are always keen to give training. We buy power tools, the Ramset, [and] they are always keen. James Hardie is very pro-active, actually. Well, it depends if you are doing big projects. They're not bothered with the small [ones] (HD09).*

Housing developers were also keen to point out that getting specific detailing from manufacturers / suppliers was an issue. One of the smaller housing developers had found it difficult to receive any assistance from product manufacturers about new products being installed on their sites so relied on their builders to figure it out. Another participant questioned how a product could be accredited for use in certain environments and then, down the track, have limitations attached to it but still be allowed to be sold in the New Zealand market.

*It is a very drawn-out process and it's a struggle to get someone to come to have a look at the product and, you know, do something about it. It is a very, very, drawn-out process. But builders have got to take the time to do it and it's another one of those things, to spend the time learning (HD03).*

*The accreditation process is... they get BRANZ accredited and you look at it and go yes, well, that's fine but the reality is that if the timber in that wall moves a little bit then the cladding is going to move. And if the cladding moves, then what is that movement going to result in? A classic one is Titan board. And even \*\*\*\*\* have now come out and said that Titan board is a rain screen. They don't call it a cladding anymore. So what the heck is a rain screen? And yet the New Zealand government allows it still to be sold (HD05).*

It seems evident from the interviews that developers, depending on the size of their organisation, receive a different range of support. The findings are concerning as a characteristic of the construction industry in New Zealand is that about 91 per cent of all housing and sub-contractor firms have five employees or less (Page, 2014a).

Participant HD10 further suggested that manufacturers were aware that the more they engage with consumers about products, the higher the risk of being caught up in future litigation if anything goes wrong. Another two participants, HD08 and HD04, argued that the manufacturers and their products were not the problem and that issues occurred when two different products formed a junction. In that case, it should be raised with the designer. This finding suggests that designers have a role of confirming building code compliance when two different products are placed in conjunction with each other. If this is the case, the question arises about how designers confirm compliance.

Housing developers were also questioned on their views about homeowners' attitudes towards the building consent process. The purpose of this question was to establish the behaviour and expectations of homeowners during the building inspection process. The majority (six out of 10) of interviewees agreed that homeowners had no knowledge (or very little) of the building consent process and the reason they engaged the services of a

developer was to have a completed product without the hassle. The views of HD02, HD04 and HD08 are summarised in the following transcripts.

*Most of them have never built before so they are quite new to it. So they don't understand the process. I mean we spend quite a bit of talking to them, saying, "This is what's going to happen". But when push comes to shove, when we finally start, there are still a lot of things that come out of the woodwork. So they still don't understand (HD02).*

*They want somebody who will take all the pain away from them and they can just answer the questions about what colour they want or what sort of switch they want or what sort of tapware they want. But they don't want to be heavily involved in the construction process. (HD04).*

*They don't really have a choice. I mean, if they're buying a house and land package, it's like a television. It's take it out of the box and there it is. Most owners don't understand building because they're not builders (HD08).*

Some participants indicated that homeowners who did have knowledge of the building process had many expectations. These participants mentioned that some clients were no longer hands off; these clients would get fully involved in the construction process. One participant suggested that the internet and reality building shows provided homeowners with ideas and alternatives on how things should be done even though it may not be the correct way of doing things. Homeowners have gone as far as employing a private building inspector to inspect the quality of the build during construction.

*The odd customer that's come from a building background is going to be quite detailed about quality... So I think we do get some customers that pay for a building inspector to go and inspect the quality of a build but in most cases they just want the end product (HD03)*

Further, participant HD06 elaborated that homeowners are very demanding because they are spending so much money with the development company and, to some extent, the developer should have the flexibility of accommodating their request.

*I know there are other companies that won't do a variation in construction, But you look at the flip side, the customer is spending \$4-*

*5-600,000 with us. We should be able to change things. So it's being realistic but it's trying to manage that expectation (HD06).*

Similarly, one participant supported HD06's view and added that owners expect housing developers to push the limits in their projects; the end results could produce non-compliant or illegal construction.

*In a recent case, a guy said, "Just shift something on a balcony and just do this". And we said, "No, we can't because it's a balcony and if that gives way and somebody falls down and kills themselves, we're liable." "Oh, no, it'll be all right." "Okay, well, you sign a document and you put into trust \$2m to protect us in the event that that happens or give us a bank bond to that effect." "Oh no, I wouldn't do that." It's like, "Well why do you expect us to?" (HD05).*

One developer pointed out their frustration about homeowners being pedantic in areas of quality. Participant HD07 provided an example of a newly planted lawn which did not flourish overnight, to the dismay of his client. Another example involved the internal painting of a 300m<sup>2</sup> house in which the owner picked up a colour deficiency in the toilet area, due to the fact that they had been staring at a wall while carrying out their business.

*Owners want a result and they don't know the trouble that we have to go to, the hoops we have to jump through to be able to produce a product for them, and then the ongoing latent liability that we have with that (HD05).*

In mitigating these high expectations, one participant (HD09) introduced a process so clients were kept in the loop about construction progress by offering fortnightly viewing of the construction process. This, the participant thought, kept the homeowner engaged and they were able to ask any questions during the visits. Similarly, participant HD06 had incorporated delays in their costings and had established a kick-off meeting before construction physically commenced and periodic site meetings to keep clients up to date with construction productivity.

## 5.8 Theme 6: Building Inspection improvements

The final theme that emerged from the face-to-face interviews with housing developers deals with opinions expressed about improvements that could be made to the current building regulatory inspection regime. As housing developers deal with building inspectors on a regular basis, during notifiable intervals, they would be in the best place to provide suggestions about improvements to the inspection regime that would benefit the construction industry's productivity. The objective of this line of questioning was to identify key areas where improvements could be made to ensure improved performance in the building inspection process.

Participants provided a number of suggestions about improvements to the building inspection regime. Some of these were closely linked and influenced by previously discussed themes, such as the suggestion to relax the regulatory oversight in favour of third party involvement. Also, some participants were of the opinion that changes had to be around the relationship between building inspectors and building contractors in which BCAs target inspections with regard to the complexity of the job and with council focusing more of their resources on the bad builders than that of the good builders.

Many participants strongly suggested that building a relationship with one inspector was important in that they were then familiar with the projects and there would be consistency in their inspections. For example, HD08 and HD04 noted that,

*What makes a huge difference is if we can have the same inspector through the duration of any one project. The environment that we've got going at Addison is working outstandingly. We are building a house a week there, so nominally there are two inspections every day. Now, what actually happens is the inspector comes three times a week, and when he is there he does the inspections that are ready (HD08).*

*.....to allocate an inspector to a job and you knew you were going to get that inspector each time would probably make things a lot easier because an inspector has been there several times. He knows what's*

*happening with the job. He knows the builder that's doing the work, so it can flow a lot better. (HD04).*

In support of these views, HD07 and HD06 explained the frustration of having different inspectors showing up on site with their different interpretations, which inadvertently slows down progress. Another participant pointed out that certain building trades are licensed and other trades (for example, those that fix structural bracing) are not. In his opinion these other trades should be licensed.

*We get one guy who decides to do it one way and so then you start doing it that way and then the next inspector comes in and says, "Don't do it that way" and then you've got to redo it. You never know. So that is also a cause of slowing it down because you're just not sure who's going to turn up to do it (HD07).*

*One council I have to flood test, one council I don't. Why am I doing that when I'm doing the memorandum? I'm using a certified installer. He could be an LBP. And then you've got the flip side of things where you've got a person installing gib board who cannot become licensed. So I'd rather that guy was licensed than my water proofer guy who can be. So it doesn't make sense to me that little bit (HD06).*

A significant number of participants (five out of 10) agreed that the reduction of the current notifiable inspections and the targeting of inspections in crucial areas would improve the building inspection process. One research participant mentioned that the reduction of inspections from the BCA has meant that the current notifiable inspection still needed to be checked and recorded by someone competent. Another participant suggested that a check sheet could be set up on site. A record in the form of photos could be used to show compliance where BCAs no longer carried out inspections or had failed previous inspections.

*There would be certain points in the build, maybe two or three points where you would get an outside person like the council or an engineer to come in to check stuff. But all the intermediate [stuff], the smaller stuff, where they come and they check that the insulation is done and they check that there are straps on the wall. I mean that sort of thing is pretty basic stuff and anyone that's competent could do that. Maybe you*

*set up a file on the job and you have a check sheet that you go through and take a few photos and attach to it (HD01).*

Similarly, HD05 provided a suggestion of having a work history of contractors in that random checks were conducted during the construction phase and if any non-compliant issues arose then more scrutiny would be applied in the form of more inspections, or the privileges of fewer inspections would be lost. This participant suggested that the BCAs would carry out random audits providing a history of what contractors did and how contractors were performing.

*If you had a record of accomplishment and a history and then there could be independent spot checks at any one stage. Like with Fletcher Construction, you could go, right, those guys are good; they have a really high standard. There's lots of builders who do [have a high standard of work]. If there's ever a spot check, and you fail a spot check, then you lose that privilege after two or three in 12 months. A bit like losing your license after so many points that you gain by doing things wrong (HD05).*

HD09 recommended that BCAs should increase their resources by employing more building inspectors to solve the current delays in inspection wait times. These delays add to the running costs, for example scaffolding and portaloos hire. Overall, the housing developers agreed that reducing regulatory intervention would increase productivity but emphasised that the final product still needs to be compliant and a good investment for clients.

## **5.9 Summary of the research findings**

The following paragraphs summarise the research findings presented in sections 5.1 to 5.9. On completion of the face-to-face interview transcript analysis, the summary of the research findings produced six key themes that are significant to the current building inspection process and the full implementation of risk-based inspections within the residential sector in New Zealand. These themes are: building consent process, regulatory building inspections, risk-based building inspections, Licensed Building Practitioners,

manufacturers, suppliers and homeowners, and building inspection improvements. Addressing these themes could help to improve productivity within the residential sector.

It is apparent from the analyses that the current building inspection process contains bottlenecks that stagnate productivity within the residential construction sector. The resourcing issues experienced with the local BCAs and the number of inspections are key attributes of this issue. The majority of housing developers take the view that the notifiable inspection sequences were correct and that combining the notifiable inspections would cut down on the number of inspections from the BCAs.

All participants agreed that risk-based inspection has a place in the New Zealand construction industry but robust building regulations championed by central government need to be in place before the risk-based regulations can be fully implemented.

Further results reveal that a significant proportion of housing developers were not satisfied with regulatory building inspections being carried out by professionals other than the BCAs. The survey found that designers conducting regulatory building inspections would add significant cost to the process, and builders must improve their technical aptitude in building code compliance and associated building regulations.

The housing developers provided their suggestions about regulatory inspection barriers which included frustration with inconsistency from inspectors in the decision-making process, building inspectors' post-training courses, and the excessive paper work required by BCAs after the building inspection process. The participants also provided their suggestions about building inspection improvements which included having the same building inspector on the job, BCAs spending less time on good builders, focusing on not-so-good performers and reducing the number of inspections by having them only at

crucial stages. A summary of the key points from the housing developers' interviews is listed in Table 5.5.

Table 5.5: Summary and key points that emerged from the housing developer interviews

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No.	Summary and key points from interviews
01.	Booking of inspections: builders are waiting five to 10 days to have an inspector carry out a notifiable inspection, as BCAs do not have the resources for next day inspections.
02.	Regulatory inspection numbers: The range of inspections seems reasonable as clients are aware of shoddy workmanship. Regulatory inspectors provide a quality control measure when head contractors are too busy but a review of who should certify an inspection in terms of complexity could be undertaken.
03.	Risk-based inspections has a place in the New Zealand construction industry in the future but currently the sector is not ready and not mature enough.
04.	Self-regulation will not work as many builders have not been educated or trained in the aspects of building code compliance and rely heavily on council as a quality control checker. It will take many years for builders to be trade qualified and owners to be educated for mind-sets to change.
05.	Designers signing off regulatory functions: Designers signing off on building work would be an expensive exercise and will not provide any cost saving to the process. Designers already have enough work in the front end of the process, and adding building inspections would stretch their resources. They are seen more as a theoretical component to construction than practical.
06.	Builders signing off regulatory functions: Builders signing off would not be a good idea, even though the LBP Scheme has been up and going for the last eight years. Builders and owners are still heavily reliant on building inspectors for building code compliance. Builders have a history and culture of being reliant on a second pair of eyes to double-check their work, whether it is a project manager or a building inspector.
07.	A review of the LBP Scheme has been long overdue and is a step in the right direction. There is still a long way to go as builders are slowly coming to terms with being responsible for their work. The LBPS is slowly weeding the bad builders out of the sector, and the good builders that have been well-established can now be members of a professional institute.
08.	Manufacturers, suppliers, homeowners and regulatory balance. The larger the building company, the more support you are likely to receive from product manufacturers. The major issue with products is the relationship or lack of design detail with other products. Builders revert to the designer or building inspector for compliance. Manufacturers are happy to stand back and avoid any liability if any should arise in the future.

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**No. Summary and key points from interviews**

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09. Regulatory inspection barriers:

The frustration with regulatory inspections in that different inspectors lack consistency in the decision-making process.

Builders are aware of times when an inspector had been on training. They would be the flavour of the month during inspections. At times it is very frustrating, as the consented plans had already been approved.

The paperwork that is required for consenting, and especially code compliance, is excessive and more time is spent providing documentation than constructing a building so at the end of the day the same people are still liable.

10. Regulatory inspection improvements:

A building project or area should have the same inspector allocated to it so a builder is able to build a working relationship with that inspector.

Councils must find ways to spend less time on inspecting builders who are doing a good job and more where they are really needed.

Councils must reduce the amount of current inspections but still have them at crucial points.

The overall sequence of current inspection is good so inspections that are not undertaken by Council must be picked up by other building professions who are in the best position to address risk.

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This analysis gives an indication of the extent and nature of building inspection problems in the New Zealand construction industry. As the analyses shows, these are not minor issues and, in some cases, have added considerable costs and time as well as creating substantial challenges for the various parties involved. These findings were further compared and confirmed by the survey of building industry leaders in subsequent chapters.

### **5.10 Chapter summary**

The chapter has presented the results of the semi-structured face-to-face interviews carried out with housing developers in the New Zealand residential construction industry.

The data obtained from the interviews has been analysed using the qualitative software Nvivo, from which emanated six main themes and sub-themes. The opinions of the interviewees have been presented in line with the key themes covered by the current study.

The succeeding chapters analyse the findings from the online survey questionnaire and face-to-face interviews with key residential construction stakeholders as subject matter experts (SMEs).

## **Chapter 6 Validation of Key Research Findings**

This chapter presents the findings of the validation interviews conducted in this research investigation. This aspect of the research identified three key industry stakeholders as subject matter experts (SMEs) for the study. These SMEs were selected to represent designers, building inspectors and house building developers. The researcher interviewed a senior executive of the New Zealand Institute of Architects (NZIA), a regional service manager from the Registered Master Builders Federation (RMBF), and a senior manager representative from the Building Officials Institute of New Zealand (BOINZ).

The chapter begins with a brief description of the SME persona and then presents the findings from SME into associated themes which are in line with the research objectives and questions discussed in chapter five of the study.

At the conclusion of the analysis in chapter four, and in chapter five, is a summary of key research findings which largely formed the basis for the SME interviews for this chapter. The two methods, which consisted of quantitative and qualitative analysis, provided findings that were presented to the SMEs for their professional verification and additional commentary. The SME interviews followed a similar procedure to the semi-structured interviews at the beginning of the field study. The SME interviews were conducted face-to-face, in line with the interview guidelines attached in Appendix (C1). The SMEs provided their views and further extended knowledge to the research findings in order to establish risk-based inspection as a BCA tool.

### **6.1 Demographic information of subject matter experts (SMEs)**

The demographic information of the SMEs that participated in this validation exercise are presented in Table 6.1, giving the number of years they have been in the New Zealand construction industry, organisation representation and the designation they held.

Table 6.1: Demographic information of SMEs

<b>Participant Identification</b>	<b>Experience in Construction</b>	<b>No. of years in company</b>	<b>Organisation representation</b>	<b>Participant's designation</b>
SME001	20+	10+	RMBF	Senior Manager
SME002	20+	15+	BOINZ	Senior Manager
SME003	25+	10+	NZIA	Managing Director

SME001 was selected to represent residential building contractors as one of the key stakeholders in New Zealand's residential construction industry. As a senior member (Regional Service Manager) of the Registered Master Builders Federation, this SME has 25 years' experience in the construction industry including project management, residential carpentry and regulatory consenting work experience.

SME002 is a representative of the Building Officials Institute of New Zealand (BOINZ). This SME holds a senior role in local government building controls and has over 25 years' experience in the residential construction sector. The SME has a very good knowledge of the building inspection process and legislative documents used in the construction sector. The participant also has a very good understanding of the regulatory legislative system and has over 15 years' experience as a regulatory building inspector.

SME003 is a representative from the New Zealand Institutes of Architects (NZIA). This research participant has over 25 years' experience in the development of sound technical resolutions to complex constructional challenges in the New Zealand construction sector. The participant is currently a member of NZIA and has represented the Building Research Association of New Zealand (BRANZ) programmes on numerous occasions.

## **6.2 Research validation and themes**

The key research findings that emanated from the first phases of quantitative and qualitative data analysis have been compiled and presented to the SMEs for their

verification and additional input. These three phases complete the research triangulation with the penultimate qualitative and quantitative methods being validated by the SMEs in the final qualitative phase. The SMEs' responses on the various issues discussed will be presented, with relevant quotes as appropriate. The findings from the quantitative (inspectors' and designers' questionnaire surveys) and qualitative (housing developer interviews) exercises were presented to the three SMEs for their validation and opinions. The following list presents five findings that were presented to the SMEs for their opinion.

- Building regulation legislation in New Zealand
- The current building consent process
- Risk-based Inspections
- Stakeholder themes
- Suggestions for improving the building consenting process

### **6.3 Research verification of building regulation documents in New Zealand**

The key issues within the building regulations documentation, in regard to residential buildings which the SMEs were required to validate, included:

- a) The reason(s) for low awareness and the use of government building documents to increase productivity in the building consent process. In particular, the DBH Simple House Design and DBH multi-use consent process.
- b) The reason(s) for the low level of awareness of the Building Act Amendment 2012 and the New Zealand Government's future initiatives for the introduction of certain types of building consents and systems.

### **6.4 Opinions of SMEs on these New Zealand building regulation issues**

The key issues highlighted above were re-phrased (See Appendix C) into a questionnaire format and presented to all SMEs for their professional opinions. Thematic analyses of the SMEs' comments on these issues are presented in the following paragraph.

#### 6.4.1 Low awareness or use of DBH Simple House Design

SME001 believed that the lack of uptake of the DBH Simple house Design is due to the fact that it is not “simple” to use. SME001 explained that they have attempted to use the design but the criteria are complicated, creating difficulty in understanding and being not practical to construct.

*The Simple House Design is not a simple house design. It is complicated. They don't use that because the Department of Housing doesn't even get it themselves. The people who designed the simple house design are bloody \*\*\*\* that come from university and they've got no idea about the practicality of it. When I draw, I draw as if I am building it. These guys are just on the conveyor belt; that's all they're doing because they've got no practical application to this at all. (SME001)*

SME002 believed the two key factors for the low use of the Simple House Design was because the construction sector lacked awareness about it. Some had no knowledge of its existence. The second factor was when it was first introduced, it was more prohibitive to build a house using a simple house design than using NZS 3604 and NZBC Building Code E2. SME002 provided an example of a deck design and pointed out the number of extra metal brackets and straps that are required because of the conservative design.

*So there was an overly conservative approach to it, originally. I know that they say they pulled it all from E2 and from 3604 but they made things up that weren't covered; so they never had the barrier design in there at the time. So there's things like that.(SME002).*

SME003 confirmed the findings from a designer's view that the simple house design concept was one they were not familiar with or had used in the past.

*To be honest, I'm not sure about the simple house design...No. I'd have to confess that I'm not actually familiar with that one. I think I've heard of it ....I'd better have a look at that. (SME003)*

Upon closer examination of SME003's opinion, it is evident that the DBH Simple house Design that was targeted at key stakeholders, including designers, had not been promoted or implemented successfully. The view is consistent with what housing developers said that also did not utilise the building regulation documents.

#### **6.4.2 Low awareness or use of DBH multi-use consent**

SME001 explained that the industry had misunderstood the concept of the multi-use consent. The idea, according to SME001, was that a consent that was processed and passed by one BCA should simply be accepted as code compliant at any other BCA around the country. Similarly, SME002 was of the opinion that the feedback the BCAs were getting from the industry was that the multi-use consent was too restrictive.

*If they go to Invercargill with that same plan that was up in Auckland, the problem is that if the plan comes from Auckland then Invercargill will still double-check these guys up here to see if they got it right for a multi-consent; they're not supposed to check anything. All they're supposed to do is OK it and just stamp it off. (SME001)*

*The Kiwi culture of having a one-off design and having something different from your neighbour really doesn't sit well with the multi-use programme. When they started getting into different versions, it became a cost issue as well, because you will find that even our group home builders give the customers so much flexibility in the end design that it's very rarely as per their original template. (SME002)*

The participant further added that an earlier concept of multi-use consent had been trialled. This concept was for a garaging company which had stock shop plans of their designs but also provided an optional foundation design to compensate for the ground conditions around the region. This concept has gone well, as SME001 has experienced the company consents being issued from Council within ten- and five-day processing periods.

SME002 also suggested the incentive of promoting the multi-use consent as a ten-day turn-around processing tool which would have a ripple effect on productivity during the building consent process.

*It was just like Versatile Garages; they're supposed to be all [16.32] and then they brought back a verified method. They bring that with a certificate and then the slab is supposed to be the same and then they have a difference for low soil, silt and sand; they have that option. Now that's a multi-use consent (SME001).*

*Now if they were to put their foot down and say, "This is it, you will get your consent in 10 days because this is an approved design," and sell it as a cost-effective way of doing it, you imagine the productivity and the cost. Everything would come down because it's cooked; you go to the cookie-cutter.(SME002)*

#### **6.4.3 Low awareness of the Government review of the Building Act 2004 and associated documents**

All SMEs were of the same opinion in that the low awareness of government building regulations was due to the government not promoting and supporting the release of documents to the industry. SME001 believed that the Government releases new policies into the industry and expects the industry to iron out the wrinkles. SME002 also supported this view with an example of the proposed new building consents under the Building Act 2013's amendments which were released with no regulations stating exactly what they consisted of. SME002 added that if policies are not released with the appropriate regulated documents or support then there will be inconsistency throughout the construction sector through different interpretations.

#### **6.5 Research verification on the Building inspection risk association**

The current research identified that building inspectors and designers ranked the current notifiable inspections by taking risk into account (left hand side of Table 6.2). The SMEs then commented on each criterion, the comments are shown in the right-hand column in Table 6.2.

Table 6.2: Building inspection risk-association ranking

Rank	Inspection type	SME comments in brief
01	Membrane tanking	“Externally yes; internally no” (SME002)
02	Cladding	“Claddings... you have got flashings that you just don’t know about. You put a flashing on a wrap and then you put a cladding over it; anything could happen to that flashing during installation of the cladding.” (SME002)
03	Foundations and Subfloors	“On the face of it, it seems to make a lot of sense because the best person to inspect the foundations is the competent engineer.” (SME003)
04	Roofing	”There is a misconception that we are not looking at the roof but the guys are looking at the roof; they check the TV, they check the gutters, the valley gutters. But they’re not actually walking around on the roof; not counting the nails, not counting the flashing fixings.” (SME002)
05	Cavity / Wrap	“You put a flashing on a wrap and then you put cladding over it; anything could happen to that flashing during installation of the cladding.” (SME002)
06	Code Compliance Certificate	“With bigger buildings we’re covering that off with producer statements and from engineers.” (SME003)
07	Final Inspection	
08	Post / Fire line bracing	“With the LBP Scheme you need a Memorandum of Works so it breaks down all that stuff.” (SME001)
09	Drainage	
10	Siting	“I think in this day and age, yeah. Most of them are surveyed. The sites are getting too small to risk trying to set it out yourself, with fire and all the other bits that come with it.” (SME002)
11	Block work	“With block work you know the steel is in place; it’s all tied. You pour it and it’s not going to move after that.” (SME002)
12	Framing	“The framing being all pre-cut nowadays... maybe that takes a lot of the risk away from the builder on site.” (SME002)
13	Pre-line building	“Pre-line and even block work as well; you can actually see the detail before it is all closed in.” (SME002)

It should be emphasised that during the face-to-face interviews, SME002 made an observation from Table 6.2 regarding the ranking of building inspections risk association. This SME said that they were, in some form, aligned to the judicial weather-tightness litigation claims that have been experienced in the New Zealand construction sector.

*The natural order they have got there is almost the same sort of order that you have in court claims. Very few court claims are for structural failure of framing or block work. Whereas more are from tanking and cladding and weather tightness. (SME002)*

### **6.5.1 Building inspection regulatory intervention**

The current research had identified that building inspectors and designers ranked the current notifiable inspection in accordance with their opinion on inspections that required regulatory intervention (left-hand side of Table 6.3). All SMEs were of the same opinion, that is, that high-ranking notifiable building inspections required regulatory building inspection intervention. This was due to the fact that these were critical stages in the process and, once closed in (or covered up), it would be difficult to detect failure(s). Participants also agreed that the lower-ranking inspections were because a third-party professional was providing the observations and documentation for compliance to the BCA.

SMEs commented on each criterion; their comments are shown in the right-hand column in Table 6.3.

Table 6.3: Building inspection regulatory intervention ranking

Rank	Inspection type	SME comments in brief
01	CCC	“It kind of makes sense to me because these are all issues that you are reliant on; things that you can’t see. They may be certificates from third parties. It’s all closed in and wrapped up and covered now so you can’t see things at the final inspection of claddings. So you’re really reliant on making sure all the stuff done behind that was done correctly. That’s the most crucial stage, to make sure everything is wrapped up paperwork- wise and inspection- wise. As you get further into it and the more open, the easier it is to catch any sort of issues or mistakes.” (SME002)
02	Final Inspection	
03	Cladding	
04	Drainage	
05	Foundations	
06	Cavity / Wrap	
07	Pre-line building	“Pre-line and even block work as well; you can actually see the detail before it is all closed in.” (SME002)
08	Membrane tanking	“Externally yes; internally no” (SME002)
09	Post/Fire line bracing	“With the LBP Scheme you need a Memorandum of Works so it breaks down all that stuff.” (SME001)
10	Framing	“It is very hard to get framing wrong from a structural point of view unless you do something to it afterwards.” (SME002)
11	Roofing	“To some extent, LBPs sign off on this stuff at the moment” (SME003)
12	Block work	“Block work, you know the steel is in place; it’s all tied. You pour it and it’s not going to move after that.” (SME002)
13	Siting	“That’s taken care of by the surveyor. That’s what a survey certificate is for” (SME001)

### 6.5.2 Stakeholders’ professionalism and competence to Building Code compliance

The current research had identified that building inspectors and designers both agreed that builders and manufacturers needed to improve their competence and professionalism in regard to Building Code compliance (left-hand side of Table 6.4). All SMEs were of the opinion that stakeholders needed to be proactive in improving building code compliance knowledge rather than waiting for issues to arise. SMEs briefly commented on each criterion; their comments are shown in Table 6.4.

