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DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION

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Abstract

This research addresses the problem of construction defects and their impact on the construction sector and economy. It explores the types of defects, including design deficiencies, poor workmanship, material defects, and distinguishes between apparent and latent defects. The study emphasizes the need for effective defect management throughout the construction process, examines barriers to implementation, and investigates the role of modern technologies and workmanship-related issues.

The research objectives are to analyze the type and severity of defects in commercial construction projects, compare different approaches to defect management, and explore obstacles to adopting modern approaches in the commercial construction sector. The significance of this study lies in providing insights for construction professionals, addressing the pressing issue of defects, and recommending new approaches to defect management. The literature review examines the nature and phases of construction defects, highlighting the role of workmanship, design, and maintenance. It also explores various methods and systems proposed for defect management currently used in the industry.

The research methodology employs an ethnographic research design to understand the cultural context and develop a narrative account of the construction sector. This design allows direct access to practices and culture, facilitating a deeper understanding of behavior within the specific context. Additionally, a case study research design is used, incorporating interviews with managers and workers from selected construction firms to gain diverse perspectives on defect management. Data is collected from over 14 sites using 21 professionals in Brisbane which includes primary data from 21 interviews and secondary data from reliable sources such as Google Scholar and industry reports. Thematic data analysis is conducted to identify major themes in the collected data, providing a mixed and nuanced account. Ethical considerations are strictly adhered to throughout the research process. The study acknowledges limitations, including the subjective nature of the data, potential sample size constraints, and the absence of software tools for analysis.

The research aims to emphasize the importance of defect management in construction and provide practical insights for construction firms to enhance their practices and effectively address common defects.

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I certify that the ideas, results, analyses and conclusions set out in this dissertation are entirely my own effort, except where otherwise indicated and acknowledged.

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1.0 Introduction

1.1 Background of the Problem

Defects in commercial construction need to be reduced and better managed to improve the quality of projects, reduce reconstruction costs, ensure safety for occupants, and meet project timelines. The cost of construction projects is continuously rising; one way these costs can be reduced to ensure longevity for the sector is to manage/reduce the number of defects existing throughout and upon completion of a commercial construction project. An example of the above reasons why defects need to be managed/reduced can be seen in the Mascot Towers project in Sydney. This apartment block was subject to major defects in the building's structural integrity, leading to all 132 apartments being evacuated in 2019 due to cracking found throughout the building and its foundations (Thomson, 2022). As shown in 'Figures 1 and 2' below from the Mascot Towers, structural defects are often the most costly and dangerous.

Figure 1 Part A and B: Mascot Towers Structural Integrity Cracking

(Source: (Daly, 2020) and (Charlie Moore For Daily Mail Australia, 2019))

Commercial construction defects result from design deficiencies, poor workmanship, and material defects. Design deficiencies occur when architects and engineers fail to adhere to building codes while developing a project's design (Waziri 2016). On the other hand, poor workmanship can manifest as either aesthetic concerns or serious structural integrity issues. Aesthetic issues are relatively easy to address, while structural issues are often difficult to identify until significant damage occurs. Material deficiencies, on the other hand, arise from the contractor delivering low-quality products (Fazel and Izadi 2018).

In simpler terms, construction defects occur when a finished or partially finished construction fails to perform as intended. These defects can be either obvious or latent. Obvious defects, such as undersized beams or coating failures, are apparent during the construction process (Pereira, de Brito and Silvestre 2018). In contrast, latent defects are initially hidden and only become apparent after the entire project is completed. For example, a structural beam may meet the expected requirements for size, color, and grade but be understrength. Latent defects pose a greater risk as they can worsen over time.

Defects have a severe impact on both the building industry and the economy. The cost of defects refers to the amount of resources used on rework as a result of resolving the problem (Baiburin 2017). The resources stated here include work time, materials needed, and the time for which the equipment is employed to fix the fault. Time is undoubtedly wasted as a result of a certain problem, and costs must be incurred regardless of who pays. Something that must be acknowledged in all aspects is that defect control is a requirement in the building industry (Tayeh et al., 2020). This must begin with flaw analysis and realizing that defect tracking must begin during the design phase.

