THE UNIVERSITY of ADELAIDE

High-rise Residential Buildings in Dhaka, Bangladesh: Strategies for Socially and Environmentally Sustainable Practice

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A thesis submitted to The University of Adelaide in fulfilment of the requirements for the degree of
Doctor of Philosophy

THE UNIVERSITY OF ADELAIDE

May 2016

Table of Contents

LIST OF FIGURES ..... **VII**

LIST OF TABLES ..... **XI**

LIST OF EQUATIONS ..... **XV**

LIST OF ACRONYMS AND ABBREVIATIONS ..... **XVII**

ABSTRACT ..... **XXI**

THESIS DECLARATION ..... **XXIII**

ACKNOWLEDGEMENTS ..... **XXV**

DEDICATION ..... **XXVII**

SECTION I: BACKGROUND AND CONTEXT ..... **III**

1 Introduction **1**

1 . 1 Introductory Background 1

1 . 2 Problem Identification 3

1.2.1 Problem as a result of increasing urbanisation and rapid population growth 4

1.2.2 The specific condition of current high-rise residential buildings in Dhaka 9

1 . 3 Research Focus and Delimitations 13

1.3.1 Research Focus 13

1.3.2 Delimitations 13

1 . 4 Research Aim 14

1 . 5 Research Questions and Objectives 14

1 . 6 Significance of the Research 15

1 . 7 Research Methodology 16

1 . 8 Thesis Structure 20

2 Contextual Settings 23
2.1 Introduction 23
2.2 Physical settings and growth of Dhaka 23
2.3 Climate of Dhaka 26
2.4 Social problems of Dhaka megacity 26
2.5 Environmental problems 27
2.5.1 Air pollution 28
2.5.2 Surface water contamination, sewage management and ground water declination 28
2.5.3 Poor waste management 29
2.5.4 Decrease in water bodies, cultivated land, vegetation, wetlands and loss of biodiversity 29
2.5.5 Sound pollution 30
2.6 Natural and human induced hazards 30
2.6.1 Earthquakes 30
2.6.2 Fire hazards 31
2.6.3 Flooding and water logging 32
2.6.4 Storms 32
2.7 Governance for housing/ development control 33
2.7.1 Housing regulations/ development control related Rules and Acts 33
2.7.2 Building approval process 40
2.7.3 Violation of development control rules and acts/land use plan and building regulations 41
2.8 Infrastructure and services 43
2.8.1 Land and housing 43
2.8.2 Electricity, gas, water and sanitation 56
2.9 Conclusion 57

3 Literature Review 63
3.1 Introduction 63
3.2 Sustainable Construction 64
3.3 Sustainable Building 69
3.4 Sustainable High-rise (Tall) Buildings 70

3.4.1 Sustainable building assessment frameworks 72
3.5 Sustainable High-rise Residential Building 75
3.6 Satisfaction of high-rise living 79
3.7 Concerns of High-rise Living 82
3.8 Energy Use in High-rise Residential Buildings 84
3.9 Conclusion 93

4 Methodology and Methods 97
4.1 Introduction 97
4.2 Evidence-based research 97
4.3 Research Methods/ Design 98
4.3.1 Questionnaire Survey 1: Stakeholder Questionnaire Survey 99
4.3.2 Questionnaire Survey 2: Household Questionnaire Survey 1 110
4.3.3 Questionnaire Survey 3: Household Questionnaire Survey 2 117
4.3.4 Field Survey 1: Building and Neighbourhood Survey 120
4.3.5 Field Survey 2: Electricity Use in High-rise Residential Buildings 120
4.4 Ethics 122
4.5 Data Analysis 123
4.6 Development of strategies 125

SECTION II: RESULTS AND ANALYSIS 127

5 Views of Stakeholders 129
5.1 Introduction 129
5.2 Methods 129
5.3 Results 130
5.3.1 Background 130
5.3.2 Stakeholders' view of building height and open space in high-rise residential buildings 131
5.3.3 Stakeholders' scoring of the stages at which sustainable issues can be applied 133
5.3.4 Views of criteria for sustainable high-rise residential buildings 134
5.4 Discussion 149
5.5 Chapter Summary 150

