



## COVER SHEET

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# ACHIEVING SUSTAINABILITY IN ARCHITECTURE: THE APPROACH OF ARCHITECTS TO CLIMATE RESPONSIVE BUILDING DESIGN PRACTICE IN SOUTH-EAST QUEENSLAND

Nur Demirbilek and Amanda Cheetham  
*Queensland University of Technology*  
*School of Design and Built Environment*  
2 George Street, GPO Box 2434 Brisbane QLD 4001  
*n.demirbilek@qut.edu.au*

## SUMMARY

Research is carried out in the form of a survey, which attempts to explore and demonstrate the approach of architects to climate responsive building design practice in South-East Queensland. The hypothesis for the survey is to identify if architects take climate responsive design (CRD) principles into consideration during the design stage of a project. Results indicate that architects understand the importance of designing in response to the environment; they value CRD as important and believe that CRD strongly contributes to good design; there will be a need for specialised consultants for large-scaled projects to aid in dealing with sustainable ideas. However, there is a decline in the commitment from beginning to the end of the project and they believe that the main hindrances are the client (budgetary constraints, lack of understanding) and Town Planning rather than their own lack of understanding. They also think that clients must be educated in how to maintain climate responsive processes of the building.

## INTRODUCTION

Amendments to the Building Code of Australia concerning energy efficiency measures for housing will be released by January 2003. Some State Governments have already implemented policies for achieving sustainable outcomes or are in the process of developing policies to be implemented. In Queensland, the Environmental Protection Agency continually works towards developing guidelines and initiatives for a more sustainable future. Initiatives so far implemented for the building industry are:

- Developing guidelines for energy-efficient and sustainable building development;
- Expanding annual reporting systems for energy auditing and conservation initiatives undertaken by the Queensland Government;
- Developing energy rating standards for public housing;
- Encouraging the adoption of energy conservation technologies and renewable energy supplies for government-owned buildings; and
- Promoting the adoption of energy performance contracting.

(Environmental Protection Agency, 1999, pp.6.19-6.10).

The Royal Australian Institute of Architects (RAIA) has also contributed through its Environmental Design Guide. This guide is intended to aid architects in understanding the principles involved in environmental design and architecture. It argues on ethical grounds that "sustainable design can significantly reduce adverse human impacts on the natural environment while simultaneously improving the quality of life and economic well being" (RAIA, 2001, p1). Furthermore, the RAIA Queensland Chapter is aiming to encourage its members to design beyond eliminating worst practice through targeting best practice by offering skill development courses on energy efficiency. As 'Climate Responsive Design' (CRD) contributes to energy efficient design, which is a part of the sustainable ideal, it is believed that it will contribute to the goals of RAIA.

## THE SURVEY

Sustainability is a broad term used across many different disciplines. Within architecture there are many sustainable strategies. CRD is one such methodology sustainable outcomes through increased energy efficiency. Climate Responsive Designing can be a tool, which aids in achieving an energy

efficient design, through the use of building adjustment methods. As CRD is the basis for most other methods of achieving sustainability within architecture, it is believed that many domestic buildings designed by architects in South-East Queensland do not entail the full scope of it and hence are not achieving a level of sustainability. Therefore, research is carried out aiming to explore and demonstrate the approach of architects to CRD strategies within architectural practice, in the South-East Queensland region.

The research was conducted with the help of an e-mail survey that was distributed to architects within the South-East Queensland region. The research aimed to investigate whether architects take CRD into consideration during the design stage of a building. It looked at how responsible architects consider themselves in designing for the environment; if they know the requirements of CRD for South-East Queensland; and which of those they incorporate in their designs; what they believe are the hindrances towards designing for climate; and what they believe the future entails for architects, architectural practice and sustainable design.

## RESULTS OF THE SURVEY

Seventy-four of the 385 members of the Queensland Chapter of the RIAA responded to the e-mailed survey and the responses are compiled and evaluated. The results of some questions are compared with the results of equivalent questions from a previous survey conducted nationwide by Sabine Wittmann (1997a, 1997b, 1998). Wittmann surveyed a sample of 650 RIAA members and the response rate was 62%. The survey covered energy efficient and ecologically sustainable architecture in general whereas the current survey investigates sustainability in general and CRD in particular for South-East Queensland. An issue that should be pointed out about the present survey is that it may present a bias, due to the possibility that the architects who responded may personally have an interest in this field of study and as the questions rely upon the architects' opinions rather than measurable facts. However the results will still allow a cross-section of issues to be discussed at both global and local scales.