Building performance is directly related to the quality of design and construction decisions. Inadequacies in building performance are caused by flaws in design and construction. These are then reflected in the degree of maintenance during operation. It has also been discovered that the post-occupancy period of a project is frequently disregarded and undervalued, which leads to a variety of faults (Lee et al, 2018). This implies that every level of building necessitates the detection, investigation, and correction of flaws. However, certain building problems are visible while others are not, making the entire context of defect identification a difficult endeavor. Still, certain steps must be taken to determine how flaws in the construction sector may be effectively handled, and losses avoided (Zakariya et al, 2020).

Defect management in the construction industry may also be linked to the usage of current technology that assists experts in the industry in making better judgments. Still, the use of technology and safeguards fall short as the number of errors detected in construction grows, and the industry is worried (Aljassmi el al, 2016). Poor workmanship is often a prevalent problem, potentially caused by a lack of skills and unfavorable working conditions at construction sites, which adversely impact workers' productivity. Numerous interconnected factors contribute to this

complexity. Consequently, construction defects can be deemed hazardous, leading to severe consequences such as building collapses and casualties.

Another project that ran into issues causing failure was the 5 Point construction project on Agnes Street in Brisbane city's inner North which made headlines across the state. The project experience a catastrophic wall collapse which caused huge steel spreader beams holding the excavation pit apart to collapse. This was suspected to be caused by a burst water main which also resulted in half Agnes Street to be sucked into the sinkhole. This is another example of how minor defects/issues can result in catastrophic disasters.

1.2 Statement of the Problem

Identification and analysis of defects in the commercial construction sector pose a challenging task due to the presence of both visible and concealed defects. Each commercial construction stage can be impacted by various defects, ultimately compromising the quality of the structure and leading to severe consequences like building collapses (Baiburin 2017). Consequently, there is a deficiency in effective measures for defect management, necessitating further exploration of potential solutions. Many Brisbane commercial projects are government funded and the cost implications caused by defects directly affects the tax payers' and wastes money that could be going towards hospitals and roads.

1.3 Research Objectives and Questions

The objectives of this research are as given below:

1. To investigate the type and severity of defects in commercial construction projects in Brisbane.

2. To compare various approaches used to manage defects in commercial construction projects.

3. To investigate the obstacles to implementing modern approaches for managing defects in the commercial construction sector.

The research questions are:

1. What are the different types of defects in commercial construction projects in Brisbane?

2. What are the various approaches to managing defects in commercial construction projects?

4. What are the barriers to the adoption of modern approaches for managing defects in commercial construction projects?

1.4 Significance of Study

The study offers valuable insights for project managers, contract administrators, foremen and site managers involved in the construction sector, particularly those concerned with the pressing issue of defects. The study's findings will shed light on innovative and effective approaches to effectively manage defects in commercial buildings in the Brisbane region. Furthermore, based on the collected data, the researcher can provide recommendations on how the construction sector should adopt these new approaches for defect management. The investigation will thoroughly explore the chosen topic, ensuring that all gathered information offers valuable insights. By proposing a comprehensive approach, the study aims to address and rectify defects in the construction sector. Ultimately, this research will significantly contribute to the understanding of this topic.

2.0 Literature Review

2.1 Introduction

Commercial construction defects in Brisbane can be categorized based on their time of occurrence and nature, known as patent and latent defects, respectively. Latent defects, caused by designers, remain hidden, while patent defects, caused by constructors, are easily noticeable upon inspection (Khan, Hussain, and Saquib, 2021). Nature-wise, defects can be classified as structural or nonstructural, depending on the severity of damage or the likelihood of future occurrences. Defects in commercial construction projects significantly impact life cycle costs, making defect management highly important (Pereira, de Brito, and Silvestre, 2018). This preliminary literature review aims to explore insights into defect management in the Brisbane commercial construction sector and its significance.

2.2 Defects and Different Phases of Construction

According to Khan et al, (2021) and in the below 'Figure 2', the majority of defects occur during the construction stage of a project. Investigations have revealed that internal wall defects account for nearly 89% of all defects. These defects found in the commercial sector are primarily caused by workmanship problems. Rafieyan, Sarvari, and Chan (2022) emphasize that certain prerequisites are unavoidable at a construction site, particularly during the construction stage. These prerequisites include site supervision, monitoring of materials, and, most importantly, attention to workmanship. However, Raviv, Shapira, and Sacks (2021) identify the use of low-quality materials as the primary cause of commercial building collapses. They also suggest that buildings failing to meet local construction specifications are more likely to have defects. Similarly, Baiburin (2017) also notes that approximately 60% of accidents can be attributed to defects in commercial construction facilities and materials used during the construction stage. To ensure both the quality and safety of erected buildings, it is crucial to accurately control the construction process using indicators such as defect absence, accuracy, and stability.