6 High-rise Living in Dhaka 153
6.1 Introduction 153
6.2 Methods 154
6.3 Results 155
6.3.1 Personal characteristics of the respondents 155
6.3.2 Social issues 156
6.3.3 Spatial Design Issues 168
6.3.4 Environmental Issues 179
6.3.5 The satisfaction of high-rise living 187
6.3.6 Concerns of high-rise living 206
6.3.7 Behavioural aspects 208
6.3.8 Discussion 212
6.4 Chapter Summary 219

7 Electricity Use in High-rise Apartments 223
7.1 Introduction 223
7.2 Methods 223
7.3 Results 227
7.3.1 Design characteristics 227
7.3.2 Household characteristics and appliances 230
7.3.3 Household practices 231
7.3.4 Electricity use of apartments in high-rise residential buildings 233
7.4 Discussion 246
7.4.1 Relationship between apparent temperature and electricity use 246
7.4.2 Regression analysis for total annual electricity use 246
7.4.3 Regression analysis for total annual cooling and air-conditioning electricity use 249
7.5 Chapter Summary 250

SECTION III: RECOMMENDATIONS AND CONCLUSION 255

8 Strategies for Socially and Environmentally Sustainable Practices 257
8.1 Introduction 257
8.2 Method: Critical Review Process 257

8.3 Results: Additional Strategies 258
8.3.1 Social issues 259
8.3.2 Environmental issues 260
8.4 Results: Final Strategies 261
8.4.1 Socially sustainable practices for high-rise residential buildings 261
8.4.2 Environmentally sustainable practices for high-rise residential buildings 262
8.4.3 Overall socially and environmentally sustainable practices for high-rise residential buildings 262
8.5 Conclusion 283

9 Conclusion 285
9.1 Introduction 285
9.2 Research questions answered and research objectives achieved 285
9.3 Contributions of this research 292
9.4 Limitations of this research 295
9.5 Recommendations for the strategies 295
9.6 Recommendations for further research 295

REFERENCES 297

APPENDICES 330
Appendix A: Stakeholder Questionnaire Survey Documents 330
A-1 Participant Information Sheet 330
A-2 Consent Form 332
A-3 Stakeholder Questionnaire Survey 333
Appendix B: Household Questionnaire Survey-1 Documents 341
B-1 Participant Information Sheet 341
B-2 Consent Form 343
B-3 Household Questionnaire Survey-1 344
Appendix C: Household Questionnaire Survey-2 Documents 352
C-1 Participant information sheet 352
C-2 Consent Form 354
C-3 Household Questionnaire Survey- 2 355
Appendix D: Ethics 359

D-1 Human Research Ethics application form 359
D-2 Contacts and Independent Complaints Sheet 366
D-3 Human Research Ethics approval letter 367
Appendix E: Floor plans of high-rise residential buildings 369
E-1: Floor plan with two apartments 369
E-2: Floor plan with three apartments 370
E-3: Floor plan with four apartments 371
E-4: Floor plan with four apartments 372
E-5: Apartment complex with two buildings (four apartments in one and two apartments in the other) 373
E-6: Floor plan with six apartments 374
E-7: Floor plan with six apartments 375
E-8: Floor plan with eleven apartments 376
E-9: Floor plan with twenty apartments 377
Appendix F: Draft strategies 378