Results of the survey are grouped and presented under four subheadings as:

- The Direction of Practice,
- Architect's Understanding,
- The Pressures and Hindrances,
- Architects, Clients, and Climate Responsive Design.

Some of the results are shown as graphs and unless the legend is given next to the graph, numbers from 1 to 6 in the abscissa represent Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, and Not Responded, respectively.

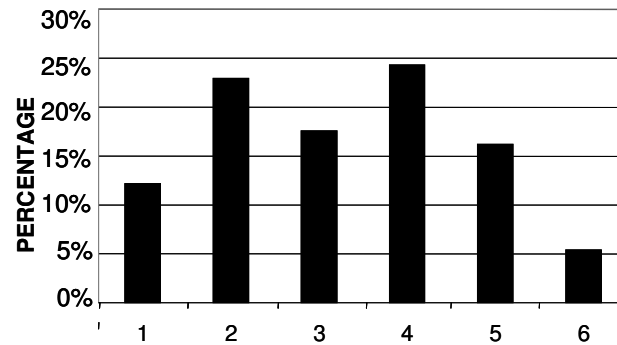
### The Direction of Practice

*"Rafael Pelli of Cesar Pelli & Associates says, 'When we talk about green building, we are really talking about redesigning the design process- rethinking everything from the team to the schedule and pace of the design'. Enlarging the design team to include multiple disciplines, developing goals for sustainability early in the project, and assessing how each design decision affects the overall performance"* (Snoonian and Gould 2001, p96).

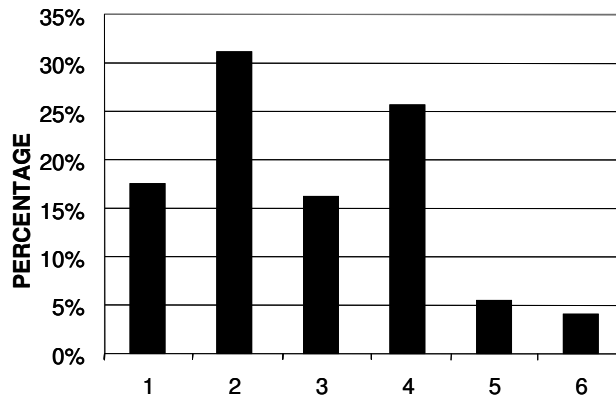
In order to check if South East Queensland architects agree with this statement two questions are asked of them. The first is whether they believe it is their sole responsibility to design in response to the environment. The number of respondent who believe that it is the sole responsibility of architects to design in response to the environment (44%) is similar to the number that believe it is not their responsibility to design in response to the environment (56%) ( $\chi_1^2=0.5$ ; NS) (See Fig.1). The second question involves asking the architects whether, in the future, to achieve a sustainable building will require a team of experts. Results from this question reveal a similar number (48.7%) agree to the number that disagree (31.1%) to this statement ( $\chi_1^2=0.27$ ; NS) (See Fig.2).

Combining these two sets of results using cross tabulation shows that 12% of respondents believe it is both their sole responsibility to design in response to the environment, both now and in the future,

whereas 23% believe both that it is not their sole responsibility and it will require a team of experts. This supports the comments of Pelli (in Snoonian and Gould 2001) and Snoonian and Gould (2001), who suggest expanding the design team to include cross-disciplinary members. Further analysis of those who believe it is their sole responsibility shows that of these respondents are commissioned for small-scale projects whereas just over half of those who believe it is not their sole responsibility are commissioned for larger scale projects. This would indicate the belief in necessity for having other consultants for larger scale projects.