Table 6.4: Stakeholders' professionalism and competence to Building Code compliance

Stakeholders	Needs Improvement	SME comments in brief
Builders and sub-trades	30%	<p>“That’s correct. I agree because a lot of the time I go and sort out these guys.”(SME001)</p> <p>“I can see it though; if you think about it, there’s issues on site. Most of the issues that you get from the builder’s point of view is they’ve done something wrong, so they need to step up. “ (SME002)</p> <p>“We tend to work with good builders but I think there’s obviously a much bigger issue in terms of their competency which is getting better.” (SME003)</p>
Building manufacturers and suppliers	23%	<p>“I think if you look at what is happening out there, right now, the manufacturers are definitely hands off and that’s because of the issues with Hardies and previous failures.” (SME002)”</p> <p>“They just need to get organised. If you’re going to be selling a product out there you’ve got to have all the back-up information, you’ve got to have all the technical information available. And they’re getting there. I think it’s improving.” (SME003)</p>

## 6.6 Research verification on risk-based inspections

The following key issues within risk-based building inspection concepts, which the SMEs were required to validate, included:

- a) The majority (70 per cent) of building inspectors and designers agreed that the current notifiable inspection should be reviewed.
- b) The majority (70 per cent) of building inspectors and designers agreed about the reduction in regulatory building inspections. They were in favour of a risk-assessment approach, similar to that of the UK Building Control model.
- c) The majority (58 per cent) of building inspectors and designers agreed that the New Zealand construction industry was not ready for the current regulatory inspection to be relaxed. They were in favour of a risk-based assessment approach.

### **6.6.1 Current notifiable inspections**

Building inspectors (71.70 per cent) and designers (68.80 per cent) agreed that the current notifiable inspections required a review. The SMEs agreed that the current notifiable inspection process required a review. SME001 believed the reason there were so many inspections was that there were a lot of builders that did not know what they were doing. Similarly, SME002 explained that there were double-ups on some inspections and that building inspectors were taking a risk-averse approach but insisted that they could work smarter and more efficiently without reducing risk.

*So at the moment, yes, there are too many notifiable inspections but that was because the industry did it themselves. SME001*

### **6.6.2 Participants in favour of a United Kingdom model of risk-assessment of building projects and the reduction of regulatory inspections**

Building inspectors (76.70 per cent) and designers (67.50 per cent) agreed that they were in favour of the UK risk-based model concept. SME002 and SME003 were of the opinion that it needed to be looked at and the proposed legislation from government indicated this was the direction they were heading.

*Well, it's going to happen. The Government's determined to make it happen so it's going to happen. Yeah, there is a place for it but they've just got to go out and do some proper consulting of the parties involved and have a system that everybody's happy with. (SME002)*

SME001 also agreed that reducing the number of regulatory inspections was required but strongly disagreed with adapting the UK model into the New Zealand construction sector as the participant felt that the New Zealand environment was totally different and the New Zealand constructor had the ability to fix its own problems.

### **6.6.3 The New Zealand construction industry is not ready for a risk-based approach**

Building inspectors (65.20 per cent) and designers (52.50 per cent) did not agree that the New Zealand construction industry was ready for the relaxation of regulatory building inspections. Nor were they in favour of a risk-based approach. SME001 agreed with the findings and explained that the New Zealand construction industry was not ready because every stakeholder needed to be on board and ready to take on its new regime. SME001 further suggested that the Government had a major part in organising such a nationwide project.

### **6.7 Construction stakeholders' themes, issues and improvements**

The current research identified the following themes (see Table 6.5) in the current building consent process. All SMEs were asked to provide their opinions which are noted in Table 6.5.

Table 6.5: Construction stakeholders' findings for SME validation

No.	Findings for SMEs to validate
01	Booking of inspections: builders are waiting five to 10 days to have an inspector carry out a notifiable inspection, as the BCA does not have the resources for next day inspections.
02	Regulatory inspection numbers: The range of inspections seems reasonable as clients are aware of shoddy workmanship. Regulatory inspectors provide a quality control measure when head contractors are too busy but a review of who should certify an inspection, in terms of complexity, could be reviewed.
03	Risk-based inspection has a place in the New Zealand construction industry in the future but currently the sector is not ready and not mature enough.
04	Self-regulation will not work as many builders have not been educated or trained in aspects of building code compliance. They rely heavily on Council as a quality control checker. It will take many years for builders to be trade qualified and owners to be educated for mind-sets to change.
05	LBPs (builders and designers) signing off regulatory functions: Designers signing off on building work would be an expensive exercise and will not provide any cost savings to the process. Designers already have enough work at the front end of the process and adding building inspections would stretch their resources. They are seen more as a theory component to construction than practical. Builders signing off would not be a good move, even though the LBP Scheme has been up and going for the last eight years. Builders and owners are still heavily reliant on building inspectors for Building Code compliance. Builders have a history and culture of being reliant on a second pair of eyes to double-check their work, whether it is a project manager or a building inspector.
06	The LBP Scheme has been long overdue and is a step in the right direction. There is still a long way to go as builders are slowly coming to terms with being responsible for their work. It is slowly weeding the bad builders out of the sector. The good builders that have been well established can now be members of a professional institute.
07	Building product manufacturers and suppliers: The larger the building company, the more support you are likely to receive from product manufacturers. The major issues with products are the relationship and lack of design detail about other products; builders revert to the designer or building inspector for compliance. Manufacturers are happy to stand back and avoid any liability if it should arise in the future.
08	<p>Regulatory inspection barriers:</p> <p>The frustration with regulatory inspections in that different inspectors lacked consistency in the decision-making process.</p> <p>Builders are aware of times when an inspector had been on training as that would be the flavour of the month during inspections; at times it is very frustrating, as the consented plans had already been approved.</p> <p>The paperwork that is required for consenting, and especially code compliance, is excessive. There's more time spent providing documentation than constructing a building so, at the end of the day, the same people are still liable.</p> <p>Council needs to find ways to spend less time on inspecting builders who are doing a good job and more where they are really needed.</p>

The following sub-sections describe, compare and contrast all these themes, based on the responses received from all three SMEs. The discussion follows the order of the findings listed in Table 6.5.

### **1) Booking of inspections**

SME001 explained that the reason why builders are waiting five to ten days for an inspection, was that the larger commercial companies were block-booking inspections. Block booking of inspections is where builders book a week of inspections in advance and if they were not ready on the day of their booked inspection they would contact the BCA, and cancel. The purpose of block booking was to have an inspector ready once a notifiable inspection was due. Also, SME001 said that the BCA's customer service team that take bookings did not understand the building consent process which included not fully understanding what "notifiable inspections" consisted of.

SME002 agreed that the timeframes had been drawn out for inspections; this participant had introduced initiatives to provide quicker service without compromising risk. Initiatives included increasing resources and concentrating on staff training.

*You will probably find that back when you had that finding there would have been a massive – and I'm talking 14-15 per cent – vacancy in our building inspection teams, whereas now you will find it would be three per cent. So there's a huge difference in that. SME002*

*Obviously it took a lot of work to get them because in the building boom trying to get good people is hard; so the people we did get were a lot less experienced than we would have normally. We have spent a lot of time training them up. It has taken probably six months to a year before we can get them out on the road fully competent to do residential work. That in itself has reduced our timeframes. SME002*

SME002 was expecting work in the industry to ramp up again. This participant had forecasted a 14 per cent increase in work by the end of the year. They had instigated a lot of initiatives, from hiring more staff and providing more training to cope. They utilised

inspection waivers for qualified or experienced people that the BCA can trust; they increased the use of the producer statement process and tapped into the knowledge of certain contractors for quality assurance processes. SME002 also shared that the BCA was working with some group homebuilders and provided an example of a housing development company having 6000 houses planned for the next three years northwest of Auckland alone. The plan would be to get housing developers and builders on board into a quality assurance programme. The benefits gained were reducing wait times just by reducing their inspection regime from 12 to 15 inspections per house, down to about four or five.

## **2) Regulatory inspection numbers**

Both SME001 and SME003 agreed that the number of notifiable inspections was reasonable and that clients were aware of shoddy workmanship. SME001 further stated that the industry had come a long way in getting the inspection structure to where it was currently. However, SME002 was surprised that stakeholders were happy with the current number of inspections, providing an example of where notifiable inspections could be combined to reduce the amount of overall inspections.

*Put it this way: a single storey brick-and-tile house you could do the half type brick and wrap together – two inspections in one. You wouldn't need a separate inspection for each one of those; you can see the entire wrap at that stage still and if there are issues you can reach down. If there are major issues, that would be a different story. But for, say, simple group homes there wouldn't be any risk because you're still doing full inspections. You're just doing both at the same time. SME002.*

SME002 provided an example of the current inspection regime not requiring specific inspections for acoustic sound transmission and ventilation, and relying on professionals to carry out the specialist inspection. The SME also provided an example of where the reduction in the number of inspections could occur in a low-risk situation. In SME002's own words:

*If you delve a little bit deeper, an inspector looking at a water membrane would be no different from the LBP membrane applicator looking at it; simply because we don't know how thick it is, and we don't know how many coats have been applied, whereas the LBP water membrane applicator does. If they're willing to put their name to it, and they're qualified to do that, then we don't see any reason why not.*

This verified the findings in section 6.5 in which designers and building inspectors did not think that the New Zealand construction industry was ready for a risk-based approach.

### **3) Risk-based inspections**

All SMEs suggested that risk-based inspection does have a place in the New Zealand construction industry but would need to be implemented with a robust process. SME001 and SME002 said that risk-based inspections would not work, as the New Zealand construction sector was not mature enough.

*The problem is, in my opinion, that the workforce out there is just not ready for it. That is an issue that needs to be dealt with right back at the start from training institutions, apprenticeship schemes. The qualifications of an LBP is another thing they need to look at; they need to look at the minimum requirements. When I say qualification, [I mean] experience and the history of the work that they have done. If they get that right, then absolutely I would fully support a government-based, streamlined process. SME002*

SME002 also stated that you could not lump everyone into the same box. This SME said there were some very good practitioners and companies that were ready to use the risk-based inspection concept. The SME further added that in real life, if we do not practise this we would not be able to cope with demand. SME001 and SME002 did agree that firmer legislation was needed from central government to address stakeholders' accountability and responsibility of Building Code compliance.

*This is our industry, as a whole. Every quarter needs to be put in place. So until they get their crap sorted up here – and I mean the government comes through... until you separate the people from this particular problem, it isn't going to happen. We are always going to have that issue. The risk base is that you have got people up there who don't want to take or make the call. (SME001)*

*I think one of the things that would help both those questions would be legislative change back to complying with the Building Code as opposed to complying with the building consent. That would allow the inspector a lot more leeway on site. (SME002)*

#### **4) Self-regulation**

Both SME002 and SME003 agreed that self-regulation was dependent on the category of the building, in terms of risk, and nothing to do with a person or people carrying out the building work. Once the building category or risk of the building had been established, checks and balances in the form of a robust quality assurance process had to be in place to monitor contractors, according to the participants.

*But if you have got checks and balances that will catch out these things, you keep them honest; and the knock-on effect is you will also educate. So if you fail an inspection once, for any reason, the chance of repeating that issue is slim, unless it is done by human error. It doesn't mean that they won't learn on site. (SME002)*

SME003 provided an example from a risk-based pilot conducted in Christchurch in which the Council would not let some architects participate due to their risk-based matrix evaluation, indicating that they were not experienced enough for the work involved. Stakeholders were put through a criteria check based on their qualifications, experience in the industry and competency to be a part of the pilot.

SME001 disagreed with the other two SMEs, explaining that Building Code compliance was a specialist field and that other sectors of the construction industry did not have the background or experience to carry out the function.

*Bad. What I mean is that they have got people that are outside the industry; a lot of people coming from the UK, a lot of people who have gone from other industries that have come into the inspection side of things and are now inspectors. Based on three months training or this Regulation 18, or whatever it is called, they're supposed to be building inspectors. (SME001).*

### **5) LBPs (designers and builders) signing off on regulatory functions**

Generally, the SMEs were all of the same opinion that designers signing off on regulatory functions would add further pressures to their current workload. SME001, who is also a draughtsperson, suggested that the consented plans that went onto the building site should be straightforward to follow in regard to building compliance, as all the checks and balances were in place due to the pedantic consenting process. Additionally, SME001 suggested that the only time a designer should go on site is when a contractor cannot figure out how something is constructed, although this is very rare. Similarly, SME003 explained that designers' sign-offs added a completely different work-stream (building inspections, apart from design work) to their sector, which they are not really set up to do, and envisages a fair amount of resistance too. SME003 added that designers did not want to accept responsibility for regulatory sign-off functions and in doing so would have to increase their costs to cover additional overheads.

*If we were to have to start doing it we're going to start charging a whole lot more and then we're going to have to take on somebody [else]. Basically, you're taking on a building inspector, and then you've got to take on the liability and the insurance and all that stuff, and it will just cost a whole lot more. (SME003)*

In a slightly different light, SME002 submitted that there are some jobs where designers could add value in regulatory inspections and project sign off. SME002 provided examples of complex commercial or high-end residential construction where designers would be acting in a clerk of works capacity. The benefit, according to SME002, would be that the quality level of workmanship would increase as well as the Building Code requirement. The SME shared the view that about five per cent of builders and housing developers would easily be able to sign off their own work, and if they were able to do it then why couldn't others.

### **6) The Licenced Building Practitioners' Scheme**

All SMEs agreed that the LBP Scheme is not robust enough and the initial intention of the industry, being more accountable for the work they produce, has not eventuated. Participants also suggested the introduction of an LBP disciplinary board had not been a deterrent to practitioners as the board's actions were lenient and repeat offenders' outcomes had not been widely publicised. SME002 expressed that the LBP Scheme had provided council with a disciplinary process to deal with people but were not going to do that because 97 per cent of building consents were getting requests for information (RFIs). The BCAs will only do that with worst-case scenarios where people are clearly out of their depth, working outside their scope, consistently providing poor quality design work, and providing a false Certificate of Work (COW) declaring that it complied.

*The only thing we've got there is their disciplinary tribunal, or process which, from what I have seen, hasn't really shown much teeth. Regarding the practitioners that have been reprimanded or dealt with, there hasn't been enough publicity around any that have been struck off to provide a deterrent to others. (SME002)*

### **7) Building product manufacturers and suppliers**

All SMEs agreed that product manufacturers and suppliers needed to be more proactive in the construction sector. All the participants explained that the lack of product details and testing for building compliance caused issues for builders and BCAs. SME001 pointed to the Building Act 2004 where the supplier must provide materials and evidence (acceptable, verified or alternative) that show their product or system is compliant with the relevant legislation. The SMEs elaborated on this issue:

*Manufacturers need to step up their game. They're selling the stuff but they're not providing the industry options to use it with other materials or other products. I think if you look at what is happening out there right now the manufacturers are definitely hands off, and that's because of the issues with Hardies and previous failures. (SME002)*

*The main problem, at the moment, is a lot of the manufacturers and suppliers have been a bit slow to catch up with their regulatory*

*obligations in terms of providing, for instance, BRANZ appraisals on products, or the backup of information which the Council is completely asking for now. They just need to get organised. If you're going to be selling a product out there you've got to have all the backup information, you've got to have all the technical information available. (SME003)*

Therefore, having access to product information about materials available in New Zealand would support the designers' and BCAs' approval process in achieving Building Code compliance during.

**8) Regulatory inspection barriers:**

*(a) The frustration with regulatory inspections, due to implementation inconsistencies* SME001 and SME002 agreed that having different inspectors to deal with on site is very frustrating. SME003 provided an example in which, during the course of construction, the same inspector had undertaken inspection but when the final residential inspection was notified, a different inspector turned up requesting information on issues that had already been resolved. SME001 provided an example in which, on Waiheke Island, the concept of using the same inspector provided benefits for the designer, builders and building inspector. The participants further explained that designers and builders need to acknowledge that the BCA is part of the team and building good relationships would encourage a productive working environment.

*It is really good that the guys know the names of the guys that they're talking to. If one builder is not pulling his weight and he is backstabbing their building inspector, the other guys will say, "Hey what are you doing that's causing this?" (SME001)*

Similarly, SME002 agreed and explained that building relationship helped the BCAs. As an inspector who is familiar with the job, building a relationship with the builder on site works really well. SME002 also cautioned that the one thing that the BCAs have to keep on top of is independence. There are natural checks and balances. You can have those but every now and then "just throw in another inspector, just to keep things on track".

SME003 argued that the BCA's lack of understanding and interpretation of the Building Act 2004 had caused a lot of frustration to builders. SME003 referred to the same Act where it states matters for considering by the building consent authority in deciding issues about the code compliance certificate that "*A building consent authority must issue a code compliance certificate if it is satisfied, on reasonable grounds that the building work complies with the building consent.*" (Section 94, BA2004)

*That's the other thing that a lot of these guys don't seem to get their head round... that after the 2004 changes, the drawings have been approved and all the builder has to do is build what's on the drawings. We've had this argument before, and they'll say, 'No, it doesn't comply with the Building Code.' But it's been approved. (SME003)*

SME001 explained that the inconsistencies in decision-making can be attributed to the resourcing of new building inspectors from different industries such as police officers, tax auditors, safety officers, detectives and demolition workers. People are in places that they shouldn't, and when it comes down to resourcing the correct people for the job, BCAs tend to look more for business aptitude rather than industry construction practice. Additionally, SME001 suggested that the staff in the BCAs did not trust one another and that policies and procedures were not understood.

SME002 expressed the reason for inconsistency from building inspectors was due to the lack of training. The BCAs were addressing these inadequacies with more frequent training sessions for their staff.

*Yeah, there is inconsistency. Unfortunately, the only way to address that is with training the inspectors, and we have only just started doing that in the last few years. That's really only the people coming into the inspection teams now; for the ones that are already in there it is very difficult to bring them all up to the same speed. (SME002)*

***(b) Building inspectors' inconsistency with training output***

SME002 admitted that this had been happening as the BCAs had, in the past few years, introduced a training school targeting new building officials in the industry. New building

inspectors were finding their feet, once released out on the field. The SME also suggested that builders or customers thought that the BCAs were moving the goal posts. The risk was not the result of the building inspector learning the information but designers and builders not knowing of the risk and the risk also being missed through the consenting stage.

SME003 agreed that their site projects had been affected by a building inspector who had just attended a training session and issued a non-compliance for work already consented by the BCA. The SME also suggested that BCAs were narrow-minded in their decision-making process and that building inspectors were required to be more aware of other guidance such as “determinations” from MBIE in understanding building code compliance. SME002, further suggested that the BCAs have an avenue of combating the inconsistency of its inspectors on site where situations can be escalated to a senior person or team leader to deal with.

***(c) Excessive paperwork and procedures***

All SMEs agreed that the requirement for paper work at the CCC stage had become excessive. SME001 and SME002 acknowledged the paperwork requirements and suggested it was due to recent and past court cases in which documentation was required by BCAs to prove that they had not been negligent.

SME001 further suggested that the construction industry had done it to themselves and the BCAs had every right to acquire information that would protect ratepayers in the long term.

*I think with the cases that have been through court, that's the number one reason that has driven the paperwork to the point where it is now where every single thing is documented. It becomes an arse-covering exercise. (SME002)*

*The paperwork, I believe, is correct. And the reason why there is paperwork is because the people that are requiring the paperwork for the CCC is quite horrendous. The CCC is based on all that, the whole process, and it comes back down to liability. The council needed to know that these people who have done a job are correct. Then you go back to the Act, the regulations, then you come back down. So it all fits in. (SME001)*

SME002 further shared that with technology on board and the introduction of the BCAs Building Information Model system, it would put the mountains of paperwork into the digital world and therefore would no longer be an issue.

***d) Allocation of building regulatory resources***

SME001 agreed to disagree that even the good builders could get complacent; a lot of good builders and building companies had gone under. Builders, therefore, need to have reassurance in some form or another. SME002 was of the opinion that the BCA was treating everyone in the same manner, in terms of building inspections, and there could be some smart initiatives to reward good performers.

*We know that there are good players in the market that we could reduce some regulatory oversight of; those customers, I think, we could probably do things smarter by using an audit process. The issue that I see is that, with the customers we have, no two customers are the same. So even though you might have group home builders that do cookie-cutter-type buildings all the time, they've all got different ways of doing it; so you can't kind of come up with an audit process that's going to satisfy everyone's needs. SME002*

**6.8: SME suggestions on improvements necessary within the building consent process**

The three SMEs were required to comment further on general issues that were relevant to the current research and could improve productivity within the building consent process regarding new residential buildings in New Zealand. The key issues are now discussed.

The first issue is how to improve the current building consenting process. The three SMEs were of the general opinion that all key stakeholders needed to take responsibility and be

accountable for their work; inconsistency developed poor relationships between professions.

*The current building inspection process could be improved a great deal if we worked a bit smarter; and if we managed to sort of make the process more efficient, or speed it up with the good players, then that would enable us to spend more time on the people that need a lot more oversight. So, at the moment, we treat them both the same. (SME002)*

*Be consistent. Do not chop and change the inspectors because you can't build up a relationship and they don't build up knowledge of the job. (SME003)*

The study revealed a general concern about inexperienced new recruits joining the BCA and being trained as building inspectors. SME003 believed that the BCA was recruiting people from overseas to become building inspectors and these people were struggling with their lack of knowledge about New Zealand's building regulations. The SME further added that on numerous occasions, there had been the frustration of forging a relationship with a building inspector or team leader and then finding out this inspector had, unfortunately, left the BCA. SME001 supported this view, suggesting the exodus of staff had resulted in the BCA recruiting inexperienced staff, externally and within the organisation, with limited building regulation experience. They had become building inspectors with insubstantial training. SME003 noted that:

*It's frustrating for everyone. I think we find that the inspectors tend to be overloaded and in a lot of cases. You might question their experience level because I think a lot of the old builders who used to be building inspectors seem to have drifted out and you've kind of almost got professional building processors who are coming from other backgrounds. (SME003)*

This finding confirms that the lack of experience and training, and the recruitment strategies from the BCA, had resulted in inconsistency within the building consenting process. SME001 believed that one of the failures of inconsistency experienced by

builders on site had been by a senior or team leader at the BCA who had not been able to make a direct decision. SME001 explained:

*He is supposed to be the go-to guy. You are in that position for a reason; the people that are working for you, or underneath you, need to know that you are the go-to guy, and if you're not, you need to get out of their way and find somebody else who does. At the end of the day, they're a reflection of the guy that they're under. The failure that is noticed down here is due to the fact that the person up here has got no idea how it is working. (SME001)*

### **6.9: SMEs suggestions on risk-based consenting process**

All SMEs gave suggestions on how a risk-based consenting process could be fully implemented as a BCA tool. SME003 had been involved in a pilot with risk-based consenting in Christchurch which involved MBIE, the Christchurch City Council, architects, the NZIA and various representatives. Overall, the participants thought that there was not enough detail or structure in the project, and that the lack of communication between key stakeholders resulted in confusion and frustration during the pilot. According to SME003, the champion of the pilot, which was central government, expected other stakeholders to take the lead and produce a process that could be implemented nationwide at the end of the pilot. The lack of direction resulted in the project being dropped and the pilot declared a failure. SME003 provided an overview of that pilot:

*The Council didn't understand it. The inspectors certainly didn't understand it. They turned up onsite and said, 'We're not actually doing full inspections, we're just doing a brief audit,' which was completely wrong 'cause the council's own legal opinion said, 'No, we can't do that; we have to do normal at this stage,' because the Act actually hadn't come in. Obviously the legislation has not been enacted. Their own legal opinion, from the Christchurch council lawyers, was, 'No, you've still got to do all the normal inspections.' But these guys are wandering round saying, 'No, we're not doing inspections.'*

*All we did was our inspections. A hard copy was kept on site. There was a record, a file, of all the architects' inspections, all our site ... and they could come in and audit those each day or each week and check them through. The problem was getting everybody to understand exactly what they were doing. I think, in the end, we got the basic structures sorted out but obviously, by this stage, Christchurch just said, .This is all too difficult.so they dropped it. (SME003)*

SME003 provided the suggestion that if a pilot project of this magnitude was to be conducted in the future, central government (MBIE) would have to organise the whole project but did not necessarily need to run it. The result would be consistency across the country. From the participants' experience from the Christchurch pilot, the BCA would not necessarily do all the inspections. They would do some critical ones but would essentially audit random inspections. SME002, in support, suggested that the overall process could be a template in which the detail of how much regulatory oversight done on each inspection would need to come down to the actual people or the customers doing the work. Their history, the type of quality, the experience, and all the work that goes with it would be taken into account. SME002 added, as a building inspector on site,

*I can very easily ascertain who did the work by asking. You don't need to have a bit of paper, at the end of the day, listing all the work you've done, when you could ask someone for his licence like you do with drainlayers and plumbers.*

SME001 provided the view that a similar risk-based approach to streamlining consents has been bantered around for the last 20 to 30 years.

*It was just a production line: you're just putting the product on a belt and just letting it go without stoppages in the process. If issues occurred during the process then the start of the project would be responsible as all quality checks and balances should have been performed and satisfied before going through the process.*

In keeping with the theme of quality, quality assurance was predominant, among the suggestions offered by SMEs, and as an area requiring improvement in the building consenting process, particularly if risk-based inspection was to be a BCA tool. SME001

suggested that the quality assurance system was based on the methodology of the construction; it is based on the building legislation and regulations which measure the parameters of what someone can or cannot do. Step outside those parameters and there are consequences. Similarly SME003 added that a quality-control measure can be in the form of “a second pair of eyes”. The SME explained:

*Spending long periods on a project can make people become complacent and it just takes another person to point out a lot of things you don't see sometimes.*

SME002 argued that builders have not grasped the intention of quality control; some builders use building inspectors as a clerk of works. According to the SME, the more you use the BCA as a quality-control check, the fail rates rise, more inspections are required which, in turn, tie up BCA resources which ultimately result in a timeframe blowout.

### **6.10: Summary of SME verification and key inputs into research findings**

The following sub-section provides a brief summary of the SME validations and key inputs of the research findings discussed in this chapter.

#### **6.10.1 Summary of building regulatory documents:**

The low awareness and use of government building documents (such as simple house design, the multi-use consent process and the Building Amendments Act 2013) had not been communicated and promoted to stakeholders effectively. SMEs agreed that the risk-based documents were too restrictive, and there was uncertainty from all stakeholders how the process should work.

The findings suggest that the introduction of new legislation should be promoted to all stakeholders with the benefits at the forefront. Key points of contact with the constant support of the legislation would ensure the process runs efficiently.

### **6.10.2 Summary of building inspection risk association:**

The SMEs agreed that the findings of risk associated to inspection were ranked accordingly. Once a building stage had passed inspection, the inspected work would be covered up. This disguised any failure that could become preventive in the future. SMEs also pointed out that the ranking order of the five findings (with regard to membrane tanking, cladding, foundations, roofing and cavity wrapping) were, in some form, related to the weather-tightness litigation claims that had been experienced in the New Zealand construction sector. This suggested that building inspectors' and designers' risk-averse attitudes related strongly to weather-tight issues. The most common issue was the leaky-building saga (See Literature Review, Section 2.5.1). This finding supports the literature review in that the leaky-building saga has had a major influence in how the New Zealand construction industry perceives risk.

### **6.10.3 Summary of risk-based assessment concept:**

Refer to Table 6.5's summary verification No. 2 and section 6.10.5.

### **6.10.4 Summary of construction stakeholders' findings for SME validation**

Table 6.6 presents a summary of the SME validation and key points from the research findings.