List of Figures

Figure 1-1 Housing situation in Dhaka 4
Figure 1-2: Six steps of research methodology employed 17
Figure 2-1: Historical Growth of Dhaka 24
Figure 2-2: Housing delivery system 46
Figure 4-1: Evidence-based research methodology employed in this research 98
Figure 4-2: Research design involving evidence-based research methodology 99
Figure 4-3: Five groups of stakeholders 106
Figure 5-1: Distribution of respondents by profession 130
Figure 5-2: Distribution of respondents by years of working experience 131
Figure 6-1: Advantages of high-rise living across different floor categories according to the 117 respondents 157
Figure 6-2: Disadvantages of high-rise living across different floor categories according to the 117 respondents 158
Figure 6-3: Community safety and security 162
Figure 6-4: Neighbourhood facilities of one of the case study buildings (shaded in orange) 164
Figure 6-5: Observation of public awareness programs according to the 117 respondents 167
Figure 6-6: Cross section of a case study building and the neighbourhood to illustrate effective canyon ratio 171
Figure 6-7: Places of interaction with neighbours according to the 117 respondents 172
Figure 6-8: Corridors in buildings with 4 and 6 apartments per floor 174
Figure 6-9: Corridors in buildings with 11 and 20 apartments per floor 174
Figure 6-10: Playing spaces for children according to the 117 respondents 175
Figure 6-11: Children playing in the corridors 176
Figure 6-12: Children playing inside the apartments 176
Figure 6-13: Designated playing space for of a high-rise residential complex of 4 buildings 176
Figure 6-14: Playing space for the children of a high-rise residential complex of 27 buildings 177
Figure 6-15: Lack of visual privacy in the apartments 178

Figure 6-16: State of fire safety provisions 181
Figure 6-17: Different use of bins in apartments of one building 182
Figure 6-18: Waste collection systems from the 117 apartments 183
Figure 6-19: Collection and disposal of waste 183
Figure 6-20: Waste collection in garbage chute 184
Figure 6-21: Maidservant dumping waste in the drum located in the building complex 184
Figure 6-22: Resource metering systems in the 117 apartments 186
Figure 6-23: Low setback distance between buildings causing lack of visual privacy 190
Figure 6-24: Low setback distance between buildings 191
Figure 6-25: Spaces used for storage 195
Figure 6-26: Community spaces 196
Figure 6-27: Position of illuminance readings in a typical room 198
Figure 6-28: Typical floor plan of a building with six apartments per floor 199
Figure 6-29: Rooms with windows that do not face external walls 199
Figure 7-1: Data collection method and objective for electricity use 226
Figure 7-2: Number of apartments surveyed by floor levels (Sample size, N= 342) 228
Figure 7-3: Number of apartments surveyed by floor levels (Sample size, N= 100) 228
Figure 7-4: Air conditioning usage time in the 36 apartments 232
Figure 7-5: Set-point temperature ranges of air conditioners in the 36 apartments 232
Figure 7-6: Box plot of monthly annual electricity use of the 342 apartments 233
Figure 7-7: Correlation between apparent temperature and mean monthly electricity use in 342 apartments 235
Figure 7-8: Method of estimating monthly cooling electricity use of an apartment based on the baseline electricity use 239
Figure 7-9: Correlation between apparent temperature and mean monthly cooling electricity use in 342 apartments 240
Figure 7-10: Figure explaining the literal meaning of different values of effective canyon ratio 251
Figure 8-1: Socially sustainable practices for high-rise residential buildings 261
Figure 8-2: Environmentally sustainable practices for high-rise residential buildings 262
Figure 8-3: Socially and environmentally sustainable practices for high-rise residential buildings 263
Figure 8-4: Conceptual section showing podium and stepped building form 266

Figure 8-5: Multiunit furniture system showing a wall bed transformed into a sofa 269
Figure 8-6: Conceptual section showing false slabs for storage in collectively located service areas 270
Figure 8-7: Conceptual section showing interactive community spaces.....271
Figure 8-8: Conceptual plan showing diagonal location of windows 272
Figure 8-9: Conceptual section showing the sill and lintel height of the windows of the two buildings to be different from each other to increase visual privacy 272
Figure 8-10: Conceptual section showing the neighbourhood facilities on the lower floors of the building.....273
Figure 9-1: Strategies for socially and environmentally sustainable practices for high-rise residential buildings.....293