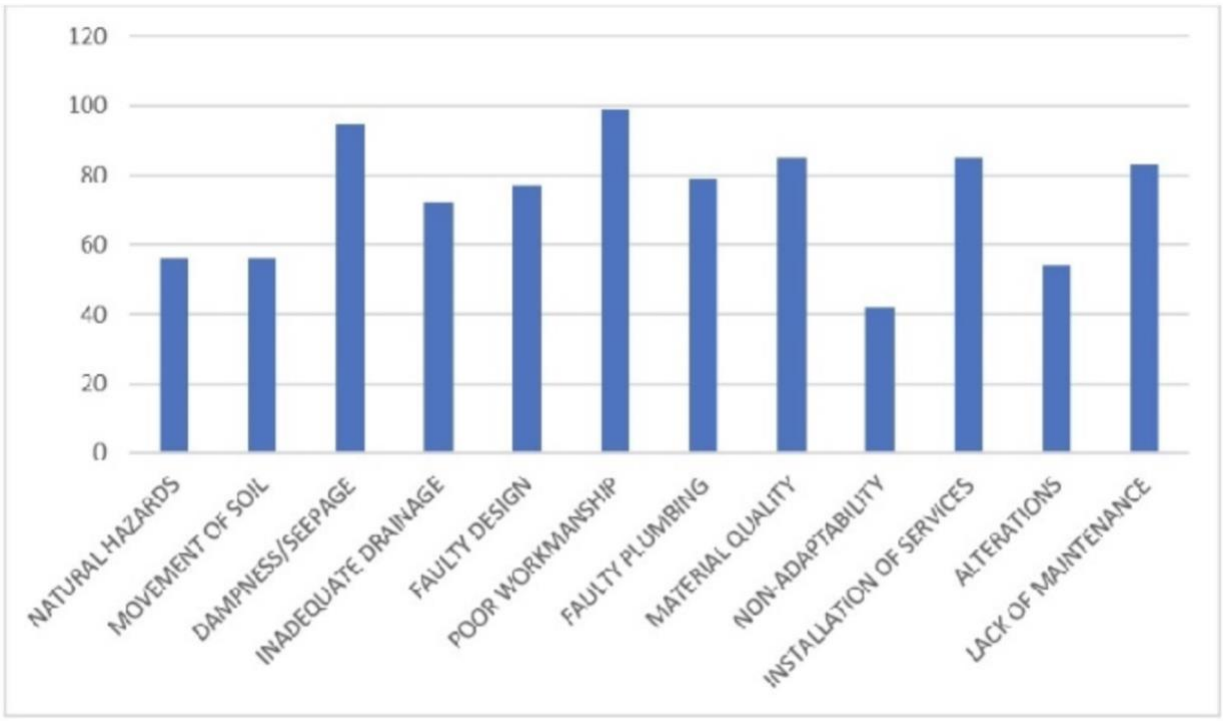

Figure 2 General Perception for Causes of Defects in Commercial Construction

(Source: Khan, Hussain, and Saquib (2021))

According to Khan, Hussain, and Saquib (2021), the design phase of commercial construction offers the greatest potential for technical performance problems to arise. They assume that inadequate detailed design practices are responsible for performance issues in later stages of building life. Tayeh et al. (2020) agrees and further states that all defects occurring during the later stages of construction can be traced back to the early design stage in some way or another. Hasan et al. (2016) highlighted that defects in the design stage of commercial construction can be attributed to factors such as poor design, exposure of the building to unwanted variables, deviation from the design during construction, and poor workmanship.

According to Khan, Hussain, and Saquib (2021), the design phase of commercial construction offers the greatest potential for technical performance problems to arise. They assume that inadequate detailed design practices are responsible for performance issues in later stages of building life. Tayeh et al. (2020) agrees and further states that all defects occurring during the later stages of construction can be traced back to the early design stage in some way or another. Hasan et al. (2016) highlighted that defects in the design stage of commercial construction could be

attributed to factors such as poor design, exposure of the building to unwanted variables, deviation from the design during construction, and poor workmanship.