Table 6.6: Summary of SME verification and key inputs

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No.	SMEs Validation and key inputs
1.	All SMEs agreed that the booking of inspections does create a bottleneck in the building consenting process; this was due to the increase in building work around the region, resourcing issues of building inspectors and the non- technical ability of front-of-house staff at the BCAs.
2.	All SMEs agreed that notifiable inspections were correct and that the combination of inspections would reduce the overall number of inspections required. SMEs recommended that targeting inspections based on the complexity of the project would also reduce the number of inspections.
3.	All SMEs suggested that risk-based inspection does have a place in the NZ construction sector but would need to be led by central government, with robust policies and processes in place.
4.	The majority of SMEs agreed that self-regulation was dependent on the complexity of the project and the establishment of a robust quality-control process.
5.	SMEs suggested that designers signing off on building compliance would be an expensive exercise, and would add more work and pressure to their current role in the consenting process. It was also suggested that their skills could be used to inspect high-end residential construction or complex commercial work. SMEs were of the opinion that a minority (less than 5%) of builders would be able to sign off their own work. However, organisations would need to upskill and train members in building compliance for overall approval.
6.	SMEs agreed that the LBP scheme was not robust enough, and the LBP disciplinary board was not a deterrent for LBPs that produced non-compliant work. The criteria for becoming an LBP needed to be reviewed, with the focus on qualifications and experience set at a minimum to lift the standard and professionalism of practitioners.
7.	SMEs agreed that product manufacturers and suppliers needed to be more proactive in the construction sector. Not knowing the background of their products, in terms of testing and compliance with the Building Codes, provided bottlenecks in the BCA building consent process or making decisions on site during inspections.
8.a)	SMEs agreed that having the same inspector on the same job would improve relationships and consistency between builders and the BCA. Regular and specific training of inspectors would also improve decision-making on site.
b)	SMEs agreed that the different interpretations and changes in decision-making after inspectors attended a building site was frustrating for builders and created a bottleneck in the process. SMEs suggested that any inconsistencies or challenges in decisions made could be raised with a senior person or team leader to resolve the issues. Additionally, SMEs agreed that seniors or team leaders needed to be technically competent and efficient when responding on issues.
c)	SMEs agreed that paperwork and procedures had become excessive, but councils had good reason to act in such a way due to recent and past court cases exposing BCAs for negligence when all other parties fell away. The SMEs suggested that, with technology, the excessive paperwork would become digitalised and the mountain of paperwork would no longer be an issue.
d)	SMEs agreed that good builders should be rewarded for consistently complying with the Building Code but suggested that through a quality control process a different inspector would be brought in for random checks and balances.

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**6.10.5 Summary of SME suggestions for improvements necessary within the building consent process:**

- The current building inspection process could be improved by making the building inspection process more productive and efficient for all the players who comply. This would then enable the BCAs to spend more time on the people that need a lot more oversight.
- The resourcing of BCA staff requires a review. Inexperienced new recruits, with limited building regulation experience and insubstantial training, have frustrated designers and builders.
- Attention needs to be paid to seniors or team leaders within the BCAs who are not able to make a direct decision. The inconsistencies that have been noticed on site are due to the fact that seniors at management level have distanced themselves from the technical operations of the consenting business. BCAs are more system- and procedure-based. They must become more cognisant of the unacceptable and unfair delays in building progress caused by a consenting process that does not work efficiently.

**6.10.6 Summary of SME suggestions regarding the risk-based consenting process:**

**Risk-based pilot project negatives:**

- Not enough detail or structure in the project.
- The lack of communication between key stakeholders resulted in confusion and frustration during the pilot.
- Central government expected other stakeholders to take the lead and produce a process that could be implemented nationwide.
- The lack of direction resulted in the project being dropped and the pilot declared a failure.
- Stakeholders involved in the pilot did not understand their role.
- The pilot was run in conjunction with existing legislation in which stakeholders reverted back to the time when no clear guidance was available, compromising the risk-based intention of the pilot.

**Risk-based pilot project positives:**

- All inspections were kept on site as a quality-control check which was available to any stakeholder to audit.

- Central government (MBIE) would have to organise the whole project but would not necessarily need to run it, resulting in buy-in from stakeholders and consistency across the country.
- A template, or guidance document, of what is expected from each party and who is responsible during the process must be accessible to all stakeholders.
- Stakeholders who want to participate in the process must be vetted for competency against the complexity of the project. For example, their history and experience on projects, the type of quality control and assurance, insurance cover and their experience (qualifications and affiliations) must be sought.
- Projects involved with risk-based inspections should flow through the process without any stoppages. All quality checks and balances should be performed and satisfied before the building under inspection can be accepted to go through the process.

### **6.11: Overall Summary**

This chapter has presented the results of the SME interviews conducted in order to validate the research findings from the interviews provided by the construction stakeholders. The key research findings consist of construction stakeholder themes, building regulations in New Zealand, the current building inspection regime and risk-based inspections, all of which were presented to SMEs for their opinions.

The research findings obtained from the literature review, the on-line questionnaire survey, semi-structured interviews and the SME interviews will be synthesised and the overall research output will be discussed in Chapter 7.

An overall conclusion will conclude in Chapter 8, the final chapter of the research study.

## **Chapter 7 Synthesis of Research Findings and General Discussion**

This chapter will present a synthesis of the research findings from chapters four; the questionnaire survey, chapter five; semi-structured interviews and chapter six; SME interviews. The synthesis is presented so that significant findings are drawn together to answer the research questions and deliver the stated research objectives. The chapter is divided into four sections in line with significant themes that emerged from the analyses in chapters 4, 5 and 6. A synergy of all the information collated from the literature review, through to the research investigations, is therefore presented under the four sections. Essentially, this chapter completes the triangulation of this research.

### **7.1 Synthesis**

The methodological framework and research methods provided the structure for this investigation, which commenced with a set of specifically formulated survey questions designed to gather information from building inspectors and designers. The participants provided information on their own professional backgrounds, and opinions on current and proposed building regulation concepts. In addition, building inspectors and designers were asked to provide information on building regulatory documents, risk-based inspections, and the building inspection process in New Zealand. The survey results were reported in Chapter 4. In conjunction with the survey questions phase, a second phase of in-depth interviews with house developers took place. The interview participants were verbally provided a set of semi-structured open-ended questions that were similar to those given to the building inspector's and designers. Interviews were recorded and transcribed, and the transcripts were examined individually and grouped into systematic classifications of common characteristics of the housing developer's experiences. The results of the face-to-face interviews were reported in Chapter 5.

Significant findings from both the survey of building inspector's, designers, and house developers formed the basis for the interviews with SMEs. A summary of the key issues was compiled and presented to three SMEs in order to validate and amplify all prior findings. The face-to-face semi-structured interviews were conducted with three key representatives, with professional affiliations to the New Zealand construction sector. The analysis of the three investigations revealed four major aspects concerning risk-based building inspections as a regulatory tool in New Zealand. They consisted of building regulation documents, the building consent process, building inspection process, and risk-based inspections. These four themes are discussed in the following paragraphs.

A number of disparities and gaps were identified about the building consenting process hindrances, in particular the regulatory inspection stages. Situating these research results in relation to the literature confirms the findings of this study, within the New Zealand context, both support and contradict established perspectives. Following the four most significant areas of discussion highlighted previously, this study presents new insights.

## **7.2 Building regulations**

Building regulations are minimum standards for design, construction and alteration of any building. They are developed by government and approved by parliament. These regulations set national standards for most building work. A detailed review of risk-based documents was given in sections 2.5.1 to 2.5.5 and section 2.12.5 of chapter two. A summary of the key issues in these legislative documents was presented in Table 2.11 to include:

- promoting a regulatory system that is administered in an efficient and cost effective manner
- existing legislation use and understanding
- understanding risk-based models

It became evident, from the problems outlined above, that there were gaps in knowledge which had to be addressed by this research, so that risk-based regulations are implemented, understood and used to their potential in a regulatory environment. The gaps identified in chapter two include the following (as detailed in Table 2.11):

- articulation of the nature of legislative problems
- limited suggestion of solutions, especially from a stakeholder perspective
- limited knowledge on stakeholders uptake of existing legislation
- applicability of the United Kingdom model in New Zealand

The knowledge gaps outlined above were then re-structured, so that the problems could be investigated further during the investigation phases of the study (chapters 4 and 5). The results of both the investigation phases were validated further with interviews with SMEs (chapter 6).

### **7.2.1 Existing legislation use and understanding of risk-based models**

The literature review (see section 2.12.5) shows that New Zealand introduced some risk-based concepts into the construction sector as government initiatives, to improve affordability and increase productivity in the housing sector. The New Zealand Government introduced the multi-use consent, simple house design and Building Act 2004 Amendments with the focus of reducing the timeframes within the building consent process, and having less reliance on Building Consent Authorities. An initial review of the existing literature was performed to establish the uptake and use of government building documents, which contained risk-based concepts for new residential buildings in New Zealand. This research shows a generally poor understanding of these initiatives. This study generated a standard list of building regulatory documents for the residential building sector. The list of building regulatory documents was included in the survey questionnaire for designers and building inspectors, who were required to indicate their

awareness of each document. The study revealed there is low awareness of government building documents, simple house design, multi-use consent process and the Building Act 2004 Amendments. The field investigation with SMEs confirmed there was a low understanding of the government documents, due to them being too restrictive, and there was uncertainty from all stakeholders on how the process for each should work. The findings indicate that New Zealand construction stakeholders have a low use rate and understanding of risk-based models, and these initiatives have had minimal impact in productivity in the sector. This research contends that the implementation of new legislation should be promoted to all stakeholders with the benefits highlighted. Further, key points of contact, with constant support of the legislation, would ensure the process runs efficiently. These findings support existing literature, that there is a need to improve existing capacities (in the number of trained professionals able to implement and support the new legislation), and the number of trained stakeholders able to adopt the techniques involved (Spence, 2004). This confirms research that for building regulation policy to be effective, stakeholders must understand how it works, and it must require ongoing training and educational programs (Burby, Salvesen & Creed, 2008).

### **7.2.2 A lack of skills and knowledgebase in the construction industry**

Stakeholders indicated they have concerns with the lack of skills and knowledgebase presently within the New Zealand residential construction sector. All construction stakeholders require on going education and have suggested a minimum qualification for the sector. The responses particularly targeted Licence Building Practitioners (LBP) for their lack of knowledge in building code compliance and their need to upskill. The study revealed that building inspectors and architects have a good understanding of building regulatory compliance but non-professional, unqualified designers, building trades people and homeowners have poor understanding. This finding supports Baiche et al., (2006), who suggested that trades people are believed by the inspectors to not know

building regulations. Designers are of the opinion that there is a lack of good training in the practical aspects of building code compliance within their own profession, which makes it difficult for their younger, inexperienced designers to make competent assessments. Responses relating to the lack of skill and understanding in the residential construction industry demonstrate that there is low confidence amongst stakeholders for enforcing regulatory compliance, meaning that confidence of customers would also be low. The finding supports an earlier literature review from Yau (2009), who suggested that it is necessary to boost the confidence of the general public in a regulatory regime, as public confidence is a matter of public education and understanding of the regulatory regime. Study participants expressed the view that there is already low confidence amongst construction stakeholders in New Zealand, given the constant legal problems from the leaky home saga (see section 2.5.1).

An interesting observation that emerged from the study was that developers suggested that the lack of building compliance skill and knowledge leads to reliance on BCAs taking on a quality assurance level inspection as part of their risk-averse approach. Further, construction stakeholders suggested that building regulations were being changed to suit the BCAs. The research concludes that there is a need for further training and upskilling for all construction stakeholders in building code compliance, in the form of a minimum qualification supported by ongoing continuous professional development (CPD) programmes. The literature review found that stakeholders who are well trained and educated make a big difference to building regulation compliance. Correspondingly, updating knowledge through CPD schemes could keep them current with happenings in the industry (Baiche et al, 2006, Chan & Kumaraswamy, 1997).

### **7.2.3 Quality control in the construction industry**

A significant number of study participants highlighted quality assurance as central to the low levels of quality assurance in many projects, and that more prescriptive checks are required now more than ever, to discover incompetent contractors. The construction industry has poor standard of quality on projects and the industry is far from ready for less rigorous inspection regimes. Also, consumers need more quality assurance, even on relatively simple projects. Multiple failures by all stakeholders on the same project is due to exacerbated current pressures on the building industry and the large number of relatively inexperienced stakeholders. Attributing building risk to councils is an inappropriate way to control quality, is a disincentive to good trade practices, and has had a significant negative impact on productivity (Yau, 2009).

The current study suggests that a quality assurance system should be based on the methodology of construction. It is based on building legislation and regulations that dictate the parameters of what someone can or cannot do. One of the SMEs suggested that self-regulation was dependent on the category of the building in terms of risk, and nothing to do with the person or people carrying out the building work. Therefore, once the building category or risk of the building has been established, checks and balances in the form of a robust quality assurance process need to be in place to monitor contractors. This suggestion is supported by the literature review finding (see section 2.8.2) that having a proper quality management system within a construction organisation and productivity are positively related (Page, 2010).

Housing developers are aware that even good builders can get complacent, and a lot of good builders and building companies have gone bankrupt. Surveyed building inspectors confirmed this finding, that they were seen by housing developers as providing a quality control check when lead contractors were busy. These findings support the existing

literature from Almeida et al. (2010), who suggest that diverging perspectives define construction quality, and that multiple construction stakeholders aim simultaneously at the fulfilment of different sets of requirements, thus using different references to support their own perception of quality (Almeida et al., 2010).

According to the building inspectors, builders have not grasped the intention of quality control, for which some builders are using building inspectors and inspections as clerks of work. The findings suggest that the more the BCAs are being utilised as quality control checkers, the higher the fail rates rise, and consequently more inspections are required. This consumes BCA resources, which ultimately results in timeframe problems. Another consequence is that failed inspections will damage the reputation of the whole construction industry.

#### **7.2.4 Professionalism and competence of building stakeholders in regard to building code compliance**

##### **Licensed Building Practitioners**

This research has shown that there are concerns with the LBP scheme members in the residential building sector of the construction industry. A review of the LBP scheme is presented in chapter 2, where benefits of the scheme were seen to underpin an efficient and accountable building sector that is focused on quality. However, analysis of information presented in chapter six of this study consistently highlighted that the LBP scheme is not robust enough, and that the LBP disciplinary board was not a deterrent for LBPs who produced non-compliant building work. The initial intention of the industry becoming more accountable for the work they produced, has not been fulfilled.

The research also revealed that while the LBP scheme has provided BCAs with a disciplinary process to deal with non-conformers, the majority of building consents that went through the building consent process largely generated requests for further

information (RFI). The BCAs were reluctant to report every LBP, as this would reduce productivity in the sector. It would only report to the LBP Board the worst cases; where people are clearly out of their depth, working outside their scope, consistently providing non-substantial design work, or providing a Certificate of Work (COW) declaring that it complies. This study suggests that the criteria for becoming an LBP may need to be reviewed, with a focus on qualification and experience set at a minimum, to lift the standard and professionalism of practitioners. The study also suggests the LBP disciplinary board needs to engage in harsher penalties for LBP offenders and that outcomes be widely publicised throughout the construction sector.

### **Product manufacturers and suppliers**

Construction stakeholders need to be proactive in improving building code compliance knowledge, rather than waiting for issues to arise. For product manufacturers and suppliers, not knowing the back ground of products, in terms of testing and compliance with building codes, provides barriers to BCAs approving building consents or making decisions on-site during inspections.

This study, through a questionnaire survey (see section 4.7.3, chapter 4) and semi-structured interviews (see section 5.7, chapter 5), has found that professionalism and competence in regard to building code compliance towards product manufacturers and suppliers needs improvement. BCAs, designers and developers expressed concerns about the lack of product, limitations and testing information for building compliance provided by product manufacturers and suppliers. The Building Act 2004 legislates where the supplier must provide material and evidence (acceptable, verified or alternative) that show that a product or system is compliant with the relevant legislation. Access to product information on materials available in New Zealand would support designer and BCA

approval processes, and consumers would be able to make informed decisions when making transactions in the residential sector.

### **7.3 The building consent process in New Zealand**

This research explored the New Zealand residential sector to examine the current building consent process. The building consent process requires Building Consent Authorities (BCAs) to review and inspect processes to ensure that the proposed building work, and completed buildings are satisfactory on reasonable grounds to meet the performance requirements of the building code and protect current and future owners (Bates & Kane, 2009; Pringle, 2009).

The literature (see section 2.3) revealed that over half the population of New Zealand (52%) lives in the four main urban areas of Auckland (1,454,300), Wellington (398,300), Christchurch (381,800) and Hamilton (224,000) (NZEFO, 2016). Auckland demands (Auckland Council, 2013, Page, 2013a) compounded by the Canterbury rebuild (MBIE, 2013) have put pressure on the construction sector and BCAs to be more efficient. The preliminary reviews identified the following key issues, which were outlined in Table 2.11 in chapter 2:

- to ascertain problems with ensuring responsibility sits in the right place throughout the Building Consent process
- building inspection process and statutory requirements
- BCA resources
- BCA improvements

These key issues were resolved into knowledge gaps as follows:

- limited knowledge of building inspection process bottlenecks
- implications of inspection delays on construction projects
- limited knowledge of consequences of BCAs resource shortages

- limited suggestion of solutions, especially from a stakeholder perspective

The knowledge gaps summarised above were re-structured so that these issues could be investigated further during the next phases of the study (i.e. chapters 4 and 5).

### **7.3.1 The building consent process**

The review of literature (section 2.3.4 of chapter 2), related to the New Zealand construction industry, revealed that the New Zealand building consent process engages multiple stakeholders of different professions and skill sets. The building consent process can be split into three main parts: lodgement and processing, building, and code compliance certificate (CCC) stages. During these three stages, the BCA and other stakeholders are responsible that building code compliance is satisfactory on reasonable grounds. The lodgement and processing stages must follow the guidelines set by the Department of Building and Housing (2014), in which the owner/designer prepares detailed plans and specifications for the BCA, the BCA checks plans and specifications, and issues the building consent. In the next stage, of 'building', the builder will notify the BCA during the construction phase, where a building inspector completes an on-site inspection report, identifying if inspection has passed or failed. If a failed inspection is recorded, the inspector issues a Notice to fix (NTF), detailing the remedial work required and making a re-inspection to satisfy the problems. Once the final inspection has been passed, an application for a CCC can be lodged with the BCA for approval. Once the BCA is satisfied that all documents and fees have been addressed, the BCA can then issue the Code Compliance Certificate.

### **7.3.2 Responsibility and accountability in the building consent process**

This study found that designers and building inspectors indicated that during the building consenting process, responsibility, accountability and those best to deal with risk can be outlined as follows : for 'lodgement' and 'processing' of building consents, designers are

suggested to be in the best position for dealing with risk. Critically, these results differ from the current building consent process, as ‘lodgement’ and ‘processing’ is conducted by the BCAs, not designers. In the construction phase of building work, results recommended builders, which is in line with the current practice. The execution of ‘notifiable inspections’ is deemed best done by the BCAs as it is currently. Finally, the BCAs were thought by stakeholders to be in the best position to deal with CCC’s according to participant results (refer table 4.5, chapter 4). Developers, through face-to-face interviews, suggested that BCAs should only be responsible for the quality control of documentation, in that the correct paperwork for construction should be submitted and signed off by the appropriate parties.

### **7.3.3 Excessive documentation during the consenting process**

The study found the paperwork required for consenting, and especially code compliance, to be excessive, and the time spent providing documentation to be a hindrance to productivity, hence creating a bottleneck. Stakeholders agreed that the paperwork and procedures had become excessive, but councils had good reason to act in such a manner due to recent and past court cases exposing BCAs for negligence, even in some cases just for being ‘the last man standing’. One SME suggested that the excessive requirement for paperwork was a waste of time, because history suggests that council will always be held liable for any issues during the building consent process (*Invercargill City vs Hamlin*, 1994). Stakeholders suggested that with technology, the excessive paper work could be digitised and the problem would no longer be such an issue. The SMEs suggested that the construction industry had done it to themselves and the BCAs had every right to acquire information that would protect ratepayers in the long term. The finding supports the existing literature, in that a paper trail was important as a means of demonstrating to stakeholders that decisions had been resolved collectively, and the key objective was to avoid ‘individual’ blame should things go amiss (Imrie & Street, 2009).

#### **7.3.4 Resourcing of Building Consent Authority staff**

This study has revealed that BCAs are having difficulty in recruiting sufficiently qualified, competent and experienced staff, causing a resourcing issue for processing and inspections of building consent work. The increase of work has also put a strain on staff to make quick decisions in reviewing and inspecting consents, as the BCAs have adopted a risk-averse approach. The recruiting of inexperienced new staff with limited building regulation experience and in-substantial training is creating a hiatus in the building consenting process. BCAs are recruiting people from outside the construction sector and from overseas, to become building inspectors, who struggle with the knowledge and practical application of New Zealand building regulations. The sourcing of new building inspectors from different industries, such as policemen, tax auditors, health and safety inspector, detectives, and demolition people are contributing to inconsistency in decision-making.

The research also revealed that the exodus of senior and experienced staff members has implications on stakeholder's relationships, with new senior/team leaders at the BCA being unable to make a direct decision when clarifying discrepancies for their staff. Research participants thought that the BCAs have people in positions who shouldn't be and when it comes to sourcing the right people for the job, BCAs tend to look more for business aptitude than construction industry practice, so policies and procedures are not being understood. The SMEs suggested that inconsistencies in direct decision-making can be attributed to senior and mid-management people distancing themselves from the technical operations of the business. This finding suggests that BCAs have become more system and procedure-focused and less regulatory and technical, confirming that the lack of experience and training, and the recruitment strategies of the BCA are resulting in inconsistency within the building consenting process and creating bottlenecks.

## **7.4 The building inspection process In New Zealand**

In the review of issues around the building inspections process presented in chapter 2 of this research, it was established that improvements are needed in the working attitudes of construction operatives, in the management of technical decision-making, and in the overall building operations process. In the New Zealand residential construction sector, building inspection is usually carried out by the BCA or its consultant. Several issues of concern about the building inspection process were highlighted from the research which formed the following themes. These items are presented coupled with the outcomes of the research validation by three subject matter experts.

### **7.4.1 The building inspection process**

The results (see section 4.8, chapter 4) show that within the past two years every notifiable inspections recorded a high rate of failure. Foundations (93%), framing (87%), preline building (85%) and final inspections (85%) ranked amongst the worst four for failures. However, notifiable inspections with the highest pass rate were siting (30% failed), membrane tanking (30% failed) and drainage (22.50% failed).

Further analysis from the questionnaire surveys show that between 41 per cent and 84 per cent of regulatory non-compliance (failure) was due to errors from either the contractor or owner on-site (see figure 4.17, chapter 4).

### **7.4.2 Booking stage**

The research has identified that BCAs are not coping with the current arrangements for building inspections, as the wait-time for inspectors to attend jobs is creating hiatuses in their construction program. This supports previous studies (see section 2.3.4), which formed building inspection resources were being stretched in major New Zealand cities due to the supply and demand problems with the residential housing stock. This study confirmed that the booking stage of notifiable inspections presented issues for

stakeholders. Builders who notified BCAs for inspections were waiting up to a week to have a building inspector carry out an inspection, as BCAs did not have the resources for next-day inspections. Stakeholders suggested the main reasons for the issue were due to the increase in building work around the region, the lack of technical ability of staff taking inspection bookings at the BCAs, and large residential and commercial companies block-booking inspections. The BCA (customer service team's) non-technical ability of administrative staff who made bookings did not understand the building consent process, which included not fully grasping what "notifiable inspections" consisted of.

### **7.4.3 Regulatory inspection numbers**

This research has identified that the sequence and order of 'notifiable inspections' is reasonable, but not all of the inspection phases need to be carried out individually. This suggests there are too many inspections currently, and a review to reduce the number of notifiable inspection is required. The reasons there are so many inspection are that many builders do not have adequate knowledge, there are double-ups on some inspections and that building inspectors were taking a risk-averse approach.

The construction industry has progressed in getting the inspection structure to where it is currently, and clients are now more aware of shoddy workmanship. Stakeholders suggested that combining some of the notifiable inspections or targeting inspections based on the complexity of the project would reduce the overall number of inspections in a project. Inspections could also occur less often in low-risk situations but they still be undertaken at crucial points. Therefore, a reduction in the number of building inspection is possible, but there is still a need for a third party to carry out compulsory inspections at key stages of construction. Examples of third parties suggested by participants included: architects, IPENZ members and LBPs. These findings support research from Mulgan (2000), that suggests that contracting-out could be a means of strengthening

accountability in the private sector by moving it more closely to public sector practices. Stakeholders felt it is important to promote risk adoption and evaluation by those best placed to manage it, and provided an example of structural inspection being signed off by a structural engineer and not the regulatory authority inspector. The current building inspection regime does not require specific inspections for acoustic sound transmission and ventilation, and relies on other professionals to carry out the specialist inspection. The process allows for certain notifiable inspections to be satisfied with building compliance with a producer statement signed by a professional competent person(s).

However, the shifting of accountability to other professionals would not save money and could in fact increase fees, as in the case of an architect, where it is compulsory for them to carry professional indemnity insurance and this added responsibility would surely increase cost.

This study found that designers signing off on regulatory functions would add further pressures to their current workload by adding a completely different work-stream (building inspections) to their sector, which they are not really organised for. Participants explained that consented plans that went out to a site should be straightforward to follow, in regard to building compliance, as all the checks and balances were already in place due to the pedantic consenting process. The only time a designer should go on-site is when a contractor cannot decipher how something is constructed, although this is very rare. Designers do not want to accept responsibility for regulatory sign-off functions, and in doing so would have to increase costs to cover additional overheads, ironically employing 'ex-regulatory building inspectors' to carry out the function. The study suggests that regulatory building inspection is a specialist field, and excluding the BCAs, other sectors of the construction industry do not have the background or experience to carry out the function and would need to be trained.

## **7.5 The regulatory building inspector**

The literature provides evidence (sections 2.4.1 and 2.4.2) that illustrates the difficulty of being a regulatory inspector in that one has to be flexible and relatively lenient, should have an affirmative relationship with regulations, grant violators time to comply and possibly overlook non-compliance that poses no serious risk. On the other hand, the inspector has to enforce all regulatory requirements, deal with violations and treat all regulations in the same manner (Heijden, 2009). From the results (section 5.8, chapter 5) obtained from the semi-structured interview analysis, developers expressed the view that having different inspectors to deal with on-site created a bottleneck in the process, due to inconsistencies from inspectors. During the course of construction the same inspector might undertake inspection, but when the final residential inspection is notified, a different inspector might arrive requesting information on issues that had already been resolved.

The concept of using the same inspector provides benefits for the designer, builders and building inspector. It benefits the BCAs, as an inspector going to a job becomes familiar with the project, and within the process would have built a relationship with the designer, builder and other key members on-site. The designer and builder they are then able to deal with one person, which reduces inconsistency. A United Kingdom study found relationship is encouraged by building inspectors, who believe that having the same person as site manager right through the project not only builds a good relationship with the inspector, but also benefits the quality of the end product (Baiche, Walliman & Ogden, 2006). Designers and builders need to acknowledge that the BCA is part of the team and a good relationship would encourage a productive working environment.

One SME suggested that the one thing that the BCAs have to ensure is independence so that natural checks and balances were in place. In addition to the use of the same inspector

on the same job, the BCA would need to introduce another inspector just to keep things in check. Developers explained that the BCAs lack of understanding in interpretation of the Building Act 2004 causes a lot of frustration to designers, housing developers and builders. Building inspectors need to be more aware of other guidance in compliance, such as “determinations” from the MBIE, for understanding building code compliance. Participants pointed out that the CCC was to be issued based on the approved building consent as stated in the Building Act (2004). The BCAs was seen as requesting more information than the Building Act intended. Participants further suggested that one of the reasons for inconsistency from building officials was a lack of training.