List of Tables

Table 1-1: Key problems identified in high-rise residential buildings in Dhaka 12
Table 2-1: Population of Dhaka Megacity 26
Table 2-2: Maximum ground coverage and FAR based on plot size 38
Table 2-3: Setback distance from the back and side of the plots 39
Table 2-4: Summary of social and environmental issues about high-rise residential buildings that were reported 61
Table 3-1: Summary of key features 92
Table 3-2: Global parameters for sustainable high-rise residential buildings 94
Table 3-3: Summary of satisfaction and concerns of high-rise living 95
Table 3-4: Summary of factors affecting electricity usage 96
Table 4-1: Completed sample sizes needed for various population sizes and characteristics at the 95% confidence level, at three levels of precision 107
Table 4-2: Sample size of the stakeholders for the stakeholder questionnaire survey 108
Table 4-3: The distribution of the professions of the valid samples 110
Table 4-4: Sample size of the respondents for the household questionnaire survey 116
Table 4-5: The stages of field survey 122
Table 5-1: Distribution of building height groups based on the stakeholders' preference 131
Table 5-2: Descriptive statistics for different groups of professionals and the corresponding mean open space (in percentage) 132
Table 5-3: Descriptive statistics for stakeholders' scoring of stages 133
Table 5-4: Criteria on culture and heritage 136
Table 5-5: Criteria on spatial design 137
Table 5-6: Criteria on community safety and security 138
Table 5-7: Criteria on maintenance plan 139
Table 5-8: Criteria on local employment 139
Table 5-9: Criteria on awareness and education 140
Table 5-10: Criteria on site selection 141
Table 5-11: Criteria on ecological impact 141
Table 5-12: Criteria on impacts on adjacent properties 142
Table 5-13: Criteria on impacts on air 143

Table 5-14: Criteria on impacts on nearby water body 143
Table 5-15: Criteria on built environment 144
Table 5-16: Criteria on construction practice 144
Table 5-17: Criteria on building materials 145
Table 5-18: Criteria on water management 147
Table 5-19: Criteria on waste management 147
Table 5-20: Criteria on energy management 149
Table 5-21: Overall social and environmental criteria 150
Table 6-1: Personal characteristics of the 117 respondents 155
Table 6-2: Perception of present floor level (%) according to the 117 respondents 159
Table 6-3: Perception of building height (%) according to the 117 respondents 159
Table 6-4: Preferred floor level (%) according to the 117 respondents 159
Table 6-5: Descriptive statistics of the importance of neighbourhood facilities according to the 50 respondents 163
Table 6-6: Neighbourhood facilities of the case study buildings and DAP's requirements 165
Table 6-7: Descriptive statistics for maintenance of building services in 117 apartments 166
Table 6-8: Descriptive statistics for regular inspections of building services in the 117 apartments 167
Table 6-9: Physical characteristics of the 117 apartments 169
Table 6-10: Descriptive statistics of design characteristics of the 50 apartments 169
Table 6-11: Distribution of windows in various rooms of the 50 apartments 170
Table 6-12: Descriptive statistics for the window areas (in square metres) of the 50 apartments 170
Table 6-13: Descriptive statistics for design features for the elderly and disabled in 117 apartments 179
Table 6-14: Descriptive statistics for perceived day-lighting and natural ventilation in 117 apartments 180
Table 6-15: Frequency of fire safety provisions in 30 buildings 180
Table 6-16: Descriptive statistics for pollution in the 117 apartments 181
Table 6-17: Descriptive statistics for supply of resources in the 117 apartments 185
Table 6-18: Water saving devices used in the 117 apartments 187
Table 6-19: Descriptive statistics for the social aspects affecting residential satisfaction in 50 apartments 188