**Figure 1.** An indication as to whether it is the sole responsibility of architects to respond to the environment.



**Figure 2.** The thoughts of architects to include a team of experts.

Those respondents, who agreed to the statement that it will require a team of experts, were then asked who would form this team. The list included architects, environmental engineers, environmental planners, environmental building analysts, physicists, environmental landscape architects, mechanical engineers, structural engineers and others (such as lifecycle experts, industrial designers, and weather statisticians). Analysis of the results reveals that architects are expected to be the most important, closely followed by environmental engineers and environmental landscape architects. The results reveal that mechanical and structural engineers are expected to have little influence on this process and the specialised environmental engineers, environmental landscape architects and environmental building analysts are expected to have the most influence on the design process. This scenario of specialisation may be appropriate for firms, who are commissioned for medium to large scaled projects, where a specialised consultant can be introduced into the scope of services. Due to limitations of the budget architects may have to become skilled at designing smaller scaled projects, with little input from a specialised consultant. As Snoonian and Gould say (2001, p96), "In time, sustainable design concepts will simply be incorporated as inherent attributes of the standard practice". South-East Queensland architects support this comment as 77% of respondents either agree or strongly agree to this statement.

Analysis by cross tabulation additionally reveals that 7.4% of the respondents indicate that it is the sole responsibility of the architect but agree that it will be necessary to involve a team of experts in the future. Just over half of these respondents are commissioned for large-scale projects. It may indicate that while they believe it is their responsibility now, their expectations are that sustainability will increase and thus they believe there will be a need for a team of experts in the future.

## Architect's Understanding

In Wittmann's survey (1998) it was discovered that 90% of respondents considered energy efficient and ecological design to be important. However, when commissioned for a new project, only 30% considered it to be an important factor, and only 31% believed it needed to be part of a good design. Wittmann suggested this indicates a discrepancy between architects perceiving themselves to be committed and their actual commitment. Wittmann speculates that as the question is open-ended the results do not necessarily mean that they object to the subject but simply may not have occurred to them as most important. Wittmann (1998, p90) suggests, "not mentioning energy efficient/ ecological design as an important factor could mean that it is an integral part of architecture to such an extent it does not need mentioning". That is to say, it is integrated into architecture in such a way that it is taken for granted in the same sense as structural design and the meeting of building codes. Results of the recent survey reveal that 86% of the respondents either strongly agree or agree to the fact that CRD strongly contributes to good design.

The South-East Queensland architects are also asked to what degree CRD is important to them. Like Wittmann's results, it is discovered that 96% of respondents agree or strongly agree to this statement. When asked if CRD principles are considered as a factor at the beginning of the design, 92.2% agree or strongly agree giving an indication that CRD principles are included in the sketch design phase, thus sustaining a level of commitment. It is further asked of the respondents if the end results of their designs include CRD principles or not. Eighty-seven percent agree or strongly agree to this, which is almost a 10% decline in commitment of value to self and approximately a 5% decline in commitment from the beginning to the end result of a project. This may indicate that either commitment declines throughout the progress of a project; that there are other influences on the project that direct it in other ways; that architects do not understand how to carry it through the design, or as Wittmann (1998) suggests from the findings of the survey, that it becomes an integral part of architecture.

If architects do not understand the principles of CRD well enough, perhaps the problem lies with their educational experience. The EcoDesign Foundation has completed some studies into the teaching of sustainable design. Many problems were discovered. One problem "was that sustainability subjects had to compete with more conventional vocational subjects in the architectural education curricula (EcoDesign 2002, p2). This is obviously being pursued later in architectural practices. Tony Trobe of TT Architecture mentioned in relation to sustainable design that "A lot of my colleagues wouldn't have a clue frankly, they're into designing Miesian (architect Mies van der Rohe) boxes, with so much glass on them, they're environmentally disastrous" (Ward 2002, p13).

Further hindrances discovered were the practical orientated teaching style of the sustainable subjects. It was found "there was no consensus" (EcoDesign 2002, p3) in the understanding of the term sustainable. Furthermore, it was realised that what students were taught, was to "imagine that any building could be made sustainable with the right techniques, therefore, separating form and content" (EcoDesign 2002, p2). However, when South-East Queensland architects were asked what they believed CRD entails, 48 of the respondents believe it includes all elements listed. This list includes control of sun, control of natural ventilation, humidity levels, spatial relationships, landscaping/vegetation, building form, building orientation, building material, day lighting and other. Previous research into CRD principles revealed that all these elements contribute to CRD; however some elements do become more prominent than others, depending on other influencing factors. Therefore, 64.8% of the respondents understand the full scope of CRD. Of the remaining respondents, CRD is thought to entail control of the sun as the most prominent response, followed by control of natural ventilation, building materials, day lighting, building form, landscaping/vegetation, spatial relationships and humidity levels (See Fig.3).