### **7.5.1 Building inspector inconsistency with training output**

The research has shown there is concern about the different interpretations and changes in decisions after building inspectors attended training. This inconsistency in decision-making frustrates builders, due to rework and rebooking of inspection because of a failed inspection. This, according to housing developers, creates a bottleneck in the building inspection process. A similar finding was presented by May and Wood (2003), who said that one of the key constraints that frustrates homebuilders is inconsistencies in what building inspectors require. BCAs have in the past few years introduced a training school, targeting new building officials into the industry, and have helped new building inspectors become established in the field. The training school has had a ripple effect on the construction industry. Building officials have been proactive and have graded their knowledge base, providing refresher courses for technical staff. The result has been that BCAs are now in a better position to understand and enforce regulatory compliance in a more consistent manner. This finding supports the research by Kagan (1989), who suggests that caseworkers need to fully understand the new policy so that regulators are provided the consistent information around the region. The SMEs suggested that any inconsistency or challenge in a decision an inspector made on-site could be raised with a

senior or team leader at the BCA. Therefore, senior or team leaders at the BCA need to be technically competent and efficient when responding to issues.

### **7.5.2 Allocation of building regulatory resources**

Stakeholders were of the same opinion that risk-based inspections would be difficult in the current environment, as the construction sector was not mature enough for their full implementation. Participants further suggested that, once designed, piloted and supported well, risk-based inspection could be fully implemented in the New Zealand housing construction sector as a BCA tool. The result is suggestive of the need of the industry to improve its competencies, training (see section 2.2.6) and awareness of regulatory policy implementation (see section 2.11). Building inspectors (65.20%) and designers (52.50%) did not agree that the New Zealand construction industry was ready for the relaxation of regulatory building inspection in a risk-based approach. One SME participant agreed with the findings and explained that the New Zealand construction industry was not ready because every stakeholder needed to accept and be ready to implement risk-based inspections. Another SME further suggested that the government had a major role in organising such a nationwide project.

Stakeholders agreed that the United Kingdom's risk-based inspection model should be looked at as an alternative model to the current building inspection process. This finding supports the first result, concerning reduction of regulatory intervention but not at the expense of quality. However, one SME strongly disagreed with adapting the United Kingdom model to the New Zealand construction sector, as the participant felt the New Zealand environment was totally different and New Zealand constructors had the ability in fixing their own problems internally.

## **7.6 Risk-based regulations in New Zealand**

The lack of detailed research in the area of risk-based building inspections of residential buildings somewhat inhibits comparing the findings of this research directly with prior work within the New Zealand context. The search shows an absence of such information within the New Zealand context, hence a knowledge gap. The reviews are contained in chapter two of this thesis. Of significant relevance is a study conducted in the United Kingdom by Berman (2012), which was an impetus to start the current research. This study by Berman produced a risk-assessment decision making tool for building control bodies, which was later adopted by the British Government. The document sets out the process local authorities should follow when developing inspection service plans for building projects. The inspection service plan takes into account: the type of building work proposed, the size and complexity of the work, risks to compliance with building regulations, the builder's experience, and ground conditions.

The British Government introduced risk-based inspections as a building control body (BCB) tool, which came into effect on 6<sup>th</sup> April 2013 (UK, The Building Act 1984, Building (Amendment) Regulations, 2012). Regulation 16 of the United Kingdom Building Regulations now states the local authorities can specify notices for any stages of construction when it considers a site inspection is necessary. Therefore, local authorities are able to concentrate their resources based on the complexity or risk of the project. The interpretation and implementation of the United Kingdom risk-based model have been used as a guideline document, referred to in the preliminary parts of this study. The preliminary reviews and investigations found deficiencies that needed to be addressed in order for risk-based models to be implemented in the New Zealand construction sector. Therefore, the reviews identified problems within the context of this study. A listing of these problems was given in Table 2.11 and they include:

- risk-based inspections understanding
- risk-based inspection as a BCA permanent tool
- risk-based inspection implementation
- international risk-based regulation

The problems listed above were resolved into knowledge gaps that were investigated further in the research phase of the study. The knowledge gaps were outlined in the right-hand column of Table 2.11, and they include:

- clarity in responsibilities and arrangements to deal with the transition to risk-based inspections
- lack of information for stakeholders about risk-based regulation
- operation and coordination of the full implementation of risk-based regulations
- limited knowledge of risk-based regulations from a stakeholder perspective
- lack of information from international jurisdictions practicing risk-based regulations

These knowledge gaps were then restructured, so that issues could be investigated further during the next phases of the study (chapters 4, 5 and 6). Issues around the risk-based building model were covered in sections 4.5 to 4.9.7, and sections 5.3 to 5.8. There were four themes relating to risk-based building models described in the following paragraphs. There was also further investigation to verify the findings by engaging subject matter experts (the opinions of the subject matter experts were presented in section 6.9. of chapter six) to comment on the research conclusions.

### **7.6.1 Risk-based inspections**

This research identified that risk-based inspections would be difficult in the current environment, as the New Zealand construction sector was not mature enough for its full implementation. This is supported by the questionnaire survey analysis of ‘stakeholder understanding of risk-based building inspection’ (see section 4.7.1, chapter 4), that

building inspectors overall have a good understanding of risk-based inspections, and builders and product manufacturers needed improvement. While other stakeholders expressed their opinion that designers' professionalism and competence as being 'good' (see section 4.8.3, chapter 4) results showed that stakeholders felt that their understanding of risk-based inspections needed improvement. Results also indicated that housing owners have a poor understanding of the risk-based model. Further analysis from the semi-structured interviews (see section 5.5, chapter 5) with housing developers suggested that a framework was needed to outline the processes and procedures of risk-based inspection and who is responsible for what. The SMEs also thought that the government (MBIE) needed to lead the project, with support from construction stakeholders providing input into the process.

There is a small proportion of builders and housing developers in the sector who are ready and able to sign off their own work. The sector could not group everyone into the same category as there are some very good practitioners and companies who are ready to use the risk-based inspection concept. Further, SMEs suggested that if the sector does not practice risk-based regulations, the BCAs will not be able to cope with housing demand.

Firmer legislation is also needed from central government to address stakeholder accountability and responsibility for building code compliance. For risk-based inspection to be considered in the New Zealand construction sector, central government would need to lead the process with robust policies and procedures in place. The literature review revealed that modern codes are not being implemented because they have not been made mandatory or because there is a lack of project supervision and building control (Spence, 2004).

### **7.6.2 Designers' views on performing regulatory building inspections**

From the results (see section 4.8.2, chapter 4) obtained from the questionnaire surveys, designers nominated thirteen notifiable inspection they considered they were capable of. The purpose of this exercise was to establish which notifiable inspections designers felt comfortable in executing in the future, if regulatory inspections were to be relaxed and an alternative body was required to fill the void. The findings show that framing, cavity wrap, cladding, and roofing were all inspections that designers would be able to conduct, while satisfying building code compliance. The findings indicate that the four high-ranking inspections have a direct relationship to high-risk areas discussed in the Hunn report (see section 2.5.1) during the leaky home saga. Roofing, cladding, cavity wrap and framing are all phases that form the external envelope of a building and are referred to in the Building Code E2 risk matrix. The findings suggest that designers may be in the best position to make certain inspections, as they are required to provide a risk assessment in the form of the E2 risk matrix when applying for a building consent.

These research findings (see section 4.8.1) indicate that designers do have a good understanding of building regulatory compliance, as between 74 and 93 per cent of building consent design does not require rework. There was also a low percentage (6.41%) of rework that required the severe response of a NTF. Designers were happy to take on the responsibility for self-certifying their design, in lieu of regulatory building inspection, as certain kinds of work would be outside the scope of building inspectors, work where designers could add value in regulatory inspections and project sign off. Examples are high-end residential or complex commercial construction where designers would be acting in some respect in a clerk of works capacity. Architects should be given responsibility for consenting work, and also have the authority to sign off work with peer reviews on complex projects or difficult detailing. The benefit would be that the quality of workmanship would improve as well as building code requirements.

However, if designers were to perform regulatory inspections in place of council inspectors, that should become a statutory requirement in order to apportion fees prior to the building consent process. These findings support the existing literature from (Yau, 2009 and Spence, 2004) who support the practice of lower fees for new systems rather than the conventional approach, as this would encourage people to use the new system. However, homeowners might like the idea of reduced building costs but would be sceptical of any government changes to reduce BCA intervention as a trade-off.

### **7.6.3 Notifiable inspections in terms of risk ratings**

This study has produced a table that ranks notifiable inspections in accordance with risk, as stated by designers and building inspectors. Participants ranked thirteen notifiable inspections in terms of low, medium and high risk. The study has ranked 13 notifiable inspections in accordance with risk (1 being the highest risk, 13 being the lowest). The ranking order of the top five 'high-risk' inspections (membrane tanking, cladding, foundations, roofing and cavity wrap) followed the high risk areas identified in weather-tightness litigation claims that have been experienced in the New Zealand construction sector. This suggests that building inspectors and designer's risk-averse attitudes relate strongly to weathertightness issues. The most common was the leaky building saga (See literature review, section 2.5.1). This finding supports the literature in that the leaky building saga has had a major influence on how the New Zealand construction industry perceives risk. Similarly, Buckett (2013) explained that the leaky home crisis (weathertightness failure) liabilities have bred risk aversity and increased stringency amongst BCAs. The 'ranking system' determines the order of notifiable inspection by risk, as shown in Table 7.1.

Table 7.1: Notifiable inspection ranked in terms of risk

Inspection type	Rank	Inspection type	Rank	Inspection type	Rank
Membrane tanking	01	Code compliance certificate	06	Block work	11
Cladding	02	Final Inspection	07	Framing	12
Foundations	03	Post/Fireline bracing	08	Pre-line building	13
Roofing	04	Drainage	09		
Cavity/Wrap	05	Siting	10		

#### 7.6.4 Notifiable inspections requiring regulatory inspection

The study has produced a table that ranks notifiable inspections that the designers and building inspectors surveyed felt required regulatory inspection. The study has ranked 13 notifiable inspections and the need for regulatory inspection (1 most requiring inspection, 13 least requiring inspection). The ranking order of the top five requiring regulatory intervention (code compliance certificate, final residential, cladding, drainage and foundations) suggests that these are critical stages during construction and for satisfying building compliance before a building is finally approved. The 13<sup>th</sup> ranked, ‘siting’ inspection was felt to not require regulatory building inspection, perhaps because stakeholders utilise the services of professional land surveyors to determine regulatory compliance. Table 7.2 shows the ranking order of notifiable inspections in terms of requiring regulatory building inspections.

Table 7.2: Building inspection regulatory intervention ranking

Inspection type	Rank	Inspection type	Rank	Inspection type	Rank
CCC	01	Cavity / Wrap	06	Roofing	11
Final Inspection	02	Pre-line building	07	Block work	12
Cladding	03	Membrane tanking	08	Siting	13
Drainage	04	Post / Fire line bracing	09		
Foundations	05	Framing	10		

### 7.6.5 Risk-based models implementation mechanism

The literature review suggest, that risk-based regulation when well designed, piloted and implemented can provide a sound basis for investing resources in risk management proportionate to the risk posed (Gouldson, Morton & Pollard, 2009). The analysis of the semi-structured interviews revealed critical learning areas from past risk-based inspection projects that could contribute to the future implementation of risk-based models as regulatory tools. A risk-based pilot was conducted in Christchurch after the local BCA lost their accreditation (see section 2.6.4, chapter 4). The BCA, during the initial stages, would not let some stakeholder participate due to their risk-based matrix evaluation, indicating that they were not experienced enough for the work involved in the pilot study. Potential applicants were put through a criteria check based on their qualifications, experience in the industry and competency. This study has produced a list of issues from past risk-based model strategies in an endeavour to strengthen implementation of such models in the future.

#### **Risk-based pilot project issues:**

- not enough detail or structure in the project
- lack of communication between key stakeholders resulted in confusion and frustration during the pilot study
- central government, expected other stakeholders to take the lead and produce a process that could be implemented nationwide

- the lack of direction resulted in the project being dropped and the pilot declared a failure
- stakeholders involved in the pilot did not understand their role
- the study was run in conjunction with existing legislation, in which stakeholders reverted back to when no clear guidance was available, compromising the intention of risk-based inspection

### **7.7 Other relevant areas suggested for improvements**

The BCAs have recently introduced initiatives to provide quicker service without compromising risk. Initiatives include increasing resources and concentrating on staff training. Other initiatives include the utilisation of inspection waivers for qualified or experienced people BCAs can trust, the increased use of the producer statement process, and tapping into the knowledge of certain contractors for quality assurance processes and procedures. The plan would be to get housing developers and builders into a QA programme. The benefits would be reduced waiting times, just by reducing the inspection regime from 12 to 15 inspections per house down to about 4 or 5. The current building inspection process improvements could make the building inspection process more productive and efficient for all good players, which would then enable the BCAs to spend more time with people who need more oversight.

### **7.8 Summary**

This chapter synthesised the research findings from three methods: a questionnaire survey, semi-structured interviews and SME interviews. Important findings of the research have been discussed in detail, coupled with key results in relation to the findings of previous research on issues around building regulations in new residential construction. The findings of the research show that there are opportunities in the current building consent process for risk-based inspections to be implemented as a building regulatory tool. The challenges of building demands in New Zealand's largest cities, the resourcing

of BCAs, and the various bottleneck issues in the building consent process have been addressed in this current study. Finally, this research has helped to identify some factors that could help in the implementation of risk-based models as regulatory tools.

## **Chapter 8 General Conclusion and Recommendations**

This chapter outlines the original contributions made by this research to improve the understanding of risk-based building inspections by key stakeholders in the New Zealand construction industry. The study adds new data to the existing literature, with respect to risk-based building inspection and the current building consent process in the New Zealand context. The chapter consists of three main sections; the first section presents a summary of the fulfilment of the research questions. The second section outlines a list of recommendations that could facilitate the full implementation of risk-based building inspections in the house building sector and the wider construction industry. Finally, the chapter concludes with suggestions of areas for future investigation to complement the findings of the current study.

### **8.1 Fulfilment of the research questions**

The research intends to inform construction stakeholders of the full implementation of risk-based building inspection as a BCA tool. The study established that there were problems around the building consenting process for residential buildings in New Zealand, which was depressing productivity in the construction sector. However, there is a lack of knowledge around this subject matter, despite the abundance of literature from countries such as the United Kingdom, Australia, Hong Kong and the United States of America. Therefore, the research problems consisted essentially of:

- a lack of an established understanding of risk-based inspection and its implementation as a regulatory tool
- a lack of information of risk-based inspection from the construction industry as a cost, quality and time tool
- a lack of understanding of so-called building consent authority ‘red tape’ which is obstructing construction sector progress

- a lack of understanding by the construction sector of the move toward accountability, with the introduction of risk-based inspection as a regulatory tool

The main purpose of this section is to present these research findings by describing coherent answers that are provided to this study's stated research questions. Prior to establishing answers to the research questions and drawing conclusions about them, it is appropriate to restate the research questions as was presented in chapter one:

1. What are risk-based inspections and what impact will they have on the New Zealand construction industry?
2. How will the implementation of risk-based inspections affect building consent authorities and construction stakeholders?

Other sub-questions addressed by the study include:

- what is a risk-based building inspection?
- what alternative approaches to risk-based building regulation exist overseas?
- what risk-based building regulation concepts have been adopted in New Zealand, and are they effective?
- what is the construction stakeholders' understanding of risk-based inspection as a regulatory tool?
- what are the key stakeholders' experiences with risk-based building inspections?
- how does the New Zealand building consent process currently operate in specific building inspections?
- what would be a possible mechanism for implementing risk-based inspections as a BCA tool?

The following sub-sections describe the fulfilment of the research questions described above, with the corresponding findings of this study. The chapter is subdivided on the basis of the research questions developed.

### 8.1.1 What is a risk-based building inspection?

The research developed this research question to help fulfil objective one:

- to establish an understanding of risk-based inspection in the context of building regulations

The purpose of this question was to define ‘risk-based building inspection’ in the content of a regulatory tool. The literature review in sections 2.9 to 2.12 begins with an understanding of how ‘risk-based regulations’ been variously defined by many authors and, in particular, within the construction industry. In general, the “risk-based” approaches define the risk as a combination of the consequences derived from a range of possible failure, and the likelihood of these failures (Magnusson et al., 1995). While a variety of definitions of the term ‘risk-based regulations’ has been suggested in the review of the literature, this research uses the definition suggested by Rothstein et al. (2006), at its simplest, “*Risk-based regulation allocating resources in proportion to risks to society (such as health, safety or environmental risks), in which the consequences of it happening and the overall impact are considered, in order to establish appropriate levels of control*”. However, Risk-based inspections (RBI) offer an evidence-based means of targeting the use of resources and of prioritizing attention to the highest risks in accordance with a transparent, systematic, and defensible framework (Black & Baldwin, 2010). Similarly, Zhaoyang et al., (2011) explain that risk-based inspection is a risk-based approach to prioritising and planning inspections. This type of inspection planning analysis reveals the likelihood of failure and the consequences of the same, in order to develop an inspection plan (Bertolinia et al, 2009). This study has taken the definitions from Rothstein et al., (2006), Black and Baldwin, (2010) Zhaoyang et al., (2011) and Bertolinia et al, (2009) to interpret ‘risk-based building inspection’ in the context of this study. As a result, this research question has been answered.

### **8.1.2 What alternative approaches to risk-based building regulation exist overseas?**

The research developed this research question to help fulfil objective two:

- to investigate risk-based models used in building regulations overseas.

The literature on methodologies used overseas to study risk-based regulations in section 2.12 revealed the introduction of new incentives has provided many benefits and rewards to countries that are fully committed to their implementation. The incentives have resulted in the reduction of time, hassle, and cost of building projects. The way the models are implemented shows that countries are being clever with their policies and targeting their resources to areas that require their full attention, which are key attributes of risk-based regulations. This study has found that in the United States of America, the goal was to lower housing costs through decreased government regulations and delay. The scheme involved a streamlined review process of its building consent process. The streamlined process grants villages the rights of city inspection within four hours of notification, but if the city cannot comply, building regulators can approve private inspections. In another part of the United States of America, one can hire a private consultant to carry out regulatory functions. The regulatory department carried out unannounced inspection audits, in which the quality assurance system provided the framework for the scheme. The regulatory department benefits from the assurance that construction work is completed in compliance with building regulations and a minimal expenditure of resources. The Hong Kong government proposed a new control regime to streamline the process of building proposal approval, by allowing private-sector practitioners to certify certain types of minor building works. The study suggests that the proposed regime is generally perceived as having the capacity to speed up the process of building proposal approval, whilst also improving overall standards of building performance in Hong Kong.

In Australia, consumers are provided a choice between engaging a municipal building control officer, and seeking the same service from private building control surveyors known as “private certifiers”. The British Government introduced risk-based inspections as a building control tool in 2013. The regulations state local authorities can specify notices of any other stages of construction when it considers a site inspection is necessary. Therefore, local authorities are able to concentrate their resources based on the complexity or risk of the project. The research found that a significant percentage (71%) of stakeholders agreed that the British risk-based inspection model should be considered as an alternative model to the current building inspection process. The implementation and use of risk-based models overseas has provided an impetus for the construction sector to fully implement some of these models as regulatory tools in New Zealand.

### **8.1.3 What risk-based building regulation concepts have been adopted in New Zealand, and are they affective?**

The research developed a research question to help fulfil objective three:

- to review existing risk-based models and their effectiveness in the New Zealand building consent process

The purpose of this question was to determine what risk-based building regulations had been adopted in the New Zealand construction sector, and to gain an understanding of the uptake and effectiveness of the models. A triangulated approach was used in data collection to address this question.

A preliminary literature review was conducted of building regulatory documents in New Zealand to establish policies that contained risk-based model concepts. The results of these preliminary analyses are presented in section of chapter 2. Further investigations involved the analyses of information obtained from a questionnaire survey and semi-structured interviews with key construction stakeholders in New Zealand. The analysis

of the questionnaire survey is presented in chapter 4, and semi-structured interviews in chapter 5. The analysis predominantly involved descriptive statistics and thematic analysis approach. Finally, the results of both the questionnaire survey and semi-structured interviews were validated by further interviews with SMEs.

The collated results using the triangulated approach show there is low awareness and understanding of government building documents that contain risk-based concepts. The ‘simple house design’, ‘multi-use consent’ process and the Building Act 2004 ‘amendments’ were introduced by the New Zealand Government as initiatives to improve affordability and productivity in the housing sector. The study found that the documents were too restrictive and the construction sector does not fully comprehend how the process for each stakeholder should work. In general, the New Zealand Government has introduced risk-based building concepts into the construction sector, but the uptake and understanding from stakeholders have been low, resulting in minimal impact on productivity in the sector. This research also found the implementation of new legislation should be promoted to all stakeholders, with the benefits at the forefront, and ongoing constant support of the scheme. This would ensure the process runs effectively and efficiently. Thus, this research question has been fulfilled.

#### **8.1.4 What is the construction stakeholders’ understanding of risk-based inspection as a regulatory tool?**

This research developed the research question to help fulfil objective four:

- to determine the real position in New Zealand regarding risk-based building regulations

The purpose of this research question was to determine, from construction stakeholders involved in the building consent process, their understanding of risk-based inspection and the possibilities of it becoming a BCA tool. The research investigation involved a

questionnaire survey of designers and building inspectors, and interviews with housing developers. Finally, the research sought SME's views in order to validate and simplify all prior findings. This study has identified that the sequence and order of regulatory inspections is reasonable, and combining some inspections or targeting inspections based on the complexity of the project would reduce the overall number of inspections in a project. The finding suggests there are currently too many inspections, and a review to reduce the number of regulatory inspections is required. The reduction of inspections could also occur in low-risk situations, but still be used at crucial points. Therefore, reduction of building inspection from regulatory control was possible, but there was still a need for a third party to carry out inspections at key stages of construction. Stakeholders expressed the view that it is important to promote risk prevention by those best placed to manage it. Participants further suggested that if the sector does not practice risk-based regulations, the BCAs will not be able to cope with housing demand. The survey analysis identified current regulatory inspections that designers would consider doing if BCAs, regulatory inspection were to be relaxed. The findings show that: framing, cavity wrap, cladding, and roofing were inspections that designers were happy to carry out. This study found that designers do have a good understanding of building regulatory compliance, as a majority of their building consent designs do not require reworking. The survey results also found that designers were happy to take on the responsibility for self-certifying their own designs in lieu of regulatory building inspections. There are certain areas (e.g. high-end residential or complex commercial construction) where designers could add value to regulatory inspections and project sign-off. According to designers, these are deemed to be outside the scope of building inspectors' knowledgebase. Participants further suggested that architects should be given responsibility for consenting work and also have the authority to sign off work, with peer reviews on complex projects or where there is difficult detailing. The study suggests the benefits of designers performing regulatory

inspections is that quality of workmanship improves, along with building code compliance. However, the study found that designer sign-off would increase their current workload, resulting in increasing of costs.

There is a small proportion of builders and housing developers in the sector who are ready and able to sign off their own work. The sector could not include everyone in the same category, as there are some very good practitioners and companies who are ready to use the risk-based inspection concept. Builders therefore need to have reassurance, in one form or another, that BCAs were treating everyone in the same manner in terms of building inspections, and there could be some clever initiatives to reward good performers. The SMEs were of the same opinion, that good builders should be rewarded with fewer inspections for consistently complying with building code compliance, but cautioned, that through a quality control process a different inspector would be brought in for random checks. The study suggests that regulatory building inspection is a specialist field, and excluding the BCAs, other sectors of the construction industry lacked the background or experience to carry out risk-based building inspection and would need to be educated and retrained. These findings confirm that question five has been achieved.

#### **8.1.5 What are the key stakeholders' experiences with risk-based building inspections?**

The research developed this research question to help fulfil objective five:

- to investigate construction stakeholders' experiences of risk in the building inspection process

The identification of key stakeholder experiences with risk-based inspections has been achieved by three means. These include the review of literature in chapter 2, the questionnaire survey analysis in chapter four and analysis of interviews in chapters 5 and 6. This study has produced a list of 'notifiable inspections in terms of risk rating' (see

table 7.1, chapter 7) and another list of ‘notifiable inspections requiring regulatory inspection’ (see table 7.2, chapter 7). The study has ranked 13 notifiable inspections in order of risk and need for regulatory inspection. The list of notifiable inspections in order of risk has found the worst five to be: membrane tanking, cladding, foundations, roofing and cavity wrapping. The ranking order of the five requiring most regulatory inspection are: code compliance certificate, final residential, cladding, drainage and foundations. Although these figures were generated using the perspectives of designers and building inspectors, there is a demand for housing in Auckland and Christchurch, putting pressure on construction stakeholders, in particular BCAs to focus resources where they are most needed. The list of ‘notifiable inspections in terms of risk rating’ and list of ‘notifiable inspections requiring regulatory inspection’ generated here is new knowledge, which the researcher believes will enable the construction sector to assess risk in terms of building inspections and assist BCAs in focusing resources where they are most needed. This process would provide the construction sector a sample of risk-based inspection for full implementation. As a result, this research question has therefore been answered.

#### **8.1.6 How does the New Zealand building consent process currently operate in specific building inspections?**

The research developed a research question to help fulfil objectives six and seven:

- to determine the current position of building inspections in the New Zealand building consent process
- to capture the extent of building consent authority inspection bottlenecks, which are contributing to the construction sector’s lack of productivity

The research investigation commenced by administering an online questionnaire survey to designers and building inspectors involved with the building consent process in New Zealand. The results of the questionnaire were presented in sections 4.6 to 4.8. This was followed by interviews with housing developers, which gave insight into the building

consent process. The results of the investigation are presented in sections 5.3 to 5.6. Finally, SMEs verified and expanded on the findings from the previous investigations, as presented in sections 6.7 to 6.9. The building consent process can be split into three main parts, consisting of the lodgement and processing, building, and code compliance certificate (CCC) stages. The BCAs and other construction stakeholders are responsible to ensure that building code compliance are satisfied on reasonable grounds. During the ‘building’ stage of the consent process, building inspections are required and ‘notified’ to the BCAs for a building inspector to go out on-site to inspect building work. The inspection is carried out by a council inspector or a private consultant who has been contracted to BCAs.

The study found that during the building consenting process, responsibility, accountability and those best to deal with risk can be aligned as follows: ‘lodgement and processing’ of building consents, designers are thought to be in the best position for dealing with risk. Critically, these results differ from the current building consent process, as ‘lodgement’ and ‘processing’ is conducted by the BCAs and not designers. In the ‘building’ phase, the results aligned with builders, and doing ‘building inspections’ aligned with the BCAs. Finally, the BCAs were thought by stakeholders to be in the best position to deal with the CCC stage, as shown in Figure 8.1.