Table 6-20: Descriptive statistics for the spatial design aspects affecting residential satisfaction in 50 apartments 189
Table 6-21: ANOVA for setback distance and respondents' satisfaction of visual privacy ... 192
Table 6-22: ANOVA for open space (percentage) and respondents' satisfaction of open space 192
Table 6-23: ANOVA for size of rooms and respondents' satisfaction of room size 193
Table 6-24: Descriptive statistics for day-lighting and ventilation aspects affecting residential satisfaction in 50 apartments 197
Table 6-25: Average daylight factor in rooms of 50 apartments 198
Table 6-26: ANOVA for illumination/ daylight factor and respondents' satisfaction of day lighting in different rooms 200
Table 6-27: Descriptive statistics for the building construction aspects affecting residential satisfaction in 50 apartments 202
Table 6-28: ANOVA for internal noise and respondents' satisfaction of noise level in the apartment 204
Table 6-29: ANOVA for noise levels across different floor groups 205
Table 6-30: Descriptive statistics for the resource management aspects affecting residential satisfaction in 50 apartments 205
Table 6-31: Descriptive statistics for concerns of high-rise living in 50 apartments 207
Table 6-32: Descriptive statistics for the willingness of the respondents in 117 apartments to have/use 17 design features and facilities 208
Table 6-33: Descriptive statistics for the willingness of the respondents in 117 apartments to undertake educational and training programs 209
Table 7-1: Descriptive statistics of design characteristics of 342 apartments 229
Table 7-2: Descriptive statistics of design characteristics of 100 apartments 229
Table 7-3: Descriptive statistics for household appliances in the 50 apartments 231
Table 7-4: Monthly climate data of Dhaka for 2012 234
Table 7-5: Relationship between design characteristics and total annual electricity use of 342 apartments 236
Table 7-6: Regression model for total annual electricity use (design characteristics as the independent variables) 236
Table 7-7: Regression model for total annual electricity use (design characteristics, household size and number of air conditioners as the independent variables) 237

Table 7-8: Descriptive statistics for total annual cooling electricity use of 342 apartments...239
Table 7-9: Descriptive statistics for total annual cooling electricity use of 100 apartments...240
Table 7-10: Relationship between design characteristics and total annual cooling electricity use of 342 apartments...241
Table 7-11: Regression model for total annual cooling electricity use (design characteristics as the independent variables)...241
Table 7-12: Regression model for total annual air-conditioning electricity use (design characteristics, household size and number of air conditioners as the independent variables)...243
Table 7-13: Correlations between household practices and total annual air-conditioning electricity use of 342 apartments...243
Table 7-14: Regression model for total annual air-conditioning electricity use (household practices as the independent variables)...244
Table 7-15: Total annual electricity use for increased effective canyon ratio (or lower floors) for various cases...252
Table 7-16: Total annual cooling electricity use for different floor levels and apartment sizes for various cases...253
Table 8-1: Distribution of stakeholders in the review process...258
Table 8-2: Strategies on "Site selection"...263
Table 8-3: Strategies on "Ecological impact"...264
Table 8-4: Strategies on "Impact on adjacent properties"...264
Table 8-5: Strategies on "Impact on nearby water bodies"...265
Table 8-6: Strategies on "Culture and heritage"...265
Table 8-7: Strategies on "local employment"...267
Table 8-8: Strategies on "Spatial design"...267
Table 8-9: Strategies on "Built environment"...274
Table 8-10: Strategies on "Construction practice"...275
Table 8-11: Strategies on "Building materials"...278
Table 8-12: Strategies on "Maintenance"...278
Table 8-13: Strategies on "Resource management"...279
Table 8-14: Strategies on "Waste management"...281
Table 8-15: Strategies on "Awareness and education...282

List of Equations

Equation 2-1: Equation representing FAR……... 38

Equation 2-2: Equation representing ground coverage……. 38

Equation 2-3: Equation for calculating number of floors…….. 38

Equation 4-1: Equation for calculating Relative Important Index……... 124

Equation 7-1: Equation for apparent temperature……. 224

Equation 7-2: Equation representing the regression model for prediction of total annual electricity use (influence of design characteristics only)…….. 237

Equation 7-3: Equation representing the regression model for prediction of total annual cooling electricity use (influence of design characteristics and household characteristics)……..... 237