When asked what CRD elements are included in designs, control of sun and ventilation are included more often than other elements. Only 36 (just over half) respondents say that all elements of CRD are included in their designs. Of the remaining respondents, all respondents include controls of sun, 37 include control of natural ventilation and 36 include building orientation. This difference in understanding and inclusion of the elements would indicate that these elements of CRD are considered more highly and more important than all the elements. Furthermore, it may indicate that there could be a lack of cohesion or understanding in developing these principles throughout the design process, as suggested by the EcoDesign Foundation.

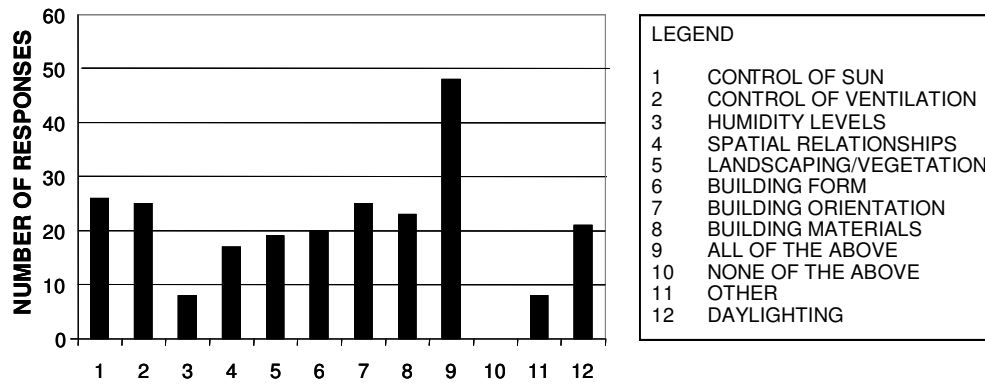


Figure 3. What Architects Believe Climate Responsive Design Entails.

### The Pressures and Hindrances

A conference discussion presented by Wittmann (1997a, p708) revealed a number of contributors to a lack of sustainable design. These included “a lack of awareness, commitment and knowledge among architects, low market demand for energy efficient/ecologically sustainable architecture, high capital cost and low financial incentives to save energy, as well as technical, aesthetic and other design related constraints that may prevent architects”. Of the architects who responded in the South-East Queensland survey, barriers to achieving a design for climate include budgetary constraints, client’s lack of understanding, client brief, and local government town planning as the most prominent. Further barriers include client expectations, inappropriate orientation of site, adjacent structures, lack of governmental regulations, architect’s lack of understanding, lack of resources, time constraints (See Fig.4). From these findings, it is believed that the client is the most prominent barrier towards developing CRD. The entire client related issues are rated as the biggest barriers. The local government town planning issues closely follows these. Twelve percent of respondents state it is due to their lack of understanding.

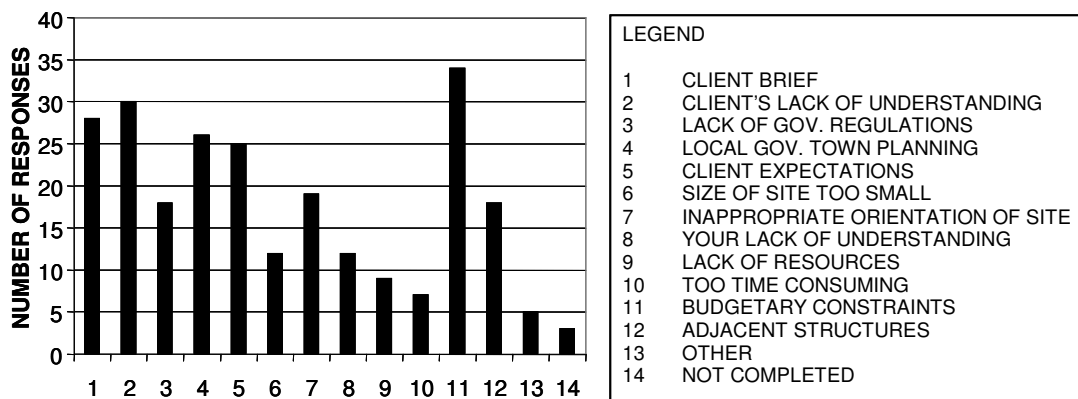
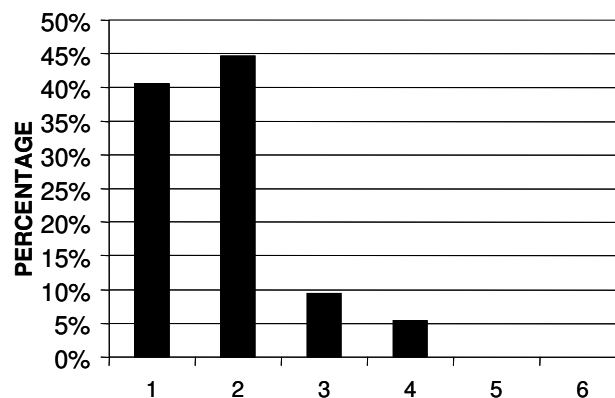