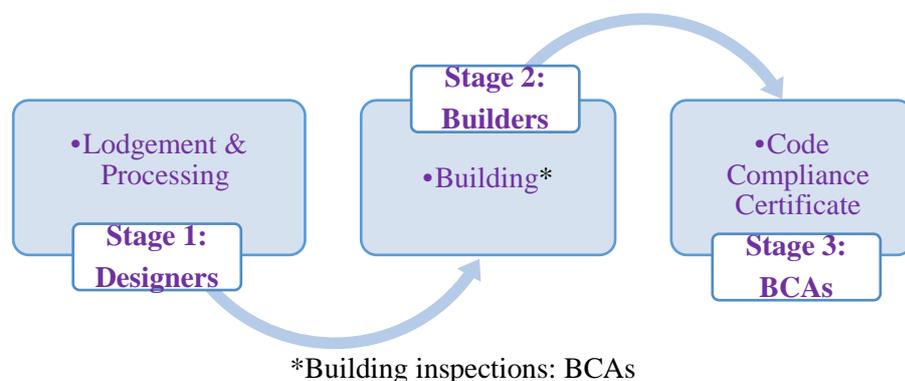


Figure 8.1: Accountability during building consent process

This investigation's results abundantly confirm that the current building consent process creates bottlenecks. It has been established that the booking stage of inspections, regulatory inspection numbers, excessive documentation, under-resourcing of BCAs, and stakeholder behaviour were contributing to bottlenecks in the building consent process in the New Zealand housing sector. Other salient factors responsible for bottlenecks are the lack of skills and knowledgebase presently within the New Zealand residential construction sector. The SMEs felt that all construction stakeholders require ongoing education, and suggested a minimum qualification for the sector. This study revealed that building inspectors and architects have a good understanding of building regulatory compliance, but other stakeholders have a poor understanding, because many of them have little-to-no experience with the entire building consent process. This research concludes there is a need for further training and education for all construction stakeholders in building code compliance, in the form of a minimum qualification supported by ongoing continuous professional development (CPD) programmes. The significance of these findings is that no prior empirical research in New Zealand has been undertaken to determine bottlenecks in the building consent process, which is impeding productivity in the construction sector. These findings have fulfilled this objective and answered the third research question.

#### **8.1.7 What would be a possible mechanism to implement risk-based inspection as a BCA tool?**

The research developed is research question to help fulfil objective four:

- to determine changes and seek suggestions from construction stakeholders about whether risk-based inspections could be a regulatory tool in New Zealand

This study found that risk-based inspections would struggle to work in the current construction environment, as the New Zealand construction sector is not mature enough

for full implementation. However, stakeholders' opinions were united in that risk-based inspection that once designed, piloted and supported well, could be fully introduced into the New Zealand housing construction scene as a BCA tool.

The questionnaire survey analysis found building inspectors' overall, have a good understanding of risk-based inspections, and that builders and product manufacturers need improvement. Although, designers' in the opinions of stakeholders, have good professionalism and competence, another finding showed that their understanding of risk-based inspections needs improvement. Further analysis of the semi-structured interviews suggested that a framework needs to be in place outlining the processes and procedures of risk-based inspection, and who is responsible for what. The SMEs further expressed the opinion that the government (MBIE) needed to lead the project, with support from construction stakeholders providing input into the process. Firmer legislation is also needed from central government to address stakeholder accountability and responsibility for building code compliance. For risk-based inspection to be considered for the New Zealand construction sector, central government would need to lead the process, with robust policies and procedures in place. The SMEs interviewed for the study expressed the view that there is critical information from past risk-based model projects that could contribute to the future implementation of risk-based models as regulatory tools. This study has produced a list of negative and positive key points from past risk-based model strategies, in an endeavour to strengthen future implementation of such models (see section 7.6.5). Therefore, it has identified that risk-based models, in the form of 'risk-based building inspections' do have a place in building regulatory and in the New Zealand construction scene.

These research sub-questions and the associated objectives conclude the research aspect of this thesis and permit a synthesis of all the information presented in chapters 7 and 8.

As a general conclusion to this section, the following explanations demonstrate the fulfilment of the two main research questions for this study. The study employed a quantitative and qualitative research approach involving a questionnaire survey, face-to-face interviews, and research verification using key construction sector stakeholders in the form of subject matter experts (SMEs), completing the triangulation approach, which yielded information that answered the research questions of this thesis. The research outcomes were produced to disseminate the research findings and used to gather feedback on the general direction of the study. A list of all the research publications generated from this study is included as Appendix D; copies of some of the research publications are included in D1 to D4.

Risk-based inspections are a risk-based approach to prioritising and planning inspections. Risk-based inspections offer an evidence-based means of targeting the use of resources in proportion to risks to society (such as health, safety or environmental risks), and of prioritising attention to the highest risks, in order to establish appropriate levels of control. The implementation of risk-based building inspections as a BCA tool will minimise or eliminate bottlenecks in the building consent process and alleviate pressure on building consent authorities in Auckland and Christchurch, which the study identified. Addressing these building consent process bottlenecks such as the booking stage of inspections, regulatory inspection numbers, excessive documentation, under-resourcing of BCAs, and stakeholder behaviour, should improve the productivity in the housing construction sector. It will create awareness of risk-based models and establishing a national qualification in 'building regulations' with a focus on 'building code compliance', which should be set as the minimum qualification to work in the sector. A minimum qualification that is supported by ongoing continuous professional development (CPD)

programmes was a further outcome of this study that was found to be an opportunity to improve the knowledgebase of construction stakeholders in New Zealand.

Finally, this research suggests specific improvements that can be made, to facilitate productivity in the house building sector, specifically in building consent processing in New Zealand. Based on the findings and general conclusions, recommendations are provided in the following section.

## **8.2 Recommendations**

The recommendations of this research are given in alignment with the findings of the reviews of the past literature, the questionnaire survey of designers and building inspectors, semi-structured interviews with housing developers, and finally the validation exercise using SMEs.

- The study found that once designed, piloted and supported well, risk-based inspection could be fully implemented into the New Zealand housing construction sector as a BCA tool. Every construction stakeholder would need to be in agreement and ready to take their new place, with the government (MBIE) needing to lead a nationwide project for its implementation.
- Firmer legislation is needed from central government to address stakeholder accountability and responsibility for building code compliance before the new scheme is fully implemented. In the United Kingdom, the Building (Amendment) Regulations 2012 of the Building Act 1984, the requirement to notify the local authority at prescribed stages of the building process changed. Regulation 16 of the amended building regulations now states that local authorities can specify notices of any other stage of construction, when it considers a site inspection is necessary. The implementation of this model could be used as a guideline in implementing the new scheme. It is therefore recommended that risk-based inspection be implemented as a BCA tool in New Zealand.
- New Zealand construction stakeholders have a low use-rate and understanding of newly introduced risk-based models, resulting in these initiatives having had a minimal impact on sector productivity. This needs to be improved so that simple

housing designs, duplication of housing projects and low-risk housing can be expedited through the building consent process. Therefore the study recommends:

- key points of contact for the schemes
- constant support from government of the legislation
- promotion to residential housing stakeholders of the benefits of the risk-based models
- improving existing capacities (the number of trained professionals able to use and support the legislation)
- improving the number of trained stakeholders able to adopt the techniques involved

This would ensure the process is widely utilised and runs efficiently and effectively.

- This study found the majority of stakeholders lack fundamental understanding of building code compliance and related legislation. An SME commented that the customer service team non-technical background of front-of-house BCA staff who took bookings did not understand the building consent process, which included not fully grasping what “notifiable inspections” consist of. The researcher believes that ongoing training and education for construction stakeholders in building code compliance will broaden the industry’s knowledge base, and increase building compliance on projects. It is therefore recommended that a minimum qualification, supported by ongoing continuous professional development (CPD) programmes, be introduced for residential construction stakeholders in New Zealand.
- Further, construction stakeholders need to be proactive in improving building code compliance knowledge, rather than awaiting for problems to arise. For product manufacturers and suppliers, not knowing the background of products, in terms of testing, limitations and compliance with building codes, provided hindrances to BCAs approving building consents or making decisions on-site during inspections. It is therefore recommended that building product manufacturers and suppliers produce relevant information on inventories for products/materials used in the New Zealand residential housing sector. This would support designers’ and BCAs’ approval processes, and consumers would be able to make informed decisions when carrying out transactions in the housing sector.
- The LBP scheme is not robust enough and that the use of LBP disciplinary board is not a deterrent for LBPs who produced non-compliant building work. The initial

intention of the industry, being more accountable for the work they produce has not eventuated. The study recommends that the Ministry of Business, Innovation and Employment re-examines the criteria for becoming an LBP, with a focus on qualifications and experience being set at a minimum, to lift the standards and professionalism of practitioners. It also recommends the LBP disciplinary board engages in harsher penalties for LBP offenders. Outcomes should be widely publicised throughout the construction sector to set a precedent for future law breakers.

- The sequence and order of regulatory inspections is reasonable, and combining some inspections or targeting inspections based on the complexity of the project could reduce the overall number of inspections in a project. This finding suggests that there are too many current inspections, and a review to reduce the number of regulatory inspection is needed. A reduction in inspections could also occur in low-risk situations, but they could still be held at crucial points. The study encourages the use of risk-based inspection so that BCAs are able to refocus their resources, based on the complexity or risk of the project. This would enable the building inspection process to become more productive and efficient for all good players, which would then enable the BCAs to spend more time on the people and projects that need a lot more oversight (e.g. non-compliant stakeholders, high-risk projects and complex buildings).
- The study recommends that designers be given the opportunity to carry out regulatory inspections at certain phases and sign-off on certain projects, such as high-end residential or complex commercial construction where designers could be acting in some respect in a clerk of works capacity. It is also recommended that designers be given responsibility for consenting work on complex projects or difficult detailing, with the use of independent peer reviews. The benefit would be that the quality of workmanship increases as well it being building code compliant.

### **8.2.1 Recommendations for future studies**

The study recommends further studies in the following areas that could expand these research findings:

- Designers are in the best position to deal with risks in the ‘lodgement’ and ‘processing’ of building consent stages of gaining building consent. Critically,

these results differ from the traditional building consent process, as ‘lodgement’ and ‘processing’ are carried out by the BCA’s, not designers. This could be because of the method of data collection in which ‘lodgement and processing’ were combined into one function. This research recommends that further investigation should be conducted into splitting the function into the individual processes of ‘lodgement’ and ‘processing’. This would be necessary for to establishing which stakeholder is in the best position to assess risk for each process.

- The research found the exodus of senior and experienced staff members has implications on stakeholder relationships, with new senior/team leaders at the BCA being unable to make a direct decision when clarifying discrepancies for their staff. BCAs tend to look more for business aptitude than industry construction practice when recruiting senior staff. The inconsistencies in direct decision making could be contributed to senior and management people distancing themselves from the technical operations of the business. The study found that BCAs have become more system-and-procedure focused, and less regulatory and technical. It is recommended that investigations be conducted to determine the effects of BCAs operations on the performance and productivity of the residential building sector and wider construction industry.
- The current research identified that excessive paperwork was unnecessary, as history suggests that council will always be held liable for any issues during the building consent process. Further research is required to investigate the “duty of care” of BCA’s and the liability set upon them through case law (*Invercargill City v Hamlin*, 1994). The precedent of this case law may suggest that whatever the allocation of risk in the residential housing building environment, BCA’s will always be apportioned liability.
- The current research has highlighted quality assurance as central to the low levels of non-compliance of many projects, and that more prescriptive checks are required to uncover incompetent contractors. Therefore, checks and balances in the form of a robust quality assurance process must be in place to monitor contractors. Despite this identification, little is known about ‘robust’ quality assurance processes in the context of residential housing. It could be useful to know whether ‘robust quality assurance’ processes and procedures are available in the industry, which could produce a template or model. Further research is recommended to investigate quality assurance processes as a regulatory tool.

### **8.3 Contribution to existing body of knowledge**

This study has contributed to the body of knowledge on risk-based inspections as a regulatory tool, in the context of residential buildings in New Zealand. It contains useful literature for future researchers who may have a similar interest in risk-based models and building regulations. In addition, this research provides essential information relevant for future industry improvement initiatives for reducing bottlenecks in the building process, and consequently improving productivity in the sector. The significance of this current study to construction stakeholders is outlined in the following sub-sections.

#### **8.3.1 Contribution to regulatory building consent authorities**

- Documentation is an important means of demonstrating to stakeholders that decisions have been resolved collectively, and the key objective is to avoid ‘individual’ blame should things go wrong. Trust and cooperation between internal and external stakeholders are formed from the outset to diffuse any issues during the project. It is also important to support risk-based inspection with the appropriate resources. The use of technology and appropriate IT programmes could mitigate or remove the need for excessive paper work during the building consent process.
- The research has found that consistency in decision making through the use of same inspector on projects provided benefits for the designer, builders and building inspector on-site. It benefits the BCAs, as an inspector going to a job becomes familiar with the project, and within the process will have built a relationship with the designer, builder and other key members on-site. The designer and builder are able to deal with the one person, which negates inconsistency. However, the BCAs have to remain independent through a quality assurance process, with the introduction of another inspector randomly through the process.
- This research produced a list of ‘notifiable inspections in terms of risk rating’ that ranks notifiable inspections in accordance with risk (see section 4.9). The BCA’s can now allocate resources based on the risks of the work inspected. Training and awareness of these tools is needed by BCA’s to assist with resourcing pressure during peak intervals.
- The research produced a list of ‘notifiable inspections requiring regulatory inspection’ that ranks notifiable inspections in accordance with need of a regulatory building inspection (see section 4.9.1). The BCAs could allocate

resources based on the ranking of the notifiable inspection. As indicated previously, an understanding of the tool through training and awareness should assist BCA's with resourcing pressure during peak intervals.

### **8.3.2 Contribution to the housing building sector**

- This research could help the housing sector to focus more on achieving building code compliance, with less reliance on a BCA. An attitudinal change will see other key stakeholders, besides that of BCAs, become more accountable for the work they perform and more aware of the importance of quality assurance processes and procedures. Hence, the BCAs will enforce deliberate non-compliance to those stakeholders that consistently breach the risk-based regulations.
- Increased productivity will result from a reduction in 'notifiable building inspections' during the building stage. Construction work could be continuous during this stage, with builders being able to organise sub-contractor time with more certainty around project timeframes.

### **8.3.3 Contribution to the construction industry**

- This research has increased the understanding of the extent of bottlenecks in the building consent process occurring during the building inspection stage and has provided opportunities to encourage using risk-based models as an alternative regulatory tool.
- It has provided further evidence that risk-based models can be implemented as alternative regulatory tools in the building consent, building inspection and building enforcement sectors where the following are considered for a robust system
  - all building inspection documents are kept on-site as a quality control check available to any stakeholder to audit
  - central government (MBIE) would have to organise the whole project but not necessarily need to run it, resulting in buy-in from stakeholders and consistency across the country
  - a template or guidance document of what is expected from each party and who is responsible during the process must be accessible to all stakeholders
  - stakeholders who want to participate in the process must be vetted for competency against the complexity of the project for example, their history

and experience on projects, the type of quality control and assurance, their experience, qualifications, affiliations, insurance cover etc.

#### **8.4 Conclusion**

This study investigated risk-based building inspections as an alternative means of compliance, and a tool for increasing the productivity of construction in the residential housing market in New Zealand. It has identified several knowledge gaps in risk-based model implementation in New Zealand. These knowledge gaps were formulated into research questions, which have been addressed through the research investigation. The extent of Building Consent Authorities inspection bottlenecks that were contributing to the construction sector's lack of productivity were systematically addressed through a mixed methodological approach. The overall aim was to evaluate the feasibility of implementing a risk-based inspection scheme in building consent authorities in New Zealand. It was found that risk-based inspection could be implemented as a BCA regulatory tool, but certain considerations, in the recommendation section of this chapter, would need to be addressed. This project is a unique study in New Zealand, because no research has conducted an extensive empirical study on risk-based inspections and the bottlenecks experienced within the regulatory building inspection process particularly within the building consent process. One major cause of hiatuses in the building consent process was found to be regulatory building 'notifiable inspection' numbers, which contributed to the bottleneck issues when booking inspections, and the under-resourcing of BCAs. Other causes of bottlenecks were the lack of understanding of builders, designers, developer and homeowners about risk-based regulations, and the inconsistency of building inspectors while interpreting and enforcing building code compliance. It was made apparent in the study that further education and on-going retraining in building code compliance is required for the whole construction sector in New Zealand. A national framework that sets a minimum qualification supported by ongoing continuous

professional development (CPD) programmes would improve the knowledgebase of construction stakeholders in New Zealand. Such a framework would facilitate both building code compliance improvements and other productivity development drivers. Some of the current research findings support existing knowledge, but substantial new knowledge in the general area of regulatory risk in the building inspection process is expounded in this study (see sections 7.3 to 7.8.) Of significant relevance is the list of ‘notifiable inspections in terms of risk rating’ (see Table 7.0, chapter 7) and list of ‘notifiable inspections requiring regulatory inspection’ (see Table 7.1, chapter 7) for residential buildings in New Zealand, which the current study recommends for the improvement of the building consenting process. These lists provide useful information for stakeholders involved in the building consent process, by establishing the ranking of a notifiable inspection in terms of risk and requirement for a regulatory inspection.

A significant number of this study’s participants had highlighted quality assurance as central to self-regulation on projects. The significance of quality assurance and self-regulation of projects has been identified by previous studies. The current study suggests that self-regulation is dependent on the category of the building in terms of risk and not the person or people carrying out the building work. Therefore, once the building category or risk of the building has been established, checks and balances in the form of a robust quality assurance process needs to be in place to monitor builders.

It is hoped that this research will make a positive contribution to housing issues that exist within the industry and, more importantly, assist BCAs with bottleneck issues that are creating pressure on resources. Recommendations made in this study, if taken on board, could improve a large number of relatively inexperienced stakeholders. During the study, further earthquakes in Kaikoura and in Wellington in 2016 damaged building stock in New Zealand, putting more pressure on the construction sector and reinforcing the need

for this research. Indeed, the current study is important in the context of low productivity within the industry as a result of complicated and extended building consenting processes.

The study can assist in achieving the government's goals of:

- quality homes and buildings produced through a business-enabling and efficient regulatory framework
- ensuring consumers are able to make informed decisions when carrying out transactions in the housing sector
- ensuring buildings are produced cost-effectively by a productive sector with the right skills and knowledge
- implementing a regulatory system that is administered in an efficient and cost-effective manner

Building Consent Authorities need to focus their limited resources on problem areas in the building consent process, and reward good players in the industry with incentives such as reduced inspections. This study therefore concludes that alternative methods of regulatory building code compliance could be in the form of a risk-based model, and in this particular case, risk-based building inspections. The implementation of risk-based inspection as a building regulatory tool would assist and alleviate pressures on BCAs and encourage productivity in the construction industry in New Zealand.

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## **Glossary of Building Terms**

### A

**Acceptable Solution** – A design solution deemed to comply with the Building Code that is pre-approved and therefore has fewer compliance costs associated.

**Alteration** – The rebuilding, re-erecting, repairing, enlarging and extending of a building.

**Alternative solution** – A design solution that differs totally or partially from Acceptable Solutions or Verification Methods in the Compliance Documents, yet complies with the performance requirements of the Building Code. These are ‘standalone’ solutions put forward and substantiated by the building consent applicant and considered and approved on their individual merits by a building consent authority.

**Amendment** – Changes to the plans and/or specifications on which the building consent was granted require an amendment to the original consent.

### B

**Beams** – Load bearing cross members, usually timber or steel, that support the upper structure of a building – additional floors and/or roofs.

**Building** – Any temporary or permanent, movable or immovable structure including a structure intended for occupation by people, animals, machinery or chattels.

**Building Code** – The national, mandatory standards for building work. All building work in New Zealand must comply with the Building Code.

**Building consent** – Consent issued by a building consent authority for building work to begin in accordance with the approved plans and specifications. For information about when a building consent is required and how to apply, see Building consents and inspections process.

**Building Consent Authority (BCA)** – BCAs are Territorial Authorities, Regional Authorities or private body that has been registered by the Department of Building and Housing. BCAs issue building consents, undertake inspections during construction and issue code compliance certificates, notices to fix and compliance schedules.

**Building envelope** – The entire exterior surface of a building, including foundations, walls, doors and windows that encloses or envelops the space within.

### C

**Cavity** – The cavity space immediately behind a wall cladding that has vents at the base of the wall. Cavities allow for drainage, which is one of the four principles in managing water in and around buildings.

**Certificate of Acceptance** – A certificate issued by a BCA to retrospectively approve unconsented work, or approve work where a BCA is unable or refuses to issue a code compliance certificate in respect of building work for which it granted a building consent. The certificate confirms that, to the extent an inspection was able to be carried out, the work complies with the Building Code.

**Cladding** – The exterior weather-resistant surface of a building.

**Code Compliance Certificate (CCC)** – A certificate issued by a BCA at the completion of building work, confirming that the building work complies with the building consent.

**Compliance** – Occurs when building performance, according to the standards in the Building Code, has been achieved.

D

**Drainage Inspection** – Inspecting of the drains includes the depth of the drains, the bedding, the gradients, leakage test, inspection points, gully traps, terminal vents and connection to approved outlets.

**Durability** – ‘Durability’ is covered by Clause B2 of the Building Code.

E

**E2** – ‘E2 External moisture’ is a clause within the Building Code requiring the prevention of water that could cause undue dampness and damage to building elements.

**Eaves** – The part of the roof that extends out over the walls.

**Exempt building work** – Building work not requiring building consent as defined in section 41 and Schedule 1 of the Building Act 2004. Exempt building work must still comply with the Building Code.

F

**Fascia** – any relatively broad, flat, horizontal surface, but usually referring to the edge of the roof line where the gutters attach.

**Flashing** – A building element used on a joint between two materials designed to catch and drain rainwater to prevent it penetrating the interior. Inadequate flashings have been linked to problems with Weathertightness.

**Foundations** – The substructure that supports a building, such as piles, piers or footings, with the purpose of transmitting structural loads from the building into the earth.

**Frame/framing** – The skeletal framework of a building to which roofs, floors and cladding are attached. Usually constructed of wood or steel, the components of the frame include studs, beams, joists and rafters.

G

**Green building** – The practice of increasing the efficiency with which buildings and their sites use and harvest energy, water, and materials, to reduce building impacts on human health and the environment. This includes aspects of siting, design, construction, operation, maintenance, and removal.

J

**Joists** – Parallel beams of timber, concrete or steel for supporting floors or ceilings, etc.

L

**Licensing Building Practitioners (LBPs)** – A licensing system for the building industry covering designers and trades. From March 2012 certain critical building work will need to be carried out or supervised by a licensed building practitioner.

M

**Monolithic cladding** – A cladding of sheet material forming a continuous mass, with an applied coating to give the appearance of a seamless cladding. This type of cladding has sometimes been implicated in issues of weathertightness.

P

**Pre-line inspection** – Checking of items that are to be closed in or covered. These items include structural framing and fixings, electrical wiring/fittings, plumbing and drainage and installation.

**Post-line inspection** – majority of wall bracing in light timber/steel framed buildings is provided by wall linings which depend on specific nailing or fixing patterns. The fixings are usually covered by plaster, skirting and scotia's and need to be inspected before finishing work commences.

**Producer statement** – A statement expressing the author's view that plans, specifications, or completed works comply with the technical requirements to satisfy some or all requirements of the Building Code – A producer statement will usually be issued by a recognised specialist, for example, an engineer, architect or competent contractor. It is up to the building consent authority (BCA) to decide whether to rely on such a statement. These documents have no specific status in law, but they can still be accepted and considered by a BCA as part of the plans and specifications.

**Product certification** – Certification by a product certification body that a specific building product, system or method meets nominated provisions of the Building Code, if used in accordance with conditions on the product certificate.

**Purlins** – longitudinal member in a roof frame, usually for supporting common rafters or the like, between the plate and the ridge

Q

**Quantity Surveyor** – A person trained in construction measurement and costs. They usually work closely with the architect/designer, engineer and builder to itemise the quantities of materials and labour needed to build a house or other building, using the design drawings, and to give an estimate of how much the project should cost.

R

**Renovation** – To restore to a previous or better condition.

**Resource consent** – A consent issued by a Territorial Authority to use the land in a way that is not a permitted activity under a council or district plan. Resource consent will be needed when a building project will contravene a permitted activity, for example, wishing to locate a building closer to the boundary than permitted on the District Plan.

**Restricted building work** – Building work that requires a building consent and relates to an element of a building that is critical to the integrity of the building and the health and safety of its occupants and includes, without limitation, work on the building envelope and the structural support of a building. Restricted building work must be carried out, or supervised by, a licensed building practitioner.

**Risk matrix** – A table in the Clause E2 Compliance Document (Acceptable Solution E2/AS1) that enables the calculation of a 'risk score' by the allocation and summing of scores for a range of design and location factors applying to a specific building design. Once this score is known, the range of allowable claddings can then be determined.

S

**Soffits** – the underside of an architectural feature, as a beam, arch, ceiling, vault, or cornice but usually referring to the underside of the eaves.

**Specifications** – Detailed written instructions containing details of work to be done and materials to be used in the construction of a building.

**Subcontractor** – A tradesperson hired to do specific work such as roofing, plumbing, wiring or painting. The subcontractor takes instructions from, is paid by, and is responsible to the main contractor.

T

**Tradesperson** – A skilled manual worker who has typically been formally trained through an apprenticeship programme, for example a carpenter, plumber, roofer, painter or plasterer.

V

**Variation** – A change to the approved plans and specifications for a building project, occurring during construction. A variation requires an amendment to the building consent and needs to be formally advised and justified to the building consent authority, and then checked, approved and recorded by the building consent authority.

W

**Warranties** – A promise, either written or implied, that the materials and workmanship of a building are without defect or will meet a specified level of performance over a specified period of time. The Building Act 2004 (sections 397–399) provides that building work on household units is automatically covered by warranties as to the manner in which the work is undertaken and the suitability of materials used. The warranties apply whether written into the contract or not.

**Waterproof/waterproofing** – The process of rendering a building element or building totally resistant to the ingress of any moisture.

**Weathertightness** – The resistance of a building to the weather. Weathertightness is not necessarily waterproofing (see above). A building is weathertight when water is prevented from entering and accumulating behind the cladding in amounts that can cause undue dampness or damage to the building elements, ie. moisture may occasionally enter a weathertight building but is able to harmlessly escape or evaporate.

Source: Ministry of Business, Innovation & Employment: Building and Housing Group

# Appendix A: Ethics Approval



A U T E C  
S E C R E T A R I A T

25 November 2014

James Rotimi  
Faculty of Design and Creative Technologies

Dear James

Re Ethics Application: **14/301 Evaluation of the feasibility and effectiveness of the newly implemented/introduced risk based building inspection scheme as a building consent authority tool.**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 24 November 2017.

As part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/researchethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 24 November 2017;
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/researchethics>. This report is to be submitted either when the approval expires on 24 November 2017 or on completion of the project.

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to obtain this. If your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply there.

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz).

All the very best with your research,

Kate O'Connor  
Executive Secretary

**Auckland University of Technology Ethics Committee**

Cc: Jeff Samasoni [jsamason@aut.ac.nz](mailto:jsamason@aut.ac.nz)

A u c k l a n d U n i v e r s i t y o f T e c h n o l o g y E t h i c s C o m m i t t e e

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## Appendix A2: Participant Information Sheet

# Participant Information Sheet



### New Zealand residential building inspectors survey questionnaire

#### Date Information Sheet Produced:

25 July 2014

#### Project Title

Evaluating the feasibility and effectiveness of risk-based building inspection scheme as a Building Consent Authority tool.

#### An Invitation

Hello, my name is Jeff Clement Samasoni; I am a doctoral student with the School of Engineering (Construction Management Programme), Faculty of Design and Creative Technologies, Auckland University of Technologies. My PhD research is on risk-based building inspection scheme as a Building Consent Authority tool. The intent of the research is to evaluate the feasibility and effectiveness of this scheme as a regulatory tool. This thesis should therefore provide a blue print for feasibility of risk based inspections in New Zealand.