Equation 7-4: Equation representing the regression model for prediction of total annual cooling electricity use (influence of design characteristics only)…… 242

Equation 7-5: Equation representing the regression model for prediction of total annual air-conditioning electricity use (influence of design and household characteristics)……. 243

Equation 7-6: Equation representing the regression model for prediction of total annual air-conditioning electricity use (influence of household practices)…… 244

List of Acronyms and Abbreviations

A21 SCDC	Agenda 21 for Sustainable Construction for Developing Countries
ANOVA	Analysis of variance
BBS	Bangladesh Bureau of Statistics
BEES	Building for Environmental and Economic Sustainability
BFSCDA	Bangladesh Fire Service and Civil Defence Authority
BILS	Bangladesh Institute of Labour Studies
BIP	Bangladesh Institute of Planners
BNBC	Bangladesh National Building Code
BREEAM	Building Research Establishment Environmental Assessment Methodology
CAB	Consumers Association of Bangladesh
CIB	International Council for Research and Innovation in Building and Construction
CCTV	Closed-circuit television
CUS	Centre for Urban Studies
DAP	Detailed Area Plan
DCC	Dhaka City Corporation
DESA	Dhaka Electric Supply Authority
DESCO	Dhaka Electric Supply Company Limited
DMDP	Dhaka Metropolitan Development Plan
DOA	Department of Architecture
DoE	Department of Environment
DTCB	Dhaka Transport Coordination Board

DWASA	Dhaka Water Supply & Sewerage Authority
FAP	Flood Action Plan
FAR	Floor Area Ratio
GDP	Gross Domestic Product
HBFC	House Building Finance Corporation
HBRI	Housing and Building Research Institute
IAB	Institute of Architects, Bangladesh
IEB	Institute of Engineers, Bangladesh
JICA	Japan International Cooperation Agency
JLN	Jurisdiction List Number
KGBCC	Korean Green Building Certification Criteria
LEED	Leadership in Energy and Environmental Design
LPG	Liquefied Petroleum Gas
LSD	Least Significant Difference
MOHPW	Ministry of Housing and Public Works
NEA	National Environmental Agency Singapore
NHA	National Housing Authority
OECD	Organisation for Economic Co-operation and Development
OUA	Other Urban Areas
PV	Photovoltaic
PVC	Polyvinyl chloride
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartipakkha
REHAB	Real Estate & Housing Association of Bangladesh
RII	Relative Important Index
SBAT	Sustainable Building Assessment Tool

SBL	Sustainable Building Lifecycle
SD	Standard Deviation
SP	Structure Plan
SPSS	Statistical Package for the Social Sciences
STP	Strategic Transport Plan
TI	Town Improvement
TPSI	Tall-Building Projects Sustainability Indicator
UAP	Urban Area Plan
UDD	Department of Urban Development
UN	United Nations
UNEP	United Nations Environment Programme
WCED	World Commission on Environment and Development
WFR	Window-to-floor area ratio
WHO	World Health Organization

Abstract

This research aims to develop strategies for socially and environmentally sustainable practice in high-rise residential buildings in Dhaka, Bangladesh. The ever-increasing demand for housing units in Dhaka is currently addressed by constructing high-rise residential buildings. More high-rise residential buildings can be expected to add to the plethora of the prevailing social and environmental problems, including pressure on utility services such as electricity, gas and water supply, lack of fire-fighting facilities, problems with solid waste disposal and non-conformance to building regulations.

The usefulness of the strategies for socially and environmentally sustainable practices for high-rise residential buildings in this research lies in a methodology that responds to the criteria set by building stakeholders and to the needs and perspectives of the specific users together with evidence on different aspects of living in high-rise residential buildings. Hence, this research has used an evidence-based research paradigm.