Figure 4. The indication of barriers towards designing for the climate.

Further suggestions include cost effectiveness of active systems to supplement passive systems, commercial pressures to do otherwise, existing building renovations, lack of architects being consulted by clients, and environment design guide structure. A number of architects additionally comment that energy costs are too low and that to make a real impact on the environment a Carbon Tax should be implemented. Therefore, the incentive to design not just climatically, but for a total life cycle would be greater. This is further related back to the client’s pocket and the long-term benefits that a client could have if life cycle costing became more acceptable. It is additionally commented that it is difficult to demonstrate to the client the long-term benefits available with this method. These comments express the concerns and difficulties that architects have in trying to achieve a level of CRD and sustainability.

In the broader community, there has been a raised awareness about sustainable architecture in recent years. Among others, a newspaper article in *The Australian* (Ward 2002, p13) emphasises and expresses the concerns when designing for a sustainable outcome. These concerns are the effect of the built environment on the natural environment, the little understanding by architects, and the pressures from statutory and regulatory bodies to design for energy efficiency. All these issues place pressures on architects to develop better skills in the field of sustainable design. While it may have already been revealed that perhaps the problem is not architect's lack of understanding, but the implementation, Figure 5 indicates that architects feel as though there is a strong need for the architectural profession to be more informed about designing for the environment.



**Figure 5.** The indication that architects would like to be better informed about designing for the environment.

### **Architects, Clients, and Climate Responsive Design**

A sustainable building is like a living organism. It takes into account its surrounding environment and works with it, not against it. However, it requires the assistance of the occupier to control which elements work at what time. For example, to achieve the warming of a room in winter, it is best to have things like shutters, blinds, curtains, or some form of adjustable shading, which can be open during the day to allow the sunlight in. At night, the shutters, blinds or curtains should remain closed, to keep in the warmth absorbed during the day. If it were not for this assistance, the room would not be warm during winter. However, it cannot be assumed that the architect will be able to continue the process once the building is complete. Therefore, it should be required by the client to continue to maintain the sustainability of the building. From the surveyed architects of South-East Queensland, 78.4% either strongly agree or agree that a client should be educated in how to maintain the sustainability of a building. This indicates that to design a climate responsive building, not only do architects need to have clear understanding but also the clients need to understand how to achieve an optimal performance. One surveyed architect comments that in order to educate our clients, there must be programs implemented within schools. Eventually, this generation of school children will become informed about designing climatically and sustainably and it will become far more acceptable. Many other architects further comment that society in general needs to be more educated in this area, so that there will be a change in attitude and social trends.

In educating the client, 86.5% strongly agree or agree that the client must be given a manual on how to maintain the sustainability of the building. This further enhances the responsibility of the client. It is not enough for a client to say they would like a building to be climate responsive/sustainable but the client must also be willing to change every day patterns and attitudes to achieve the optimal performance of the building. The respondents indicate that maintaining the sustainability of a building is a continual process, but it is not known or understood as to whether this responsibility will be more than that of a building that is not designed with sustainability principles. Figures 6 and 7 indicate the belief in this importance. If there is an increase in the responsibility to maintain a sustainable building, it may become a hindrance to the implementation of designing for sustainability. However, there is still the increasing awareness being raised that could counteract the continual maintenance of a sustainable building.