You are invited to participate in this research by filling out the survey questionnaire. Please be advised that your participation in this survey is completely voluntary. By completing the questionnaire, you are indicating your consent to participate in the survey.

Completed questionnaire should be returned in the self-addressed envelope attached or if by online by pressing the submit button at the conclusion of the survey.

#### What is the purpose of this research?

This study aims to evaluate risk based inspection for it feasibility and effectiveness or deterrent as a regulatory tool in New Zealand. Some other objectives are,

1. To determine the level of understanding of risk-based inspections amongst building controls authorities and construction stakeholders.
2. To determine the understanding of risk-based inspection and the implications on construction stakeholders.

#### How was I identified and why am I being invited to participate in this research?

You have been identified as being one of the major stakeholders in the New Zealand Construction Industry and a regulatory building inspector. Your details have been obtained through local Council database.

#### What will happen in this research?

The data collected and its analysis will provide an insight into risk-based inspection as a building controls tool in New Zealand. The results obtained from the data analysis could be published in academic conferences and journals.

This version was last edited on 8 November 2013

**What are the discomforts and risks?**

Participation in this study carries the same amount of risk that individuals will encounter during a usual organisational survey request. Potential discomfort and risk associated with this research are limited to privacy and confidentiality. All responses will be treated in strict confidence and the information you provide will be strictly utilised for this research purpose.

**How will these discomforts and risks be alleviated?**

The information provided will be totally anonymous as your name and address is not required on the questionnaire. As a result there will be no issues of discomfort and risk regarding privacy and confidentiality. There will be no way in identifying participant's responses in any future publications since no demographic details have been disclosed.

**What are the benefits?**

This research would be a catalyst for risk based inspections being implemented nationwide as a regulatory tool. Some other contributions include:

- A regulatory system that is administered in an efficient and cost effective manner.
- Stake holders view in ensuring responsibility sits in the right place
- Undue reliance on building consent authorities

Overall this study will provide a tool that will fast track the consenting process and improve productivity within the wider construction industry.

The research is in partial fulfilment of a PhD award to the researcher on completion of this research.

**How will my privacy be protected?**

This research does not seek to gather personal or confidential information from participants. The questionnaire is anonymous.

**What are the costs of participating in this research?**

The cost associated with your participation is the time involved. The questionnaire will take between 10 to 15 minutes to complete.

**What opportunity do I have to consider this invitation?**

Please take a few days to consider this invitation. Your contribution will be invaluable to this research. If you require further information or clarification on any aspect of the research, please feel free to contact Jeff Clement Samasoni, Construction Management Programme, School of Engineering, Auckland University of Technology. Ph. 021 221 3196 email: jsamason@aut.ac.nz

**How do I agree to participate in this research?**

If you decide to participate in this research, please complete the questionnaire. Your submission of the questionnaire will be considered as your consent to participate in this research.

**Will I receive feedback on the results of this research?**

A summary report of the findings will be available on request. However the full report will be available as a thesis which will be accessible at the AUT library.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Senior lecturer Dr. James Rotimi, Construction Management Programme, School of Engineering, Auckland University of Technology. Ph. (09) 921 9999 ext. 6450 email: jrotimi@aut.ac.nz*

and,

*Professor Peggy Fairbairn-Dunlop, Foundation Prof Pacific Studies, Social Sciences & Public Policy Institute of Public Policy (AP), Auckland University of Technology. (09) ext. 6203 email: peggy.fairbairn-dunlop@aut.ac.nz*

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEK, Kate O'Connor, *ethics@aut.ac.nz*, 921 9999 ext. 6038.

**Whom do I contact for further information about this research?****Researcher Contact Details:**

Jeff Clement Samasoni, Construction Management Programme, School of Engineering, Auckland University of Technology. Ph. 021 221 3196 email: jsamason@aut.ac.nz

**Project Supervisor Contact Details:**

Provide the name and all relevant contact details. Note that for personal safety reasons, AUTEK does not allow researchers to provide home addresses or phone numbers.

*Senior lecturer Dr. James Rotimi, Construction Management Programme, School of Engineering, Auckland University of Technology. Ph. (09) 921 9999 ext. 6450 email: jrotimi@aut.ac.nz*

And *Professor Peggy Fairbairn-Dunlop, Foundation Prof Pacific Studies, Social Sciences & Public Policy Institute of Public Policy (AP), Auckland University of Technology. (09) ext. 6203 email: peggy.fairbairn-dunlop@aut.ac.nz*

Approved by the Auckland University of Technology Ethics Committee on 25<sup>th</sup> November 2014, AUTEK Reference number 14/301.

This version was last edited on 8 November 2013

# Appendix A3: Consent Form

## Consent Form



*Project title: Evaluation of the feasibility and effectiveness of the newly implemented/introduced risk-based building inspection scheme as a Building Consent Authority tool.*

*Project Supervisor: Dr. James Rotimi*

*Professor Peggy Fairbairn-Dunlop*

*Researcher: Jeff Clement Samasoni*

- I have read and understood the information provided about this research project in the Information Sheet dated.
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- I agree to take part in this research.
- I wish to receive a copy of the report from the research (please tick one): Yes  No

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....  
.....  
.....  
.....

Date:

**Approved by the Auckland University of Technology Ethics Committee on 25<sup>th</sup> November 2014, AUTEK Reference number 14/301**

*Note: The Participant should retain a copy of this form.*

This version was last edited on 8 November 2013

# Appendix B1: Survey Questionnaire



Research Survey  
Construction Stakeholders in New Zealand

## Residential Building Designers

### Evaluation of the effectiveness of Risk-based Building Inspection Scheme as a Regulatory tool

Please take a few minutes to fill out this survey on risk-based inspections. Your answers will be kept confidential. Thank you for your participation.

#### Section A: Demographic Information

1. How long have you been involved in the construction industry in New Zealand?

- 0 – 24 months       2 – 10 years       10 – 20 years       20 + years

2. How long have you been a designer in New Zealand?

- 0 – 24 months       2 – 10 years       10 – 20 years       20 + years

3. What would you describe as your main role today in the New Zealand construction industry from the categories below? (Please tick 1)

- Reg. architect       Architectural designer       Graduate / student  
 Other, Please state .....

4. Which areas in New Zealand from the list below have you carried out Design work within the last 24 months? (Tick as many)

- Auckland     Christchurch     North Island (other than Auckland)     South Island (other than Christchurch)

5. Which from the list below have you provided design work for in the last 24 months? (Tick as many)

- House       Town House       Apartment       Retirement village  
 Outbuildings (Barns, Garages etc)       Fencing of swimming pools       N/A

## Section B: Regulatory Balance in New Zealand

1. Please indicate which of the following New Zealand building Regulatory documents you are familiar with? (Tick as many)

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Building Act 2004          | <input type="checkbox"/> Building 2004 Amendment Acts | <input type="checkbox"/> NZ Building Regulations 1991       |
| <input type="checkbox"/> NZ Building Code           | <input type="checkbox"/> NZ/AS Standards              | <input type="checkbox"/> Fencing of swimming pools Act 1987 |
| <input type="checkbox"/> Restricted building work   | <input type="checkbox"/> DBH Multi-use consent        | <input type="checkbox"/> DBH Simple house design            |
| <input type="checkbox"/> BA04 Schedule 1 Exemptions | <input type="checkbox"/> None listed                  |   |

2. Which of the themes from the Government review of the 2004 Building Act in 2009 are you familiar with? (Tick as many)

- |   |   |
|---|---|
| <input type="checkbox"/> Problems with ensuring responsibility sit in the right place | <input type="checkbox"/> Moving to a more balanced approach to building control |
| <input type="checkbox"/> Building consumer confidence                                 | <input type="checkbox"/> None of the above                                      |

3. Please indicate which consent type from the Building Act Amendments 2012 you are familiar with? (Tick as many)

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Standard Building Consent   | <input type="checkbox"/> Low-risk building consent | <input type="checkbox"/> Simple residential building consent |
| <input type="checkbox"/> Commercial building consent | <input type="checkbox"/> None of the above         |  |

4. Responsibility and accountability for ensuring building quality and reducing the number of defects is not well aligned to the ability of each party, in your opinion which of the following stakeholders should residential building code compliance be aligned to throughout a project. (Tick as many)

- |   |  |   |
|---|--|---|
| <input type="checkbox"/> Building Owner                       | <input type="checkbox"/> Designers                 | <input type="checkbox"/> Builders                       |
| <input type="checkbox"/> Building controls (Local Government) | <input type="checkbox"/> MBIE (Central Government) | <input type="checkbox"/> Material/ Product manufactures |

5. Prioritize your answers in the below table. e.g each vertical column should equate to 100%

STAKEHOLDERS	Lodgment	Consent processing	Construction	Inspections	Code Compliance Certificate (CCC)	After CCC Issued
Building owner						
Designers						
Builders						
Government (MBIE and Local Building Controls )						
Material / product manufactures						
Total %	100%	100%	100%	100%	100%	100%

## Section C: Risk-based Inspections

1. What is your understanding of risk-based building inspections?

- Outstanding                       Good                       Adequate  
 Needs improvement               Poor                       None

2. Please indicate from the group of inspections below what risk should be associated in terms of residential construction and in your opinion if inspection is to be carried out by regulatory inspectors. ("No" will mean that other registered parties would sign work off for building compliance, e.g LBPs, Architects, IPENZ etc)

Inspections	Low	Medium	High	Don't Know	Regulatory inspection		
					Yes	No	Don't Know
Siting							
Drainage							
Foundations							
Blockwork							
Framing							
Membrane tanking (external)							
Cladding							
Pre-line Building							
Post/ Fire line bracing							
Membrane tanking (Internal)							
Subfloor							
Isolated footing							
Wrap							
Cavity							
Re-clad							
Pool fencing							
Code compliance certificate							
Final							

---

3. Current Regulatory Inspection on a new residential building can number up to 20 building inspections, does there need to be a review on the number of inspections?

Yes |  No |  N/A

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4. United Kingdom (UK) Building controls have introduced into regulations risk-based building inspection in 2013, in which they have reviewed their compulsory building inspections in favour of risk assessment of projects resulting in reduced building inspections. In your opinion should New Zealand regulatory also look at a risk assessment approach to building inspections?

Yes |  No |  Not Sure

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5. In your opinion is the New Zealand construction industry ready for current regulatory inspections to be relaxed in favour of a risk based assessment approach?

Yes |  No |  Not Sure

## Section D: The Building Inspection Process

1. Has any of your project inspections resulted in a re-design due to non-building code compliance?

Yes |  No |  Don't know

If yes which inspections:

.....

2. Has any of your project inspections resulted in stop-work from a building inspector due to non-compliance?

Yes |  No |  Don't know

If yes which inspections:

.....

3. Has any of your project inspections resulted in a Notice to fix being issued?

Yes |  No |  Don't know

If yes which inspections:

.....

4. In your opinion which of the following inspections from the list below could be carried out by a registered architect to satisfy building code compliance without regulatory building inspector's intervention.

Residential Inspections	Registered Architect inspection		
	Yes	No	Don't know
Siting			
Drainage			
Foundations			
Blockwork			
Framing			
Membrane tanking (external)			
Cladding			
Pre-line Building			
Post / Fire line bracing			
Membrane tanking (Internal)			
Subfloor			
Wrap			
Cavity			
Re-clad			

Pool fencing			
Code compliance certificate			
Final			

3. What was your overall impression of the professionalism and competence of building stakeholders in regards to building code compliance in the last 24 months?

Designers

- |  |                               |                                   |
|--|-------------------------------|-----------------------------------|
| <input type="checkbox"/> Outstanding       | <input type="checkbox"/> Good | <input type="checkbox"/> Adequate |
| <input type="checkbox"/> Needs improvement | <input type="checkbox"/> Poor | <input type="checkbox"/> N/A      |

Builders and sub trades

- |  |                               |                                   |
|--|-------------------------------|-----------------------------------|
| <input type="checkbox"/> Outstanding       | <input type="checkbox"/> Good | <input type="checkbox"/> Adequate |
| <input type="checkbox"/> Needs improvement | <input type="checkbox"/> Poor | <input type="checkbox"/> N/A      |

Building inspectors (Council)

- |  |                               |                                   |
|--|-------------------------------|-----------------------------------|
| <input type="checkbox"/> Outstanding       | <input type="checkbox"/> Good | <input type="checkbox"/> Adequate |
| <input type="checkbox"/> Needs improvement | <input type="checkbox"/> Poor | <input type="checkbox"/> N/A      |

Building inspectors (Private sector)

- |  |                               |                                   |
|--|-------------------------------|-----------------------------------|
| <input type="checkbox"/> Outstanding       | <input type="checkbox"/> Good | <input type="checkbox"/> Adequate |
| <input type="checkbox"/> Needs improvement | <input type="checkbox"/> Poor | <input type="checkbox"/> N/A      |

Building manufactures and suppliers

- |  |                               |                                   |
|--|-------------------------------|-----------------------------------|
| <input type="checkbox"/> Outstanding       | <input type="checkbox"/> Good | <input type="checkbox"/> Adequate |
| <input type="checkbox"/> Needs improvement | <input type="checkbox"/> Poor | <input type="checkbox"/> N/A      |

**Additional Feedback**

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Thank you for taking the time to fill out our survey. Your input is greatly appreciated.

# Appendix B2: House Developers Questions

## Research Survey

### Risk-based building inspection scheme as a Building Consent Authority tool.

#### House Developers Interview

##### Interview Details

Company Name: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Interviewer Name: \_\_\_\_\_

Interviewer Title: \_\_\_\_\_ Interviewer Phone Number: ( ) \_\_\_\_\_

Years with Company: \_\_\_\_\_

##### Regulatory Balance in New Zealand

In the past 2 years has there been a notifiable increase in residential development in which your company has been involved with?

Which of the following New Zealand building Regulatory documents are you familiar with?

- Building Act 2004    NZ Building Regulations 1991    Building 2004 Amendment Acts  
 NZ Building Code    NZ/AS Standards    None listed

What are your thoughts on the Regulatory balance in construction in New Zealand?

What are your thoughts about the LBP scheme?

##### The Building Inspection Process

What are your thoughts on council inspections?

What are your experiences of council inspections?

Does the council inspections process contribute to bottleneck in your build time?

Does council inspection process need improving and if so, What would you suggest?

<b>Risk-based Inspection</b>
What is your understanding of risk-based inspection in building construction?
Have you or your company been involved in risk-based inspection in New Zealand?
Current Regulatory inspection on new residential building can number up to 20 inspections, does there need to be a review on the number of inspections?
United Kingdom (UK) Building controls have introduced into regulations risk-based building inspection in 2013, in which they have reviewed their compulsory building inspections in favor of risk assessment of projects resulting in reduced building inspections. In your opinion should New Zealand regulatory also look at a risk assessment approach to building inspections?
In your opinion is the New Zealand construction industry ready for current regulatory inspections to be relaxed in favor of a risk based assessment approach?
<b>Other stakeholders in the New Zealand Construction Industry</b>
What are your thoughts of builders signing of construction work limited to their LBP license?
Would you be confident in builders signing off the Code Compliance certificate for all your residential projects?
What are your thoughts of architects / designers signing of construction work?
Would you be confident in Architect / designers signing off the Code Compliance certificate for all your residential projects?
What are your thoughts of product manufacturers and suppliers in the construction industry during and post construction of your projects?
<b>Thank you for your time</b>

## Appendix B3: Validation Exercise



Research Survey  
Construction Stakeholders in New Zealand  
Validation Exercise – Master Sample

### Evaluation of the effectiveness of Risk-based Building Inspection Scheme as a Regulatory tool

This questionnaire is a follow-on exercise to an online survey and to a set of semi-structured interviews administered within the New Zealand residential construction industry earlier this year. The data from the online surveys have been analyzed and the results are now presented for your verification and additional input. Your answers will be kept confidential. Thank you for your participation.

You are requested to provide your comments for the following key research findings.

#### Findings 1: Building regulations in New Zealand

##### Q1. Why do you think stakeholders familiarity of DBH simple house design and multi-use consent documentation is low (35%)?

1. Please indicate which of the following New Zealand building Regulatory documents you are familiar with?

Building regulation documents	Response Percent	Response Percent	Response Percent average
NZ Building Code	98.00%	98.90%	98.45%
Building Act 2004	100.00%	90.30%	95.15%
Restricted building work	94.00%	83.90%	88.95%
NZ Building Regulations 1991	84.00%	66.70%	75.35%
Building 2004 Amendment Acts	80.00%	67.70%	73.85%
BA04 Schedule 1 Exemptions	76.00%	40.90%	58.00%
<b>DBH Simple house design</b>	<b>58.00%</b>	<b>20.40%</b>	<b>39.20%</b>
<b>DBH Multi-use consent</b>	<b>38.00%</b>	<b>20.40%</b>	<b>29.20%</b>

2. Which of the themes from the Government review of the 2004 Building Act in 2009 are you familiar with?

Building regulation documents	Response Percent	Response Percent	Response Percent average
Problems with ensuring responsibility sit in the right place	62.0%	50.5%	56.25%
<b>Moving to a more balanced approach to building control</b>	<b>62.0%</b>	<b>33.3%</b>	<b>47.65%</b>

Building consumer confidence	48.0%	37.6%	42.80%
None of the above	22.0%	33.3%	27.65%

3. Please indicate which consent type from the Building Act Amendments 2012 you are familiar with?

Building regulation documents	Response Percent	Response Percent	Response Percent average
Standard Building Consent	76.00%	71.00%	73.50%
Simple residential building consent	76.00%	39.80%	57.90%
Commercial building consent	46.00%	50.50%	48.25%
Low-risk building consent	70.00%	24.70%	47.35%
Approved quality assurance system	36.00%	16.10%	26.05%
Approved risk profile	26.00%	8.60%	17.30%
Safety system review	22.00%	6.50%	14.25%
None of the above	10.00%	12.90%	11.45%

## Findings 2: Risk-based Inspections

Over 70% of stakeholders agreed that there were too many notifiable inspections and a review needed to take place.

Q2. What is your opinion on this?

1. Current Regulatory Inspection on a new residential building can number up to 20 building inspections, does there need to be a review on the number of inspections?

Review on current regulatory building inspections	Response Percent	Response Percent	Response Percent average
Yes	71.70%	68.80%	70.25%

Q3. What is your opinion on this?

2. United Kingdom (UK) Building controls have introduced into regulations risk-based building inspection in 2013, in which they have reviewed their compulsory building inspections in favour of risk assessment of projects resulting in reduced building inspections. In your opinion should New Zealand regulatory also look at a risk assessment approach to building inspections?

United Kingdom model	Response Percent	Response Percent	Response average
Yes	76.10%	67.50%	71.80%

Q4. What is your opinion on this?

3. In your opinion is the New Zealand construction industry ready for current regulatory inspections to be relaxed in favour of a risk based assessment approach?

NZ Construction industry risk-based approach	Response Percent	Response Percent	Response Percent average
No	65.20%	52.50%	58.85%

### Findings 3: Current building inspection regime

1. The current research identified that building professionals ranked the following regulatory inspections from 1 being the most *risk associated* to 13 being the less. Could you briefly explain the significance of any of these rankings?

Rank	Inspection type	N	Minimum	Maximum	Mean (M)	Std. Error	Std. Deviation
1	Membrane tanking	126	1.00	4.00	2.7063	.05642	.63331
2	Cladding	126	1.00	4.00	2.6270	.05490	.61624
3	Foundations and Subfloors	126	1.00	4.00	2.5635	.05690	.63870
4	Roofing	126	1.00	4.00	2.4365	.06120	.68698
5	Cavity / Wrap	126	1.00	4.00	2.3175	.06537	.73377
6	Code compliance certificate	126	1.00	4.00	2.3175	.07273	.81634
7	Final Inspection	126	1.00	4.00	2.3175	.07006	.78639
8	Post / Fire line bracing	126	1.00	4.00	2.2937	.06673	.74905
9	Drainage	126	1.00	4.00	2.1349	.06700	.75210
10	Siting	126	1.00	4.00	2.1111	.07578	.85062
11	Block work	126	1.00	4.00	2.1032	.06155	.69085
12	Framing	126	1.00	4.00	2.0794	.06818	.76528
13	Pre-line building	126	1.00	4.00	2.0079	.06424	.72107

2. The current research identified that building professionals ranked the following regulatory inspections from 1 being the most *Regulatory intervention* to 13 being the less. Could you briefly explain the significance of any of these rankings?

Rank	Regulatory Inspection	Frequency	Percent	Valid Percent	Cumulative Percent
1	Code compliance certificate	109	56.5	86.5	86.5
2	Final Inspection	102	52.8	81.0	81.0
3	Cladding	90	46.6	71.4	71.4

4	Drainage	87	45.1	69.0	69.0
5	Foundations and Subfloors	85	44.0	67.5	67.5
6	Cavity / Wrap	83	43.0	65.9	65.9
7	Pre-line building	83	43.0	65.9	65.9
8	Membrane tanking	82	42.5	65.1	65.1
9	Post / Fire line bracing	79	40.9	62.7	62.7
10	Framing	77	39.9	61.1	61.1
11	Roofing	72	37.3	57.1	57.1
12	Block work	62	32.1	49.2	49.2
13	Siting	59	30.6	46.8	46.8

3. What was your overall impression of the professionalism and competence of building stakeholders in regards to building code compliance in the last 24 months?

Stakeholders	Outstanding	Good	Adequate	Needs Improvement	Don't know
Designers	4%	51%	29%	13%	1%
Builders and Sub-trades	3%	25%	23%	30%	3%
Building Inspectors (Council)	1%	40%	27%	18%	3%
Building Inspectors (Contractors)	0%	27%	23%	12%	32%
Building Manufactures and suppliers	1%	29%	31%	23%	6%
Owners	0%	8%	13%	24%	11%

#### Findings 4: Stakeholders interview themes

1. The current research identified 10 main themes on the proposed risk-based inspection scheme being incorporated as a building consent authority tool. Could you please briefly comment on them?

No.	Themes
1	Booking of inspections: builders are waiting 5 – 10 days to have an inspector carry out a notifiable inspection as BCA do not have the resources for next day inspections.
2	Regulatory inspection numbers: The range of inspections seem reasonable as clients are aware of shoddy workmanship and regulatory inspectors provide a quality control measure when head contractors are too busy but a review of who should certify an inspection in terms of complexity could be reviewed.
3	Risk-based inspections has a place in the New Zealand construction industry in the future but currently the sector is not ready and not mature enough.
4	Self-regulation will not work as many builders have not been educated or trained in the aspect of building code compliance and rely heavily on council as a quality control checker. It will take many years for builders to be trade qualified and owners to be educated on the changes for mindsets to change.
5	LBP sign off of regulatory functions: Designers signing off on building work would be an expensive exercise and will not provide any cost saving to the process. Designers already have enough work in the front end of the process and to add building inspections would stretch their resources. They are seen more as a theory component to construction than practical.
6	LBP sign off of regulatory functions: Builders signing off would not be a good, even though the LBP scheme has been up and going for the last 8 years builders and owners are still heavily reliant on building inspector for building code compliance. Builders have a history and culture of being reliant on a second pair of eyes to double check their work whether it is a project manager or a building inspector.

- 7 The LBP Scheme has been long overdue and is a step in the right direction. There is still a long way to go as builders are slowly coming to terms of being responsible for their work. It is slowly weeding the bad builders out of the sector and the good builders that have been well established can now be a member of a professional institute.
- 8 Stakeholders Thoughts on Suppliers, Homeowners and regulatory balance. The larger the building company the more support you are likely to receive from product manufactures. The major issue with products are the relationship or lack of design detail with other products in which builders revert back to the designer or building inspector for compliance. Manufacturers are happy to stand back and avoid any liability if any should arise in the future.
- 9 Regulatory inspection barriers:
- The frustration with regulatory inspections in that different inspectors lacked consistency in decision making process.
  - Builders are aware of when inspector had been on training as that would be the flavour of the month during inspections and at times is very frustrating as the consented plans had already been approved.
  - The paperwork that is required for consenting and especially code compliance is excessive and more time is spent providing documentation than constructing a building so at the end of the day the same people are still liable.
- 10 Regulatory inspection improvements.
- A building project or area should have the same inspector allocated to it so a builder is able to build a working relationship.
  - Council need to find ways to spend less time on inspecting builders who are doing a good job and more where they are really needed.
  - Council need to reduce the amount of current inspections but still have them at crucial points.
  - The overall sequence of current inspection is good so inspection that are not inspected by council need to be picked up by other building professions who are in the best position to address risk

### Demographic Information

Profession:

.....

SME past titles:

.....

Work experience in the construction industry:

.....

Educational Qualifications

.....

### Additional Feedback

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Thank you for taking the time to fill out our survey. Your input is greatly appreciated.

## Appendix C1: SME Interview

### Interview Transcript

- A: Do you want me to tick these ones? No. Just sign it down here?
- Q: Yep. If you're happy with all of that you just sign it there and just put down participant's name. I've got your details from the website so that's fine. I can fill that bit in for you.
- A: Yep.
- Q: Excellent. Thank you for that. Just make sure that's working. Yes, that's good. Thank you. What I'll do is I've got a list of questions here. I'll go through the first just to get a background of yourself and then I'll go into some of the data and we'll finish off with a few more of the stakeholders' opinions and that.
- A: Yeah John.
- Q: My research is basically on risk-based inspections. What it's looking at is are you quite familiar with the UK model where they've actually gone to a risk-based inspection regime where they've gone away from the council, the local government?
- A: I'm not familiar with the English system. You mean risk-based consenting or risk-based inspections?
- Q: Risk-based inspections. They've actually taken the focus off the regulatory and they've actually put it back onto designers and they've put it back onto the industry itself.
- A: I need to do a bit of research on that because that's interesting.
- Q: It's a 2013 Act which they've just promoted a few years. They're looking at putting in the back of [01.53]. This is where this [01.54] extend from is can they...
- A: [01.56] to this one?
- Q: That's your copy, so you can make some notes.
- A: So the English have moved... I wasn't aware of that.
- Q: It's called Risk-Based Inspections 2013 Act.
- A: What about the consenting process though? Is that still traditional?
- Q: Yeah, it's traditional way. The only time they've actually gone to a regulatory is through planning, but everything else is pretty much stakeholders, architects and engineers that have actually gone through the process. Now they've actually moved away and actually followed that.

- A: That's interesting; so they're checking all the documents and making sure they comply in their opinion.
- Q: The architects.
- A: No, the councils are.
- Q: No, just on the planning area, for the consenting, they just go for the planning area and they put a lot of emphasis back on the registered architects. So you're building these premises, go to the planning, and you're putting your [02.53].
- A: What about in terms of the building regulations?
- Q: It all goes through the architects. So they have got like a two approach. That's what they're trying to do with the inspection regime is they've actually classified a number of buildings, and depending on the building, that will dictate how many [03.14] inspections or notified inspections that the owner can call for. So the 2013 risk is basically following the consenting process where they've given a lot of probably liability at this stage and responsibility back to those best [03.36].
- A: [03.37] perspective on the English. I knew that the Canadians had done it.
- Q: Yeah. It is quite interesting because it hasn't actually popped up in New Zealand. There's always been pilot schemes and that in the UK but nowhere through New Zealand has it actually been mentioned.
- A: Risk-based inspections. Obviously they're trying to do the risk-based consenting and it seems to have fallen into a hole again. We were involved in the pilot in Christchurch on a project and it became fairly apparent. I guess you'll ask questions about that later but there were some issues on all sides.
- Q: Yeah, that's exactly what I want to hear from you. We'll start off with the first question. These are just basically your opinion. What is your opinion on the current building consenting process?
- A: It's frustrating for everyone. From our point of view it always takes too much time. I think we find that the inspectors tend to be overloaded and in a lot of cases you might question their experience level because I think a lot of the old builders who used to be building inspectors seem to have drifted out and you've kind of almost got professional building processors who are coming from other backgrounds. They tend to ask for a whole lot of information that sometimes we find we're giving this information every project. They must be able to streamline the product information which just becomes massive. They have been talking, particularly in Auckland, about online consenting and I think it's actually in place now.
- Q: I think there's 'Consent Made Easy.'
- A: Something like that. But again, it's taken them years to do it. I'm quite involved in the past with the council. I think there's a lot of goodwill at various levels but most people do find the process fairly frustrating and wonder why it could not be a lot easier and more straightforward. I don't know whether that's partly to do with

people that are involved in it and the processes.