In this research, evidence was gathered through the application of quantitative and qualitative research methodology. The collection of data was conducted in four stages. In the first stage, socially and environmentally sustainable parameters for high-rise residential buildings that exist globally were identified through a literature survey. In the second stage, the criteria for achieving socially and environmentally sustainable practices for high-rise residential buildings were investigated through questionnaire surveys of more than 100 stakeholders, comprising of architects, planners, real estate developers, engineers and policy makers. In the third stage, the current social and environmental conditions, problems, constraints and achievements of the high-rise residential buildings in Dhaka were explored through questionnaire surveys of 117 residents in 30 high-rise residential buildings. In addition, data on the building design and construction as well as energy use records

of more than 300 apartments were collected. In the last stage, factors affecting electricity use in these residential buildings were investigated.

This research has formulated strategies for socially and environmentally sustainable practices for high-rise residential buildings for the following four stages: planning, design, construction and building operation. The strategies for socially sustainable practices developed in this research emphasise on adding value to the quality of life by focusing on maintaining culture and heritage, local employment, spatial design, maintenance and awareness and education; whereas, the strategies for environmental practices focus on proper site selection, reducing impact on ecology, adjacent properties and nearby water bodies together with improving the built environment, construction methods, building materials, waste management system and resource efficiency (with emphasis on occupant behaviour and household practices).

It should be noted that even though the strategies developed in this research are dispersed widely among a broad category of issues, the main emphasis has been on issues regarding spatial design, construction practice, resource management, maintenance and awareness and education. It is anticipated that the strategies developed in this research could be used as a guide to design, or policy to promote, sustainable high-rise residential buildings not only in Dhaka, but also in other cities worldwide, which face similar problems in terms of their demography and socio-cultural background as well as environmental problems and constraints.

Thesis Declaration

I, Tahmina Ahsan certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

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Tahmina Ahsan

Date: 30 May 2016

Acknowledgements

First and foremost, I would like to thank and express my sincere gratitude to my principal supervisor, Associate Professor Veronica Soebarto and co-supervisor, Associate Professor Terence Williamson for their valuable supervision, guidance, motivation and friendship. Without their assistance, constant feedback, suggestions, interest and constructive criticism, I would not have been able to come this far and this PhD would not have been achievable. I am indebted to them for their continuous support throughout the period of this research. I would also like to thank them for the moral support and encouragements at the final stage of this research. Special thanks go out to my principal supervisor, Associate Professor Veronica Soebarto whose selfless time, genuine concern and care were sometimes all that kept me going. Special thanks also go out to my co-supervisor, Associate Professor Terence Williamson for his guidance during the critical stages of data analysis.

I sincerely acknowledge the funding sources that made my PhD possible. I am grateful to The University of Adelaide for granting me the Adelaide Scholarship International (ASI). Without this scholarship, it would have been utterly impossible to study and survive in Adelaide for the last three and a half years. I would also like to thank the School of Architecture and Built Environment (SABE) at the University of Adelaide for providing the annual postgraduate funds, which allowed me to undertake two field trips in Dhaka. I would also like to thank the Adelaide Graduate Centre for funding the Research Abroad Scholarships (RAS) that enabled me to undertake the survey research in Dhaka.

I would like to express my heartfelt thanks to my friends, colleagues and students for assisting me during the survey research and field survey in Dhaka. Their excellent work during the survey research and field survey has made a valuable

contribution towards my PhD. I would also like to thank my editor Adam Jarvis for persistently editing my thesis.

I would also like to thank my friends at SABE who supported me all the way to strive towards my goal. The chitchats at the corridor were as stimulating as a good cup of tea.

Last, but not the least, I would like to thank the almighty God and my family for all their love, encouragement and optimism. Words cannot do justice to how thankful and grateful I am to my father, mother, sister and brother for all their prayers, even before I began the PhD, without which I would not have accomplished anything. At the end, I would like to give a big thank you to my loving, caring and understanding husband who had to endure the hardest part of this PhD: a "very stressful" me!

Dedication

This thesis is lovingly dedicated to my father Syed Ahsanullah, whose last words to me, before slipping into a coma and subsequently death were to take up the PhD position "no matter what happens".

I have kept my promise dad…….