It can also be noted that the cost, safety, programme, and quality implications for poor defect management in commercial construction versus residential construction are far greater. Commercial construction is generally a more expensive sector, resulting in defects causing far greater issues to the project. This is due to commercial construction requiring more advanced materials, equipment and expert trades, for example, using concrete and steel as appose to a timber frame for the structure. Commercial construction projects also have more extensive electrical, mechanical, hydraulic, and fire systems which again drives the cost implications up for failure to manage defects in the commercial construction sector (Kosturska, 2023). This clearly demonstrates that it is even more important to ensure that defects are managed in commercial construction to reduce the large downfalls to a commercial project.

2.3 Uncertainty of Defects

Pereira et al. (2021) stated that managing defects in commercial buildings is challenging due to the uncertainty involved. They emphasized that uncertainty has become commonplace in the field of building inspection and diagnosis. To address this, there is a need to quantify uncertainty through the inspection of rendered facades. Many professionals in this field are still searching for practical and effective methods to manage the risk of defects.

In a study by Aljassmi, Han, and Davis (2016), practical suggestions for defect management were provided, considering factors such as frequency, pathogenicity criteria, and magnitude. These suggestions were aimed at managers, with the expectation that implementing them would result in high-quality outcomes. Similarly, Bortolini and Forcada Matheu (2018) proposed an objective and standardized commercial building inspection system to evaluate the technical performance of existing buildings.

In another study, Lee (2018) presented a decision-making process to optimize the selection of building facade materials. The objective was to reduce potential defects while minimizing the life-cycle cost of building maintenance.

Commercial construction defects have a significant impact on project performance. These defects stem from initial root causes, such as infectious decisions, practices, and circumstances. According to Aljassmi, Han, and Davis (2014), these root causes often act as pathogens, leading to further risky situations. The authors aimed to create an efficient method capable of capturing the complex mechanisms of defect generation. To achieve this, the study utilized a social network analysis (SNA) approach as a platform to identify the interrelationships among different defect causes. They conducted a review of SNA metrics to develop a formal mathematical expression of pathogenicity, thereby proposing a new methodology called Project Pathogens Network (PPN).

According to a study conducted by Machado and Vilela (2020), the incorporation of modern technologies such as Building Information Modelling (BIM) and Augmented Reality (AR) can significantly aid in resolving design flaws during the initial stage. BIM has demonstrated its potential in supporting various life-cycle activities and facilitating decision-making for managers. Chalhoub, Alsafouri, and Ayer (2018) concur with this and propose that integrating technologies like BIM and AR can improve coordination and communication within the project environment. Hamledari, Rezazadeh Azar, and McCabe (2018) suggest that visualizing the construction process in relation to the planned model can enhance the identification, processing, and communication of progress discrepancies at the commercial construction site. Fazel and Izadi (2018) showcased the significant impact of using AR in defect detection, which improved perception of such incidents. They also emphasized the value of visualization in construction industries, aiding in planning, operations, and maintenance. AR streamlined the execution and detection of information regarding ongoing activities at the construction site. Li et al. (2018) implemented AR in piping system assembly and observed enhanced productivity, professional performance, and a substantial reduction in cognitive workload.

2.4 Factors Controlling Designs and Construction

There have been significant and rapid changes in the various factors that govern design and construction, according to Koo and O'Connor (2021). Initially, cost was considered the primary factor, with the belief that investing heavily would result in a perfect commercial building. Over time, other factors such as speed, quantity, safety, and, ultimately quality emerged as crucial determinants of design and construction control. Zakariya, Nasiru, and Mukhtar (2020) concur

with this viewpoint and further emphasize that different perspectives play a role, as speed may not be critical to the designer or contractor in this context. Bagdiya and Wadalkar (2015) endeavored to comprehend defect causalities in the commercial construction sector and asserted their indispensability in prevention. The authors identified correlations and inter-causalities among all root causes of commercial construction defects, aiming to gain insights into the intricate mechanisms of defect causation. The analysis uncovered time constraints, financial pressure, and organizational culture as the most influential root causes.