Q: You mentioned the people, you mean the people in council itself?

A: In council, yeah.

Q: So not the actual design [06.15] as such?

A: The design industry has got a lot to answer for but I think they're getting on top of that. There's been a lot of poor information, a lot of poor drawings going. We don't do that, we do good drawings and information. We find even then that there's a lot of queries that come back that sometimes you just wonder if somebody is just standing there saying how many different ways can we cover our arse I guess. Well, it's the feeling you get anyway.

Q: And that's from the council side, they're quite risk averse.

A: From the council side. Absolutely. But there's no question that there's a lot of variables in the amount, in the standard of the documentation they're getting which is a problem from their side as well.

Q: What's your opinion on the current building inspection process?

A: It's slightly hard for me to comment. From what I can observe particularly on domestic stuff it's pretty good.

Q: Does it hold up your projects as such?

A: I don't think so. Not to our knowledge. It's really the builders would have to answer that one because obviously they're the ones who book the inspections. It depends. Again, it's variable. Actually one thing I will say about the inspection process we've found frustrating particularly in Auckland is that you do not get consistent inspectors. That's just a real pain in the neck. And particularly at the end of a job when you'll get the final inspection, one guy will come out, he'll give you a list of things, and the guy that comes to check it is somebody else and he comes up with something else. I don't know if that still goes on but certainly in the past we've had problems with that, whereas when they work on Waiheke or whatever it's much better, you get one building inspector who's consistent through the project. If they're still doing that, that is a real problem, and I suspect they are, that you don't get one inspector assigned to the project all the way through.

Q: What improvements would you recommend in terms of current building inspection process?

A: What I've just said, just be consistent. Do not chop and change the inspectors because you can't build up a relationship and they don't build up knowledge of the job. And you would want to encourage more ex-builders back into the process. It seems to me we're getting a lot of things like people from overseas. These are all kind of site hearsay stories but again, on another job, we're trying to deal with an inspector who's come in from Wales. He is struggling with his knowledge of the Building Code.

That's the other thing these guys really need to be up to speed with is determinations, particularly around the areas of things like safety from falling. Be careful what I say. A lot of them do not have a full understanding of the Building Code, particularly with things like balustrades, handrails.

Q: Alternative solutions is probably a big one.

A: Not so much the alternative solutions.

Q: Just the basics Building Code?

A: Yeah. Quick example, we've had one commercial building, we had some louvres which came down to the ground [09.54] they open and the gap between them was more than 100. So the inspector comes along and says, "Oh no, you can't do that." I said, "Well, that's not correct because you've got to go back and read the act." The code, it's got to be a place where you expect children to be.

Q: Under six years old.

A: And a commercial building is not where in the normal course of your duties you'd expect kids to be.

Q: Yeah, that's right. So [10.18] high rise.

A: Yeah. Well, I wouldn't say in a high rise, it was two storeys, but I think there's a bit of education in terms of that which they may have got better at but certainly we've had issues in the past. The safety from falling is the classic one, the absolutely classic one.

Q: I think the objective [10.35] failure for that provision.

A: Yeah.

Q: I think what that [10.40] there there's a [10.40].

A: A lot of these guys, particularly the safety from falling, they'll come along and they'll see something that says there's a metre high thing so you've got to have a balustrade. Well no you don't because it's not where people normally go.

Q: Or congregate.

A: All this sort of stuff, yeah. But that's just one thing. I think the education of in terms of the building... and it's tricky but they do need to sit them down and say, "Look, here's the determinations. Here's what the Building Code is actually all about."

Q: What is your opinion about the LBP Scheme?

A: I don't know. I really don't know much about it to be honest. It hasn't really affected us much.

Q: 'Because you are all registered architects.

A: We're all registered architects so we're qualified anyway. We do very little housing,

so we don't do a lot of restricted building work. So I don't know a hell of a lot about the LBP standards. But a lot of people have headed off and some architects have headed off and become LBPs rather than get registered cause it's an easier pathway.

Q: That's right. So you think there's a disconnect with that? What we've found is that there's a lot of designers, we've got qualified architects that once they get the projects done and dusted that's it, they just stop there, and then when it goes up to tender any LBP can pick up these designs and they're not quite familiar with the actual designs. Do you think there's a disconnect in the industry?

A: Yeah, there is, but I don't know if that's [12.05]. I guess the LBP is help...

Q: You can have the perfect plans in the world.

A: What is it, the LBP in terms of the builder or in terms of somebody [12.15]?

Q: To the builder, in terms of the builder.

A: Yeah, but that has always happened. There's never been a requirement necessarily that the designer has to go and administer the contract. There's a bigger issue there in terms of the procurement strategies of people like councils and that where they're trying to procure each stage of the work separately. That's just a mess and generally architects have stuck together on that and said, "Hang on, these guys did the design; you've got to get them to do the documentation," sort of thing. I don't know how much that's related to the LBP. I'm sorry, I'm not really up with the LBP process.

Q: That's what that consensus is coming around is that the process is there but not of a lot of stakeholders are quite familiar how it actually incorporates.

A: All it amounts to is another form to be signed by somebody to give to the council.

Q: That's a lot of the feedback we're getting back. What is your understanding of the government proposed risk-based or stepped or streamlined building consent process? This is the government's initiative.

A: Yeah. Our understanding of it is pretty good because we went through the process. We were involved in the project in Christchurch which was one of the projects that we went through the process on. They actually ended up dropping it partway through.

Q: Do you know what year that was they actually carried out that? Was it just recently?

A: Yeah. When did we finish the project? The project was finished last year and there was an awful amount of negotiations in the year before. We understand the intention of it and how it was meant to work and it was all good. I think the council didn't understand it. The inspectors certainly didn't understand it. They turned up onsite and said, "We're not actually doing full inspections, we're just doing a brief audit," which was completely wrong cause the council's own legal opinion said, "No, we can't do that, we have to do normal at this stage," because the act actually hadn't come in. Obviously the legislation has not been enacted. They just ran a pilot in Christchurch. Their own legal opinion from the Christchurch council's lawyers was, "No, you've still got to do all the normal inspections." But these guys are

wandering round saying, “No, we’re not doing inspections.”

I thought they handled it very well in terms of the consenting side of it. They structured it quite well. They had good people on their side. The government really screwed it up because they did not consult with the engineers or the architects.

Q: When you say government, was it local government?

A: No, MBIE.

Q: Oh, DBH... no, it would have been MBIE.

A: MBIE and Christchurch Council didn’t consult with the engineers or the architects. My understanding is they found this guy from Canada who’d been through the process there. They employed him. He came up with a whole lot of structures and forms and they just then came out and said, “We want you to fill in all these forms,” and everybody said, “No, we’re not doing that,” because basically it was asking everybody to take on personal liability. But this was a directive from the government and my understanding from the minister, partly because of the consequences of the earthquake in Christchurch and one of the engineers (I won’t mention his name) who basically escaped liability on the job. So the minister was saying, “We want to make these guys liable.”

We hammered out and took a lot of time. The engineers basically just said no. That’s the IPENZ said, “We’re not going to sign up to these. We already do the producer statement regime, why do you need this?” The architects and the NZIA put a lot of work into it with the lawyers. We managed to get the forms and stuff into a thing that we were happy to sign. We did that. They then just quietly dropped the whole scheme. They sort of half did the inspections. So we sort of did our project that way and it went well. The inspections, I don’t know where they actually ended up, sort of a halfway house. It was quite good. I’m not sure if they ended up doing inspections or not, they may have still, but all we did was all our inspections a hard copy was kept onsite, there was a record, a file of all the architects’ inspections, all our site reports and they could come in and audit those each day or each week and check them through.

Q: So they just randomly come through [17.32]?

A: I don’t know. I don’t know in the end. We’d have to talk to the guy who was actually the project architect and he’s away this week. But I think the basic structure of it, we managed to get that sorted out, but the problem was getting everybody to understand exactly what they were doing. It took us a while to work through the consenting side of it. I think in the end we got the basic structures sorted out but obviously by this stage Christchurch [18.05] just said, “This is all too difficult,” so they’d dropped it. I’m not exactly sure what’s happened since then. I understood Hamilton was running a pilot [18.13].

Q: Yeah. I think [18.14] president is running a risk-based consenting project with MBIE. So I think that’s on the cards. I’ve had some discussions.

A: And talking with Auckland, they said they’ve tried it once or twice on a couple of projects.

- Q: Yeah, they've done a few in Auckland underneath their building inspection regime and there's one in Manukau that they did a [18.35] house in Manukau and then they did one out Henderson way.
- A: Yeah, but I think they'd just done straight industrial buildings.
- Q: Yeah, it was just straight. They've got so many of these [18.46] tick off box.
- A: [18.50] the bus interchange in Christchurch was a reasonably complex process and it went pretty well the consenting side of it. The inspection side is the bit that nobody really understood and of course everybody's running for cover.
- Q: So you think there's a place for risk-based building consents and processes in New Zealand?
- A: Yeah, I think so. Well, it's going to happen. The government's determined to make it happen so it's going to happen. Yeah, there is a place for it but they've just got to go out and do some proper consulting of the parties involved and [19.31] system that everybody's happy with.
- Q: Who do you think should actually run it? Do you think it's too big for local government? Do you think someone from MBIE itself should actually run the whole project?
- A: I don't know about running the whole project but MBIE have to organise it. You want to get some consistency across the country. Everybody was quite willing on the Christchurch one, there was various gatherings of everybody - MBIE, the Christchurch Council, the architects, the NZIA and various representatives trying to work it through.
- Q: It's just unfortunate it was just a timing thing.
- A: I just think it was very badly handled, and the Christchurch City council, I'm not sure but you got the impression MBIE said, "We're doing this. Christchurch, you're doing the pilot. Figure out how to do it." And instead of getting together with the people like the Institute of Architects, the engineers, they came up with this sort of structure, "This is how it's going to go." And we just said, "Hang on, no, it's not going to go that way." I'm not sure that three years ago they say when it's going to happen? It's going to happen next year, 2015 it was all supposed to happen but it obviously hasn't.
- Q: Thanks for that. Now I'm going to move onto my data collection. The next themes I've got in place is data that I've collected from stakeholders. It's got different themes that's actually [21.14] in my finding. So I've done data analysis and these are the main 10 themes that have actually come up. What I'm going to do is just going to read out theme by theme and I just want to get your opinion on each of the themes. The first thing that came up was: *Booking of inspections, builders are waiting five to 10 days to have an inspector carry out a [21.34] inspector whose BCA did not have the resources for the next day inspection.*
- A: I don't have any direct expert experience. It's not something that's been raised with

us as an issue.

Q: I think it's probably the next phase of the building process where the project managers see a lot of.

A: Well no, even when we're administering contracts I haven't had reports back from any of our sites that they had been delayed by inspections. But that's only [22.05] because we would not know about it.

Q: Regulatory inspection numbers. *The [22.12] inspections seem reasonable as clients are aware of shoddy workmanship and regulatory inspectors provide quality control measure when head contractors are too busy, but a review of who should certify inspections in terms of complexity could be reviewed. This is the notable inspections, probably about 20 of them.* Industry is saying that's probably [22.35].

A: I think it's a [22.38]. Again, I'm taking examples of the house that we're doing, I think the builders find it's about right. It is a good check.

Q: That's what they're saying, that they've got it right in regards to the critical points in the building.

A: I think so.

Q: And what they're looking at is that we could review who actually checks those actually critical areas or notify errors. So if regulatory gets relaxed and let's say [23.13] or even a rap inspection, would the industry be mature enough to actually take that on board, that inspection on board?

A: I don't think so. We tend to work with good builders but I think there's obviously a much bigger issue in terms of their competency which is getting better again isn't it? They've gone back to the whole apprentice regime I understand.

Q: Yeah, that's what they try and go back to. The government's trying to buy back into that.

A: Yeah, they need to.

Q: You can see the gap between the industries.

A: And lot of the builders that we use...

Q: Yeah, we can't find workers.

A: They can't find workers but they seem to be welcoming, getting the apprentice regime back into place.

Q: Yeah, slowly, [24.02].

A: Yeah.

Q: Next one. *Risk-based inspection has a place in New Zealand construction industry in the future but currently the scene is not ready and not mature enough.*

- A: I'd have to agree with that but I'm not even sure what risk-based inspections is. Or is that like what we just described the system we ended up with in Christchurch where essentially all our inspections were... I think that's the way they intended it to go so that the council would not actually necessarily do all their inspections. Maybe they do some critical ones, but they will essentially audit all our inspections.
- Q: That's exactly how risk-based inspection looking at.
- A: Yeah, there's definitely a place for that. I wouldn't mind auditing the council's inspections as well. We should be able to have a look at what inspections they've done as well. If you've got decent competent people on the council side, yeah, that can work.
- Q: 'Cause all they'd be doing is doing an audit process, and for high risk buildings they'll be doing those critical coding inspections, foundations maybe, and then the final inspection.
- A: Yeah, but I think on those sorts of things it's kind of bloody engineer anyway.
- Q: That's what they mean is that if you've got an engineer doing a foundation, why do you need a council inspector go there and reviewing it? If you've got, say, an architect...
- A: That's happening more and more on the bigger buildings. The engineers obviously going to produce statements covering off all the critical structural areas. The facades we're now getting covered off by a façade engineer. Mechanical to a large extent is now getting covered off by producer statements from mechanical guys. So I think all those processes are in place. That is essentially to a large extent is already risk-based inspections or streamlined inspection - stop calling risk - and getting a decent regime. But the council's still got to take proper responsibility for auditing it.
- Q: So they'll do one probably foundation stage, framing stage and then one at a final; so probably three from their [26.22] 13, 14.
- A: Yeah. I would have thought they'd need to come and do the audits more often, even once a week, twice a week, and once every fortnight or whatever.
- Q: They'll probably look at that whole process, where they actually fit in, when to actual audit, and how they're going to audit.
- A: On the face it seems to me to make a lot of sense because the best person to inspect the foundations is the competent engineer and if that's audited by somebody from the council who's also competent. But you don't really need them to be in there inspecting all the reinforcement placements. Well, they can if they want to but given it should be so well documented now, photographs and everything. I think that's good.
- Q: Next one. *Self-regulation will not work as many builders have not been educated or trained in the aspect of Building Code compliance and rely heavily on council as quality control checkers who are taking many years for builders to be trade qualified and owners to be educated on changes for mind-set to change.* So that's

basically what you said in the beginning.

A: Yeah, I just don't think you could say that I have enough confidence that builders or even the inspectors are fully up to speed with Building Code. They're getting better. We'll get the builders picking up things onsite saying, "What about the..." blah blah blah, and we say, "Oh shit, that's a good point." The Building Code's so complex.

Q: That's right. One of the government's initiatives was actually to let the builders self-certify. That was on the news at the beginning of this year where the minister came out and said, "We're going to actually look at the builders certifying their own work." This is where that's come through, that many builders are not educated or they've actually not been [28.10].

A: I suppose you can be. You get into a situation, and it's a bit like what happened in Christchurch where the council would not let some architects do the streamlined consenting process because when you set up their risk-based matrix you evaluate the architects as well. They said, "These guys are not experienced enough for this kind of work." So I assume if the builders are going to self-regulate, there's going to have to be some sort of qualification or grading system for them as well.

Q: That's what that LBP scheme is [28.49].

A: Yeah, LBP, just fill out and form and send it off pretty much. It's not robust enough. It could work.

Q: One of the areas that government's looking at is LBP signing of regulatory functions. This is your licence, could be designers, and could be builders. This is one of the themes that came back from designers. *Designers signing off on building reg would be an expensive exercise and will not provide any cost savings to the process. Designers already have enough work in the front end of the process and to add building inspections will stretch their resources. They are seen more as a theory component to construction than practical.*

A: This is a common theme, (a) are our architects or designers the best people to do this, and (b) it's adding a whole different work-stream that we're not really set up to do. I think there's a fair amount of resistance to that. It's not actually what we claim to do or want to do necessarily, and if we were to have to start doing it you're going to start charging a whole lot more to do it and then you're going to have to take on somebody. Basically you're taking on a building inspector [30.12] inspector, and then you've got to take the liability and the insurance and all that stuff and it will just cost a whole lot more.

To some extent LBPs signoff on this stuff at the moment don't they, like the electrical certificates and produce [30.27] PS3s and all that?

Q: They do all that design [30.31] beginning that is designed with the code, and at inspection stage the builders get a certificate of works at the end of the job. That's quite interesting. The other flip side is that the [30.44] regulatory functions the builder signing off will not be good. Even though the LBP scheme has been up and going for the last eight years builders and owners are still heavily reliant on building inspectors for Building Code compliance. Builders have a history and a culture of

being reliant on a second pair of eyes to double check their work, whether a project manager or building inspector. So that's a whole culture change they're ready to sign off. Any opinion on that?

A: I think it's good having a second pair of eyes. I think it's good cause it's always good to have somebody else come along and look at it from a different point of view.

Q: I think this was basically the consensus that came back is that a lot of [31.32] become complacent and [31.34].

A: [31.33] become complacent but a lot of things you don't see sometimes. I've actually just had a set of drawings come back that were checked by the project manager, and once I got over my indignation... it's not bad though because you do miss some things I guess and it's quite good just to have somebody else have a look at it. A lot of his stuff is, "No, don't worry about it," but I think it's just always good to have somebody else review things. That's why one part of the current consenting process, which you shouldn't rely on but that having the building inspectors checking your drawings was actually not bad. Less and less they'll do that now but they used to quite often come back with some comments.

Q: Is this during the consenting stage or the inspection stage?

A: During the consenting stage. But you shouldn't be relying on them to check your drawings but it was always handy just to have somebody else do a bit of a thorough check. So obviously with the risk-based consenting, streamlined consenting they don't actually do that.

Q: No, it's just a stamp off [32.44].

A: They're pretty good. They did a reasonable review of the drawings and which drawings we were submitting. I think from memory they basically check a couple of sample drawings just to get a feel for it but not the whole lot.

Q: *The LBP scheme has been long overdue and is a step in the right direction. There is still a long way to go as builders are slowly coming to terms with being responsible for their work and are slowly weeding the bad builders out of the sector and good builders that have been well-established can now be a member of a professional institute. This has just come back about the LBP scheme. It's something for the builders to be affiliated with but is it enough?*

A: I don't know. It sounds good. As I said, I'm slightly lacking in my knowledge on the LBPs.

Q: It's a [33.33].

A: In theory it sounds good, yeah.

Q: Next theme. Stakeholder's thoughts on suppliers, homeowners and regulatory balance. So this is just from a stakeholder's view. *The larger the builder company, the more support you are likely to receive from product manufacturers. The major issue with products are the relationship or lack of design detail of other products*

*in which builders revert back to the designer or building inspector for compliance. Manufacturers are happy to stand back and avoid any liability if any should arise in the future. What's your comment on that?*

A: I think they're talking about a couple of specific manufacturers there that I could name. It's been a problem in the past with a couple of specific manufacturers, we know that. The main problem at the moment is a lot of the manufacturers and suppliers have been a bit slow to catch up with their regulatory obligations in terms of providing for instance BRANZ appraisals etc. on products or the back of information which the council is completely asking for now. And also a lot of them were very much behind the eight ball in terms of the fire regulation changes and service finishes and stuff. It's getting better. It should. They just need to get organised. If you're going to be selling a product out there you've got to have all the backup information, you've got to have all the technical information available. And they're getting there. I think it's improving.

Q: So you think they're proactive or do you think they're just getting by?

A: I think they're getting a lot better. They're getting more proactive. The better ones have figured out that they've got to do this because we'll just go back and say, "We want to use your product but you've got to give us this information." "Oh yeah, okay." But it's costly for them. A lot of money for the testing. But the better ones will do it. They just have to get on with it.

Q: Regular inspection barriers. These are some of the comments that came back for inspection barriers. *The frustration of regular inspections and that different inspectors lack consistency in decision making process.*

A: That's what I said before, I totally agree with that.

Q: *Builders are aware of when inspectors have been on a training as that will be the flavour of the month during the inspection and at times is very frustrating as the consents of plans had already been approved.*

A: That's the other thing that a lot of these guys don't seem to get their head round, that after the 2004 changes, that the drawings have been improved and all the builder has to do is build what's on the drawings. We've had this argument before and they'll say, "No, it doesn't comply with the Building Code." "But it's been approved."

Q: Yeah, [36.45] consented plan. That was quite interesting because the builders know and then the inspectors have gone to training and they try to change the plans once it's been consented.

A: They didn't understand that. That was the other thing, the lack of understanding of what we had to do. There's this great song and dance now that all the drawings have to be construction drawings and have to be approved and we've got to put in shock drawings for the windows. And then, as you say, then the guy will come along and say...

Q: "Wait, we've been on a training, you've missed this, missed that."

- A: Well sorry.
- Q: Yeah, that's right.
- A: You missed it. Generally, if it's something that you felt was a potential danger or whatever you'd sort it out. It's not normally he'll come up with something like a glaring omission. The interesting one is lately this change to the glazing.
- Q: Yeah, 2016. [37.39] balustrades.
- A: Yeah, we've got some glass balustrades on this house in Waiheke which have gone up under the old rules and you're sitting there thinking do we need to change it? Well, we don't have to.
- Q: Because you're going to go to that exemption so was it April the first, June the first or something?
- A: Yeah, June the first. [37.56] because we've got toughened laminated glass but it hasn't got the super layer in it.
- Q: And there's that consequence of failure, if it fails is it going to stop anyone falling over? But if it's laminated you're actually going to stop that [38.11].
- A: The worse somebody would have to do is put those little clips on meanwhile.
- Q: Yeah, and they've got those after-market coating on the top that just keeps it all...
- A: We don't want a rail on up top.
- Q: Another theme that came up: *The paperwork that is required for consenting and especially code compliance is excessive and more time is spent writing documentation than constructing or building. At the end of the day the same people are still liable.*
- A: That's true. I don't know how you change that. I remember a wad of information about that thick on the last code compliance I tried to organise for a simple [38.49] building in a school. It was... but I'm not sure how you'd...
- Q: Get around it. It's quite interesting.
- A: That's true; that's a frustration. Mind you, aren't they dropping code compliance? They're dropping code of compliance certificates aren't they?
- Q: I think it's compliance. They're changing the whole... that was part of this whole amendment 2013, consent compliance certificate. They're taking away the code and put consent compliance.
- A: That's right. That's mainly because they had about 30,000 buildings throughout New Zealand without code compliance certificates.
- Q: That came up from inspection barriers. This is what's come up from the industry for regulatory inspection improvements. *A building project or error should have*

*the same inspector allocated to its builders is able to build a working relationship.* You said that [39.53]. It's quite interesting.

A: Even dealing with the council is you build up relationships with guys in the council and then they leave unfortunately. It must be so frustrating. But it's all about...

Q: ...getting the consistency.

A: I know it's hard for the council but these sorts of things where you ring the council and you can never get hold of anyone, even if they're direct dials they never answer their phones. I rang a guy this morning and he answered the phone. Fell off my chair. But that's what you want to do is have a decent conversation with these guys.

Q: That's what the industry is actually saying is that just build a relationship with [40.30] can come up here for this project instead of trying to explain to a new inspector where you're at.

A: That's the same thing as just saying the code compliance inspections, when you get the different guys coming along, it's just...

Q: Yeah, that's right, pretty frustrating. *Council need to find ways to spend less time on inspecting builders who are doing a good job and more time where they are really needed.* So that comes back to that.

A: Yeah. But that's again about building up a relationship and having a consistent inspector. He'll figure out fairly quickly if this builder's good and he can rely on them for certain things. That's the same thing, it's consistency of inspectors and competence of the inspectors. There's a little bit of an issue there I think.

Q: *Council need to reduce the amount of current inspections but still have them at crucial points?*

A: I can't really comment on that because I'm not sure. I haven't heard builders complain that they're getting too many inspections.

Q: *The overall sequence of current inspection is good. So inspections that are inspected by council need to be picked up by other building professionals who are in the best position to address risk.* They're saying that the actual sequence is correct where they [41.49] and that and they need to stay, but the crucial inspections don't need to be relied on by council and be picked up by other professionals.

A: That's what we were saying before and [42.01] to me to a large extent that happens anyway with the producer statement regime. Certainly in terms of structure block work.

Q: [42.10] building inspector there straight after the structural engineer's been there to sign the foundation. So you've got the two people at the same time signing off the same thing. Excellent. That's basically the themes.

The next stage is I've done a quantitative data analysis. This might be quite interesting. The first theme that came out that these are all the building documentations that we...

- A: Only 98% are familiar with the Building Code but 100% with the Building Act.
- Q: The ones that [43.01] was these ones here. These are for DBH simple house designs and DBH multi-use consents which are basically your run-of-the-mill designs. Overall, there was only 39% to 29% of the industry is [43.16] designers that actually knew about it. Why do you think that area is so high or so low in regards to [43.24] to the rest?
- A: We know we've got the multi-use consent but, again, only because we've had some experience of it I think. It's like any of these things, if you don't use it... and that was because one of the guys in the office doing his own prefabricated house and the guy had got a multi-use consent set up for that one. To be honest, I'm not sure about the simple house design.
- Q: These were all designed for owners to actually fast-track design work. It seems like the design [44.01] hasn't taken the...
- A: No. I'd have to confess that I not actually familiar with that one. I think I've heard of it.
- Q: It's one of those code books. I actually picked that up just recently. I was like what's that one there? That was quite interesting.
- A: I better have a look at that.
- Q: This is the Building Amendment Act. Oh no, this is the government's review before the act. These were the four main themes in it. *[44.30] response sit in the right place, we had 56%, but the rest, this is the [44.36] fact here, 30% didn't realise of the actual government's intention to move liability or moving to a [44.44] approach.*
- A: We knew about it because the architects had been, well, some foolish architects were saying we should do it. That was in 2009 they did a review. But hang on, there's a 2012 amendment and there's the 2013 amendment.
- Q: This one's relating to 2012.
- A: So that's the one that's only partially been enacted.
- Q: This one actually popped back through that. These consenting consents everyone was quite familiar with, but then with the rest of it which haven't been [45.21] was quite low, I think it was 26% overall [45.27] of the quality insurance system that you guys were probably piloting, the pre-risk profiles. These haven't had any regulatory [45.34].
- A: Nobody knows about them. To be honest, when we started on the Christchurch one, Christchurch didn't even know themselves.
- Q: So they were trying to guess how this will look. I think that's why there's so much...
- A: It's really hard. It took us a while. First of all they had that guy from Wellington,

Holmes Farsight or...

Q: He's up here now.

A: What the hell's his name. Anyway, he was engaged. The first meetings we had on this risk-based consenting were with him and the Christchurch Council. To be honest, he had an overcomplicated thing [46.18], I couldn't figure it out. Then it took a while. Then I sort of figured out what they were on about. Then they sacked him. Then they hired the guy who was from Canada or something. And then they got him back in again. What the hell's his name? He was with the council up here.