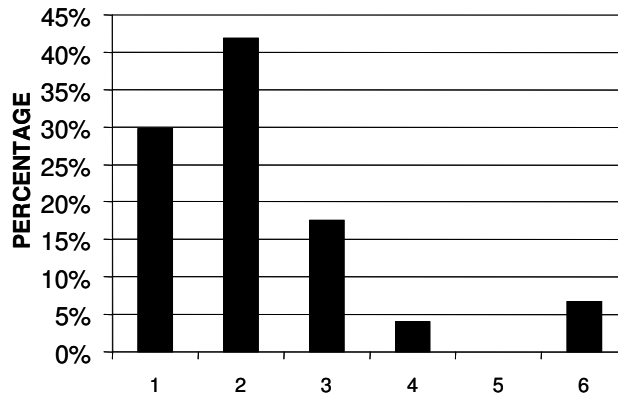


Figure 6. The belief that a sustainable building is an ongoing process to maintain.

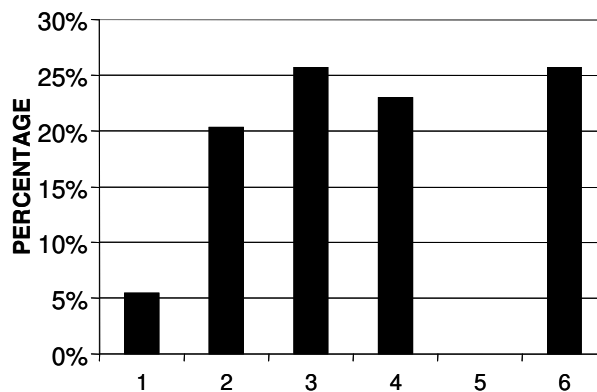


Figure 7. The uncertainty about whether the responsibility will be more than that of a building not designed with sustainability principles.

## SUMMARY AND CONCLUSION

It was found that 12% of the respondents believe it is their responsibility to design for the environment both now and in the future. These respondents are predominantly commissioned for small-scale projects. Twenty-three percent of the respondents believe it is not their sole responsibility and that the design process will require a team in the future. The latter group is predominantly commissioned for large-scaled projects and this indicates that there is a belief that there will be a need for specialised consultants for large-scaled projects to aid in dealing with sustainable ideas.

Like Wittmann's survey it is found that the majority (96%) of South-East Queensland architects value CRD as important. However, analysis of Wittmann's (1998) survey shows that only less than a third believed it could form part of a good design whereas the recent survey reveals that 86% of the respondents believe that CRD strongly contributes to good design. There may be different explanations to this variation. It may well be an indication of the acceptance of the topic in the past 5 years or since the wording of the questions are quite different (the recent survey is quite direct whereas the previous survey's question is an open-ended one) as Wittmann points out it might be accepted as an integral part of the design process and just not mentioned by the respondents.

When commissioned for a new project less than a third of respondents considered it to be an important factor in Wittmann's survey. When asked in the present study which CRD principles are included in their designs, there is a decline in the commitment from beginning to the end of the project. There are many possible explanations for this reduction in commitment throughout the design process such as that CRD principles are not understood strongly enough to carry through the design or that other influences are directing the design. Town Planning is given as an inhibiting factor but the main hindrance incurred by architects is the client. That is, they claim that budgetary constraints, client's lack of understanding, and client brief do not allow or are not flexible to enable architects to design for



climate to a full scope and add that this is a much stronger influence towards non climate responsive design than the architect's lack of understanding. This is further reinforced by the finding that clients must be educated in how to maintain climate responsive processes of the building. It is strongly recommended by South-East Queensland architects that the client should be more educated and given manuals in regards to maintaining the sustainability of a building. However, one architect suggests that the education of future clients is more important and that programs must be included in schools. It is thought that this would enable a better understanding and market drive that may prompt societal change towards CRD and sustainability. Another suggestion is implementing a carbon tax to act as a driving force.

As it has been mentioned before, there may be an inherent bias that the questionnaire methodology used may have caused self-selection of architects to value sustainability and CRD principles. Hence, the authors are reluctant to draw a concrete conclusion. In order to overcome the bias, a more controlled study is recommended. To understand what is done within architectural practice and to aid in future development a study of architects' work would be necessary. This would involve a third party analysing the design from initial concept through to built form. Elements of CRD would be identified to ascertain what is considered, included, and eliminated. This may be a study that could aid in the development of education programs not just for universities but also for the continual professional development of the architectural and related professions.

## **ACKNOWLEDGEMENTS**

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