2.5 Summary

The literature emphasizes various types of defects in commercial construction, including patent and latent defects, categorized by their time of occurrence. Latent defects, concealed and attributed to designers, contrast with patent defects, which arise from the constructor. Patent defects are easily noticeable shortcomings in a built structure. Additionally, the researcher discovered that the majority of defects occur during the construction stage of a commercial project. Moreover, it was found that commercial construction sites, particularly during this stage, entail unavoidable prerequisites. The mentioned prerequisites encompass site supervision, monitoring materials on-site, and placing significant emphasis on workmanship. However, the challenge lies in managing defects, which are uncertain in commercial buildings. This has prompted the exploration of new approaches and the adoption of modern technologies as potential solutions. Uncertainty has become prevalent in the field of building inspection and diagnosis.

Therefore, it is crucial to quantify uncertainty through the inspection of rendered facades. To improve outcomes, incorporating advanced technologies like Building Information Modelling (BIM) and Augmented Reality (AR) can significantly aid in rectifying design defects. Studies have revealed that visualizing the construction process through a connected model facilitates the identification, processing, and communication of discrepancies during construction. AR simplifies the execution and detection of information regarding ongoing activities at the building site.

2.6 Literature Gap

The literature provides valuable insights on the topic, but defect management in commercial buildings has not been adequately addressed. Building codes exist worldwide to regulate construction, yet their connection to defect management remains unexplored. The challenges faced by construction professionals and their impact on productivity, ultimately leading to poor construction, have also been overlooked. Defect management is a complex endeavor that encompasses numerous interconnected factors. While some factors have been discussed in the literature, others remain unexplored. It is crucial to establish the link between all these factors and seek the best approach to address defects in commercial construction.

3.0 Research Methodology

3.1 Introduction

In this section, an overview of the methods utilized to address the research questions will be provided. We offer justifications for the choices made, as they significantly impact the validity and reliability of the study. The research objectives have been carefully considered in the development of the research methodology.

3.2 Research Philosophy

Research philosophy encompasses the origin, nature, and development of knowledge, representing the researcher's fundamental assumptions. It entails determining how data pertaining to a specific phenomenon should be collected, analyzed, and utilized. Research philosophy serves as a reflection of the researcher's crucial beliefs. The two prevalent research philosophies are positivism and interpretivism. Positivism advocates for the reliance on factual knowledge acquired through observation, limiting the researcher to objective data collection and interpretation. The chief advantage of positivism lies in its ability to formulate robust hypotheses, enabling experimentation to yield appropriate results (Wutich and Brewis 2019). Conversely, interpretivism asserts that researchers play a distinct role in observing the social world and emphasizes the influence of their personal interests on the research process.

In this research, the chosen methodology is mixed, and the most suitable philosophy is interpretivism. The topic being investigated requires a thorough exploration, making interpretivism appropriate. This research philosophy enables the gathering of abundant information and its analysis through subjective lenses. Data generation and analysis are intertwined in interpretivism, providing significant assistance in addressing the research objectives effectively (Mohajan, 2018). The focus is on defects management in commercial buildings, necessitating the consideration of diverse perspectives. In this scenario, interpretivism proves advantageous as it supports methods like interviews and observations.

It can be seen in 'Appendix 2 – Ripley Satellite Hospital – Masonry Defects that there are several defects for the bricklaying trade discovered at the end of the project. The causes of these defects stem from poor workmanship and material quality, where the main cause of defects is poor

workmanship. The simple graph below, 'Graph 1 – Cost Implications for Different Defect Causes,' shows how poor workmanship led to the defects with the greatest cost implication. This construction project is on the smaller side for the bricklaying company and with the total cost implications, it portrays how important defect management is in commercial construction.