Q: It's on the tip of my tongue. I know who he is. He's a big Englishman.

A: Is he English? Tall guy?

Q: Tall guy.

A: He's Holmes Farsight is the company he's with and he's actually been acting as a consultant on a project we were doing in Wellington as the sort of somehow between us and the council in terms of the consents and seemed to make a meal of that.

Q: Toomey?

A: Yeah, Rob Toomey. The problem is nobody knows about this because they haven't seen it. Even when we got it and figured it out and then all this stuff. Until you've done the process you couldn't actually understand what they were on about.

Q: That's fine. That's what's come back. There's more data come through. *Current regulatory inspections are residential and can number up to about 20 inspections. Does there need to be review?* Seventy percent said there needs to be a review. They think there's too many inspections. But as you discussed, you wouldn't [47.37].

A: I don't really know. I wouldn't have thought 20 is too many.

Q: This is that UK model is that: *United Kingdom building [47.44] risk-based building inspections in 2013 in which they have reviewed their compulsory building inspections in favour of risk assessment of projects [47.54] reduced building inspections.* The question when asked was do you think it was a good idea to follow that model and think we should look into it. Seventy-one percent of the industry said yes, we could have a look at that.

A: I think they definitely need to have a look at it.

Q: If it's working over there pretty much with the same system as we have here. And then the third question that we looked at was: *In your opinion, is the New Zealand construction industry ready for current regulatory inspections to be relaxed in favour of risk-based assessment approach?* We came back at 60% said no, which was like yes, yes and then [48.32] this one and was like no. So happy for that but New Zealand's just...

- A: I think the consensus is there's still too many shoddy businesses. When did you do all this data gathering?
- Q: About two years ago.
- A: That long ago?
- Q: Yeah. I'm on the final stage of the subject matter experts like yourself.
- A: Who did you go out to with all the questionnaires?
- Q: The NZIA. I went through the NZIA portfolio. A guy in our work put it through for me. I think it was 2012, 2014, 2015.
- A: I have vague memories of it. How many responses did you get from the [49.18]?
- Q: We got guys on [49.21] and they wanted to get into it too. So then I got into their database. I got a few hundred from NZI. They were really, really...
- A: It was quite a hot topic at that stage because it was coming in and there was all the talk about it and everybody was saying, "Oh shit, what does this mean for our liability and stuff." So everybody was quite interested in it because we believed it was coming and it was imminent, and then it all sort of faded away a bit.
- Q: NZI actually flooded my data. They gave me more data than I wanted. That was good. These are the current inspections. So I asked them: *Which inspection would you as a designer or as a builder rate as your most riskiest inspection with high [50.12] and that?* This is what came back was remembering [50.17] which is number one. Cladding was another one. The foundation subfloor and then roofing and cavity wrap. Code compliance stuff. This was quite interesting. What's your opinion on those? This is for risk purposes in construction in New Zealand.
- A: The question is asking what though? These are the parts of the building that have the most risk associated?
- Q: Yeah, risk associated.
- A: Yeah, obviously they do. But in terms of the inspections, again, if these things are covered off by... cladding, facades, bigger building we're covering that off with producer statements and from engineers. I think they are the risks. They obviously are the risky parts of the building.
- Q: That was quite interesting for the risk but then I threw them another question: *Which one do you feel needed regulatory involvement?* And then when it came back to on this thing was code compliance certificate stage which is the final inspection cladding. This is where they needed regulatory involvement in these here. So the risk ones end up at the bottom of the areas and then...
- A: How's the ranking on this, I don't understand?
- Q: The rankings? This came out to frequency, 109, came out with code compliance.
- A: Is this the numbers of people who said that that was the first?

- Q: Yeah, how they actually answered this question. And then this one here was the frequency of how many times remembering [52.06] came out. This was due to risk. They had four areas. They could have high risk, medium risk, low risk or not applicable. They came out as high risk out of what they actually picked out for their designs.
- A: So your mean was 2.7.
- Q: Yeah, for the membrane [52.27] membrane and then actually took out. So that was quite interesting that for regulatory involvement they wanted these to be covered but they didn't wanted a risk was what they thought was high risk was that. So you've got two mind-sets.
- A: This is where the most risk is.
- Q: Yeah, that's where the most risk is according to the stakeholders.
- A: According to the stakeholders?
- Q: Mm.
- A: Yeah, but you're not necessarily saying that the people who are best qualified to assess that are actually council guys.
- Q: No.
- A: I think they're saying that there should be another regime, and there is, of other people taking responsibility for the taking then obviously in the first instance the supplier and the installer. I think that makes sense. You want the council involved [53.24] getting the final inspections and these other claddings and stuff.
- Q: One subject expert I did speak to actually said, "Do you realise this is what our legislation that actually gone through and claims was these ones, this order here?" So you look at the leaky homes, this is what basically they're actually ranked as. Where these ones, you never actually had an issue going down.
- A: That's true.
- Q: So if you look at all the cases...
- A: So this in terms of leaky building claims or whatever, insurance claims.
- Q: They're actually linked. I didn't realise until [54.06] picked it out said, "Do you realise that that is how they follow the claim so far?" You don't see many claims on drainage [54.14] final inspections.
- A: The claims are all about leaky [54.16] where were your leaking membrane cladding foundation?
- Q: That's right.

A: I think this is the area here. It makes sense cause what you want here is some sort of agreement that the building compliance and you're not liable later on.

Q: Thanks for that.

A: I hope that was helpful.

Q: It was. It was very helpful.

A: I rambled a wee bit.

Q: That's fine.

[End of recording 54.51]

## Appendix C2: House Developer Interview

### Interview Transcript

Date: 11 November 2015

Q: This is basically just a research on building regulations in New Zealand and just different views on it. So I'll get you just to start with your background and the background of the company, how long it's been established, how many staff you've got and just a brief background.

A: Okay. Just briefly with Stonewood Homes, we've been in business for six years I believe it is. That's when the franchise was purchased. We have grown from myself and the boss and a part time accountant through to I am now the construction manager. We have two project managers working for me, they're the site managers and in the office we have two accounts, two QS's and a business development manager and the CEO as well. We also contract out the sales team which consists of five sales team as well for the area.

My background is I was a carpenter right from school, from 17. I did that for 10 years, went into policing, went overseas, then came back and went to tertiary education to get a diploma in project management and came back in and joined the company here. Came back over the New Zealand and joined Stonewood, to present day.

Q: So you've been with Stonewood six years?

A: Yes.

Q: Do you have LBPs in...?

A: Basically Stonewood Homes is a blanket company which contracts out everything. Although I'm not an LBP but the CEO is. Geoff Wilson is LBP licensed. Basically everyone we contract is either licensed or certified in whatever they're doing.

Q: In the past two years has there been a notifiable increase in residential development in which your company has been involved with?

A: Yes. We've almost doubled turnover year on year. We've taken on staff. We've just employed another junior project manager last Wednesday with a view to next year's workload. We've still got enough homes that the boss is happy for next year already. The one thing that we're waiting on island. That's the hold up for us, receiving titles to we can proceed with the builds.

Q: This is just a generic question through all the interviewees. Which of the following New Zealand building regulatory documents are you familiar with? Building Act 2004?

A: Yes.

Q: New Zealand Building Regulations 1991?

A: Not so much.

Q: Building Amendment Acts?

A: Yes.

Q: New Zealand Building Code?

A: Yes.

Q: New Zealand Standards 364, the end standards?

A: Yes.

Q: What are your thoughts on the regulatory balance in construction in New Zealand? So that's from the point of view the government has got the monopoly on regulation at the moment. What are your thoughts?

A: Yes, I believe it has to be standardised. Quite happy with the regulations. The part I don't like is when local body has input into certain areas or it's not a level playing field. That can be right from consenting right through to inspection services, demanding different things. We became a super city but it didn't quite happen because nothing is standard and so you have to adapt depending on where you're building.

Q: So you've still got that area thing?

A: Yes. We deal with Waikato Council, we deal with Franklin Council. Papakura not so much; They seem to have come in line a little bit. Manukau; we deal with independent certifiers through Manukau Building Consultants. Then we deal with Auckland Council sometimes and we'll also deal with Professional Building Consultants as well. So we deal with so many different bodies requiring different things.

Q: Is there inconsistency in those areas?

A: There is inconsistency yes, there's quite a lot of inconsistency.

Q: What are your thoughts about the LBP scheme?

A: I see it's one of the steps to control the industry because it definitely needs it. I think we need the overview from council. I still believe that needs to happen. There are many ways that you could circumvent the system at present, so you need that oversight I believe.

Q: That's with the LBP scheme?

A: Yes.

Q: What are your thoughts on council inspections?

A: Yes, certainly they don't need as many as they have at the moment. Because as an example, if I'm getting an engineer to certify an engineering component as in a slab that they've designed or retaining they've designed, I don't need an inspector to look at it. And most inspectors will agree with that point. There's no need to look. As an example I'll do a timber retaining wall. If my licensed engineer is not geotech certified I will get him to look at it, the depth and check the size of it. I'll get a geotechnical engineer to put a share vein in to check the strength of the soils around it and then I'll get council to have a look down it as well, just because they have to. So three men to look down a hole before I pour the concrete in it. It's a little bit of overkill.

Q: Overkill and it's quite a costly process too?

A: Yes, and I'm paying for all of those inspections.

Q: Does the council inspection process contribute to bottlenecks in your build time?

A: No, because we use independent bodies as Manukau Building Consultants, an independent company, they contract to council. We get good service from them. We are striking it other councils like Waikato. We can be up to five days before they'll take a booking which hurts. And then to correct that for our build times because we can't have down time anymore, to correct that we'll put in dummy bookings which will bottleneck the system even more, but it works for us. We shouldn't have to, it's not good to do that. But that's a work around that we use, right or wrong, to keep our building process going.

Q: With your LBPs that you have on site, when there's a council inspection called for the day before and it's at the end of the day, is there work for your contractors to do or do they just hang around waiting for the inspection to be passed?

A: It depends, again because it's not consistent throughout all the areas, they don't necessarily need to be on site. I've heard Auckland Council requiring the LBP to be there with his card. Predominantly that doesn't happen with us. They're not required. The councillor will turn up, he'll inspect the product and he'll inspect the works. They rely a lot on the other work, the memorandums that get put in by the LBP. But there are holes in that system as you can see, without the person standing there with a card, photo ID. If that was adhered to, that would create a lot of downtime.

Q: Does the council inspection process need improving and if so what would you suggest?

A: Like we discussed before they need to reduce the amount of inspections but they do need them still. They need them at crucial points, before gibbing as an example, to make sure... drainage inspections. They don't always get that right. And there are the odd ones we'll fail as well if a contractor hasn't got it right. So yes, I believe that oversight needs to happen. Sorry, what was the beginning of the question again, I got side tracked then?

Q: Does the council inspection process need improving? Timeframes is probably one?

A: Yes. Again, because we use so many different forms of inspection the ones that

work for us is when they'll take a window booking. You know, 24 hours ahead they'll take a two hour booking. That can work for anything. That just works. So as long as they've got the resources to do that, that's great. I don't know if that's achievable or not, and I guess that would also work; I know that Manukau Building Consultants would also go down and help Papakura Council at some stage when they had overflow. So if they amalgamated and got one level whole thing then they should be able to level that out.

Q: United Kingdom building controls have introduced regulations in which risk based inspections have been implemented in 2013 in which they have reviewed the compulsory nine statutory inspections in favour of a risk assessment of the project, resulting in reduced building inspections.

A: That would make perfect sense. When you're talking risk, you're talking the risk of that item because then we talk about slab, engineered, no risk to council or anybody. But then you talk about bracing elements in the house prior to gibbing, there's a high risk there so it needs to be inspected prior to... because it disappears after that. So yes, I completely agree with that.

Q: Do you think that New Zealand Regulatory should look at this assessment approach for inspections in New Zealand?

A: Just from what I'm hearing now, yes, I think it's definitely worth looking at.

Q: What is your understanding of risk based inspections in building construction?

A: I don't have a lot, just what you're explaining to me now.

Q: Currently regulatory inspections on new residential buildings can number up to 15 to 20 inspections for a standard house. Do you think that government needs to review the number of inspections?

A: Yes.

Q: Any inspections in particular that you think that can be a stand alone, or that is overkill?

A: Again, the slab, your floor slab can be removed. Any engineering design like when you're talking steel connections and things like that. Although that might be an overlay when they're doing a bracing inspection.

Q: How about water membraning?

A: That doesn't need to... one council I have to flood test, one council I don't. Why am I doing that when I'm doing the memorandum? I'm using a certified installer. He could be LBP. And then you've got the flip side of things where you've got a person installing gib board who cannot become licensed. So I'd rather that guy was licensed than my waterproofer guy who can be. So it doesn't make sense to me, that little bit.

Q: Building wrap, do you think that should be a regulatory inspection?

- A: It's a water tight, yes, so it is a risk, yes.
- Q: In your opinion is the New Zealand construction industry ready for current regulatory inspections to be relaxed in favour of risk based assessment approach like the UK? Is the industry, builders out there, are they ready or do you think they'll take advantage of the...?
- A: Yes, that would be my concern. You can't just focus on that one aspect. Yes, for a company, I'm completely confident I would love to work within that system but I can't say that for the whole industry so I'd say no, it's not ready for it. Perhaps licensing is a first step and they need to put other controls in place so we get some good standards in building.
- Q: What are your thoughts of builders signing off construction work during your projects limited to their LBP licence? So if you've got LBP carpenter, would you be happy to have him signing off the framing? If you've got a LBP that was in water membrane, would you be happy with him signing off the water membrane, and they're actually taking the regulatory requirement off building inspectors coming on site?
- A: Yes. As we talked about the wrap though, because they are LBP and they're doing the waterproofing, they're doing the taping and everything. So myself yes, but in general, no. In my personal sphere of work, yes I would be. But that's because as Stonewood Homes we supervise the hell out of it anyway. We keep tight controls of what goes on in our sites. So I can quite confidently say I'd be happy. I know the LBPs personally. I don't just contract out. So if I was looking at, as an example a Fletchers based company, and you get the hierarchy that is dictating contracts based on dollar value and stuff like that – not picking on them by any means – but it can happen that you become faceless. And the bigger it becomes, they could get a contractor in who may not be above board or something like that, through no fault of their own, and we get inferior work. It's very tricky. It's not just a one stop shop to fix that.
- Q: Would there be any of the trades you would be happy to sign off their own work? We've had bricks come through and say, it's been minimal since any bricks have been rejected. We're all licensed under the block and layers registration. Is there any trade that you think would be...?
- A: Yes, again they could be rolled over. Because a brick structure is fairly straightforward and again, the contractors, yes, LBP. But if you started talking about block, that's going to be slightly different because you've got your reinforcing and engineering component on that. So brick yes, but block, I'd still like that inspected, and that can roll over to the engineer if need be. So still take it off council if they want it.
- Q: Would you be confident in builders that are LBP licenced signing off the code of compliance certificate? So overseeing the whole project?
- A: No, I wouldn't want that. I'd still want council's input on that.
- Q: What are your thoughts on architects and designers, signing off construction work during the construction phase?

- A: No. They don't have the skill set.
- Q: Engineers for slabs?
- A: Yes. Engineers definitely. But not an architect, no.
- Q: So, if an architect designed the actual housing from start to finish you wouldn't be satisfied for him to actually go out on site and sign off what he's actually designed?
- A: No.
- Q: Would you be confident in an architect or designer signing off a code of compliance certificate? Having that overall look?
- A: No. Total different skill set.
- Q: Would you be happy with local government building controls regulatory at present staying as normal and having that overall sign off?
- A: Just when it comes to code of compliance, yes.
- Q: So you'd rather have that government?
- A: I'd rather have the oversight, yes. Because if you lift that it can open it up to abuse, if you like.
- Q: What are your thoughts of product manufacturers and suppliers in the construction industry, during construction and post construction? Are they supportive or are they just hands off in regards to products? A lot of issues that come through, quality of products?
- A: It depends who you're dealing with, to be honest. It depends on the size of the company. That's the last meeting I was just in was with our supplier, our merchant. It depends. When you've got a monopoly like the gib board supply, or Firth concrete, any one of those larger companies, you know, go fish, bad luck. But then you talk to your independents and stuff like that and service is still a good part of it and they will stand behind product.
- Q: Do you find that they share the responsibility of construction? Do you think they could do more in regards to training or coming out on site to see if their products have been...?
- A: Very small amount of companies will do that. Very small.
- Q: What are your thoughts of owners in the construction process? Are they totally hands off and they expect you as the professionals to actually provide them the product?
- A: Are you talking our clients as in owners, or the company owners?
- Q: Your clients as owners.

A: Clients, no they're not hands off anymore. They're more involved in the build as we're going through. I don't know if it's, in my perspective as well, but expect a heck of a lot more than they used to as well because they're right in depth. The internet provides them with a lot of alternatives on how things should be done and it may not be the correct way. So we deal a heck of a lot more with the client than we ever would.

Q: That's quite an interesting response but the last ones I've spoken to have said exactly the same thing.

A: Yes, it's huge.

Q: They actually come in and they know they want all this. During construction when they actually sign off something they always want something to be changed. This is the plan that you actually dealt with. When I did this a year ago, interviews, it was hands off. People didn't want to know about it. All they wanted was the product at the end of it, move in. And it's been a big change in the last two years. Now they're all hands on.

A: Yes, it's very demanding and it's a process we're trying to manage. Like you talk about changes, variations in construction and we've got clients, and it's our problem to manage. But they'll have 23 sheets of variations. I know there are other companies that won't do a variation in construction which is nice, but you look at the flip side, you're spending \$4-5-600,000 with us. We should be able to change that. So it's being realistic but it's trying to manage that expectation.

Q: We're looking at delays in the process and we actually looked at this concept of owners being more hands on and it was the variations that were actually pulling the projects out. This change was a simple change towards the end of it and the boys actually closed it in, but then they said can we do this, this, this and we find that most of the delays were from the owners input which was not looked at in earlier stages.

A: That's something you capture in your cost because you've got to add delay in time and stuff like that. But to be honest, with us we'll normally get ahead of it through site meetings and kick off meetings with clients and things like that. We'll try to get ahead of any of that because our carrying costs would kill it. They would never do a variation if we start to charge. If we took a week's carrying costs nobody would make a change because it is quite high to carry it.

Q: That's our questions done and dusted.

[End of recording 21.54]

## Appendix D: Publications

### PERCEPTIONS OF REGULATORY BUILDING INSPECTORS AND DESIGNERS ON THE PROPOSED RISK-BASED INSPECTION REGIME IN NEW ZEALAND

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The New Zealand government proposed a new control regime to streamline the process of building approval by introducing risk-based inspections for certain types of building works. The risk-based inspection is generally perceived as having the capacity to accelerate the process of building approvals therefore allowing contractors to project manage their time and workers without the bottleneck of regulatory inspections. The paper evaluates this newly proposed risk-based building inspection scheme. The perception of construction stakeholders on this new scheme was sought. Data was collected through a questionnaire survey and in-depth interviews with construction stakeholders. Regulatory building inspectors expressed concerns about the shift in liability from councils to licenced building practitioners and the need for regulatory bodies to introduce compulsory surety and warranties for building practitioners. Respondents also expressed that building licenced practitioners were unskilled and not mature enough in terms of experience and qualifications to undertake self-certification.

Keywords: building regulations, liability, licenced building practitioners, risk

#### INTRODUCTION

In August 2009 the New Zealand Government announced a review of the Building Act 2004 to identify areas the Act could be improved to minimize the cost of compliance without compromising quality of building and construction works (Williamson, 2010). The Government focus is on achieving quality homes, through building activities that is business-enabling and within efficient regulatory framework. In other words, construction that is produced cost-effectively by a productive sector that is competent, and with a regulatory system that is administered efficiently and cost-effectively. Government also has a target on restoring consumers' confidence following historical building quality failures, so that they are able to make informed decisions when carrying out transactions in the building and housing market (DBH, 2009).

A report initiated by the Building and Construction Sector Productivity Taskforce (2009) had suggested that productivity within the construction industry is relatively lower than those in other sectors of the New Zealand economy. The report went further to recommend the development of quicker regulatory and consenting processes

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Samasoni, J and Rotimi, J O B (2016) Perceptions of Regulatory Building Inspectors and Designers on the Proposed Risk-Based Inspection Regime in New Zealand. In: P W Chan and C J Neilson (Eds.) *Proceedings of the 32<sup>nd</sup> Annual ARCOM Conference*, 5-7 September 2016, Manchester, UK, Association of Researchers in Construction Management, Vol 1, 227-236.

## AN EXPLORATORY EVALUATION OF A NEW RISK-BASED INSPECTION SCHEME

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Government passes laws both through statute and regulation to protect people. The Building Act is one of such government regulation that obligatorily requires buildings be designed and constructed for safety, health, development, and the safeguarding of people from possible injury. In 2010, the New Zealand Government proposed a new control regime to streamline building proposal approval by introducing risk-based inspections, where inspection were circumvented in terms of risk for certain types of building works. Risk-based inspection is generally seen as accelerating the process of building approvals, therefore allowing contractors to manage their project time without a bottleneck of regulatory inspections. The study offers a preliminary evaluation of the effectiveness of this newly-introduced building inspection scheme. The larger study programme on which this paper is based gathered the perceptions of building control practitioners. Data was also collected through a questionnaire survey to homeowners/agents of completed homes. This could improve the institution of this new scheme. This paper puts this larger study into perspective for the New Zealand construction industry and academia. It finds that risk-based building inspections will likely accelerate the building process, but can only flourish if licenced building practitioners provide a quality product and stand by their work.

*Keywords:* New Zealand, Risk-based building inspections, Licensed building practitioners, Consent process.

### 1 INTRODUCTION

Building regulations in New Zealand have gone through some very dramatic changes in the past decade, mainly due to government's reaction to the so-called leaky-building crisis between 2002 and 2004. In August 2009, the Government announced a review of the Building Act of 2004 to investigate how the Act could be updated to minimize the cost of compliance without compromising the quality of building and construction (Williamson 2010). The Government's objectives were:

- Quality homes and buildings produced through a business – enabling an efficient regulatory framework,
- A regulatory system that is administered in an efficient and cost-effective manner.

The review found that there were weaknesses in certain parts of the system, such as consumer protection and systemic imbalance. The current regulatory setting has resulted in an unduly low tolerance for risk, with a strong emphasis on central and local

# AN EXPLORATORY EVALUATION OF A NEW NATIONAL ONLINE CONSENTING SYSTEM IN NEW ZEALAND

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**ABSTRACT:** Government passes laws both through statute and regulation to protect people. The Building Act is one of such government regulation that obligatorily requires that buildings are designed and constructed for safety, health, development and the safeguard of people from possible injury. In March 2008, Government announced a package of initiatives intended to streamline the building regulatory consenting function. One of these initiatives was to investigate the feasibility of establishing a national online building consent application and lodgement tracking system, which could be used across all local government Territorial Authorities and Building Consent Authorities in New Zealand. Government is collaborating with the private sector to develop Geobuild, a set of standards for consumers, the construction sector and government that links all aspects of the construction process from design through to procurement, construction and maintenance. Geobuild will set minimum national standards and software protocols to allow information sharing between the private and public sectors. When interoperable the Geobuild standard are expected to improve productivity, building quality and safety and reduce building cost. The study evaluates the effectiveness of this proposed national online consenting system scheme in New Zealand. The larger study programme on which this paper is based intends to gather the perception of building control practitioners on this new scheme, as a form of preliminary evaluation. Also data will be collected through a questionnaire survey to homeowners/agents of completed homes. The intent is to provide an exploratory evaluation which could help institute the new scheme in New Zealand. The paper describes this larger study to put its relevance into perspective for the New Zealand construction industry and academia. The National online consenting system will potentially accelerate and provide consistency to the building process but can only flourish if a collaboration of all affected parties provides input to their aspects of the scheme.

**KEYWORDS:** New Zealand, Online consenting, Geobuild, Consent process.

## 1. INTRODUCTION

The New Zealand building industry has come to a cross road with amendments to the Building Act, 2004. The amendment was occasioned by the shortage of building stock experienced in Auckland and Christchurch (exacerbated by the 2010 and 2011 earthquakes). The Department of Building and Housing [DBH], 2012 have reported that events will have major implication on Building Control Authorities as there is evidence that consenting services already contribute bottlenecks. Prolonging building timeframes can result in a number of unexpected costs. Delays in construction cause delays in progress payments, which can lead to late payment penalties and interest incurred on debt. Labour costs may be due to increased inspections and longer building timeframes causing poor use of subcontractor time. Delays can also expose developers to the risk of contract disputes due to late delivery. If streamlining the consenting process could address these bottlenecks it is projected that the demand versus supply shortfall would improve 2012 new dwelling consents of 16,929 (Auckland, 4,582 and Canterbury, 4,037) in addressing Auckland shortfall of 13,000 houses a year and the Governments National building shortage crisis. (Statistics New Zealand, 2012).

There is however significant and justifiable concern that an increased volume of building linked with a decrease in consenting hours would result in another mass failure (DBH, 2005) in built quality in New Zealand. For example; an increase in volume inevitably draws in less skilled labour, hence the need for experienced/ competent inspectors gets greater not smaller in boom times. The repercussions of the leaky-building (Hunn, Bond & Kernohan,2002) crisis which plagued New Zealand in the early 2000, has left a perception of discontent from society towards the construction industry and central / local government (May, P. J,2003).It is an evolving affair with constant reminders through lengthy judiciary suits and the

# BUILDING CONTROL AND REGULATORY BALANCE: PERSPECTIVES OF BUILDING PROFESSIONALS IN NEW ZEALAND

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The New Zealand government proposed a new control regime to streamline the process of building approval by introducing risk-based inspections for certain types of building works. With this regulatory balance could be proportioned to stakeholders involved in the building process. A review of the Building Act in 2010 had indicated that a more balanced approach to building control is required to more appropriately allocate responsibility, accountability and liability between construction stakeholders. A larger study on which the current study is based, evaluates stakeholders perception of the newly introduced risk-based building inspection scheme and on regulatory balance issues. Building inspectors expressed concern in the shift in balance, as current regulatory inspections had a high proportion rate of failures involving competent building practitioners. However the scheme provides building regulators a tool to accelerate building processes without compromising cost and quality.

*Keywords:* Building regulations, Government, Housing, Liability, Risk, Inspections.

## 1 INTRODUCTION

In August 2009 the New Zealand government announced a review of the Building Act 2004 and identified issues that there were problems with ensuring responsibility sat in the right place and undue reliance on building consent authorities (BCA) (Williamson, 2010). The building consent authority post the leaky home saga in the late 1990s have been risk-averse with the consenting process requiring more documentation and checks and the addition of more inspections which has been applied to every project that is lodged with council. An example of this process would be a housing developer firm providing the same documentation on it stock standard house design which has been through the BCA numerous time but still require further information depending on which BCA officer was processing or inspecting it (May and Wood, 2003). The added pressures of the Auckland house shortages (Auckland Council, 2013) and the Christchurch rebuild (MBIE, 2013) has forced the government to take action. The government's announcement particular targets BCA in relinquishing its control and oversight of building work and proportionally moving risk to other professional e.g. architects, engineers and licensed building practitioners who are in the best position to assess it. The rebalancing of the building consent process will be a major change in liability shift as BCA input into certain projects would be dramatically reduced and professionals picking up the shortfall.

The government focus on achieving quality homes, through building activities that is business-enabling and within an efficient regulatory framework. In other words, construction productivity