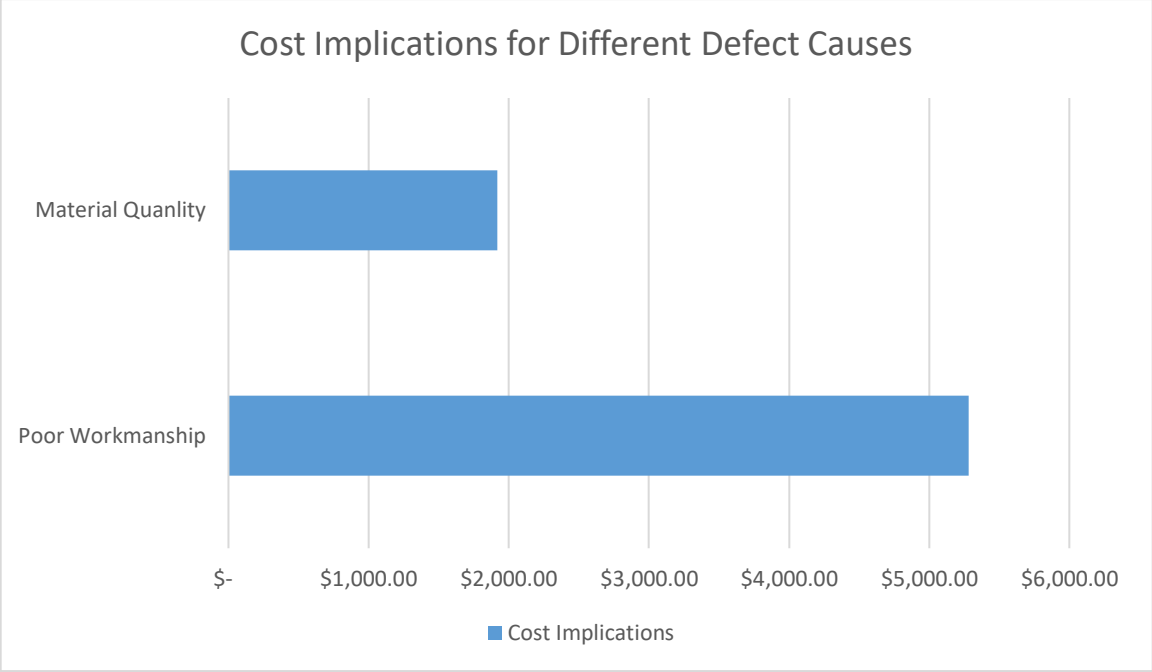

Figure 3 Cost Implications for Different Defect Causes

(Source: Created by Andrew Gillies)

3.3 Research Approach

The inductive approach involves initiating research through a series of observations. In this approach, researchers progress from specific experiences to a broader set of propositions related to those experiences. Consequently, it can be affirmed that the inductive research approach strives to move from data to theories (Tsai, 2019). The utilization of the inductive research approach comprises three key stages: observation, identification of patterns, and the formulation of general theories or conclusions.

The deductive approach is characterized as involving scientific investigation measures. It entails analyzing and evaluating existing research works by other scholars. Based on this analysis,

hypotheses are tested during the research process. In essence, the deductive approach begins with a theory and employs deductive reasoning to test these theories (Pandey, 2019).

This research approach consists of several stages. It starts with an existing theory, followed by formulating a hypothesis based on that theory. Data is then collected to test the hypothesis, which is subsequently analyzed and tested. Finally, a decision is made regarding whether the hypothesis can be rejected as a null hypothesis or not.

In this study, an inductive approach has been adopted. The purpose is to gather a significant amount of data at the beginning of the research process. Once data collection reaches a point of saturation, the researcher will analyze the data from a broad perspective (Pandey, 2019). As mentioned earlier, the topic requires capturing various viewpoints, including those of construction workers, contractors, project managers, civil engineers, and others. Therefore, interviews need to be conducted and the obtained answers carefully analyzed. An inductive approach is appropriate in order to maintain the subjectivity of the study and enable the researcher to adhere to the research objectives.

3.4 Research Design

Grounded theory is extensively employed in numerous research studies. It entails a structured approach to uncovering and formulating theories based on existing data. This method is systematically implemented and further examined through comparative analysis (Konecki, 2018). The main objective of grounded theory is to prioritize data collection measures while simultaneously scrutinizing and cultivating analytical ideas. In research, grounded theory equips researchers with effective tools to construct robust evidence and elucidate underlying processes.

A case study is a research approach used to generate a comprehensive and multifaceted understanding of complex problems within real-life contexts. This research design is widely recognized and extensively utilized across various disciplines (Schoch, 2020). The case study design employs two approaches for data collection: fieldwork and document review

Ethnographic research design is a recognized approach in which individuals are examined within their cultural settings, aiming to construct a narrative account of their respective culture against a theoretical backdrop. The design of ethnographic research is characterized by several features,

including context, naturalism, a small number of cases, multiple data sources, etic and emic perspectives, and ethical considerations (Wutich and Brewis, 2019). The primary advantage of this research design is that it allows the researcher to directly access the practices and culture of a particular group, making it a valuable tool for understanding behavior and engaging with people in a specific context.

Within the realm of mixed research, the chosen research design will be a case study. Visits will be made to various construction firms to obtain permission to conduct interviews. The interviewees will include not only managers but also workers in this sector. By considering different perspectives on defect management, the research aims to yield comprehensive and nuanced insights into this complex issue (Schoch, 2020). The case study research design facilitates a thorough exploration and understanding of the multifaceted aspects related to the topic.

3.5 Data Collection and Analysis

In this research, both primary and secondary data will be collected. Secondary data will be obtained from reputable databases such as Google Scholar and IEEE Explore, among others. Additionally, any available industry reports will be included in the research. Apart from secondary data, primary data will also be gathered. Interviews have been chosen as the preferred data collection method due to their numerous advantages. The aim is to conduct 21 interviews which will result in a wide range of data to analyse. This number of interviews is an adequate sample size to represent the commercial construction sector in Brisbane due to the range of applicants roles and experience. One key advantage is the ability to ensure accurate screening, as the individuals being interviewed are unlikely to provide false information when answering screening questions related to age, gender, or race. Interviews also enable the capture of both verbal and non-verbal cues, allowing for a more comprehensive understanding of the participants. Another advantage of using interviews as a data collection tool is the ability to maintain focus and effectively capture emotions and behaviors. However, interviews do have certain drawbacks. The main disadvantage is the associated cost, as conducting interviews requires staff and personnel, resulting in additional expenses (Lallukka et al., 2020). The interviewer's ability significantly influences the quality of the data obtained, making it a potential disadvantage. If the interviewer lacks expertise in the subject matter of the questions, it can adversely affect the data's quality. Additionally, the

interview data collection method has a limited sample size, necessitating multiple interviews at different locations. This can result in increased costs, which is a drawback. Another drawback is the manual entry of data, which requires either manual input or scanning, further adding to the interview costs.

Based on the discussion, it has been determined that interviews conducted, with a sample size limited to 20-30 individuals from the construction sector. The researcher plans to approach local construction firms near their residence to conduct the interviews. Below are the sample interview questions:

1. Hello, I hope you're doing well. May I inquire about your years of experience in this sector?

2. Please share some challenging experiences you've encountered in the workplace.

3. How do you perceive the management of defects in the construction industry?

4. Have you ever been involved in a construction project that failed due to defects?

5. Could you provide information about modern approaches to defect management in construction?

6. In your opinion, what are the primary challenges faced by construction companies when adopting new approaches?

The 21 interviews conducted using a structured format, wherein all respondents will be asked the same questions. The questions were be open-ended, allowing respondents to address them based on their personal experiences.

Thematic data analysis will be utilized in this research. The researcher will identify distinct and significant themes by examining both primary and secondary data. The researcher will then compare and contrast these themes to address the research objectives. Thematic analysis was chosen as it offers a mixed, detailed, and nuanced account of the data (Castleberry and Nolen, 2018).

3.6 Timeline

Activities	1st to 3rd Week	4th to 10th week	11th to 13th Week	14th to 17th Week	18th to 21st Week	22nd to 23rd Week	24th Week
Selection of topic							
Data collection							
Creating first layout							
Literature review							
Analysis and interpretation of collected data							
Findings of the data							
Conclusion of the study							
Formation of draft							
Submission of final work							

Figure 4 Timeline Gantt chart

(Source: Created by Andrew Gillies)

3.7 Risk Assessment

It can be seen in 'Appendix 1 – RMP Risk Assessment' there are several identified risks that are generally all low risk and have a low likelihood of occurring. These risks, though, aren't likely can have a significant negative impact on the research. As an academic researcher and student, there are not a great deal of risks that are of great concern for the research. The researcher must carefully allocate resources and ensure optimal utilization to achieve the research objectives. Conducting interviews to address the research objectives incurs the greatest risk as interaction with various potentially unfamiliar interviewees is required, which can be of concern. Additionally, interviewees backing out in the middle of the research process is a serious concern that can significantly disrupt the research progress. Although the sample size for interviews has been

limited for 20 - 30, if some participants withdraw midway, it will affect the proper representation of the population. It is an ideal assumption to expect high cooperation from all respondents.

The existing controls are designed to search for free resources that are highly relevant. Another control involves accessing different libraries. Although, this may be considered to some extent, as it will be beneficial for future research. To address interviewees backing out, an additional control is the development of a consent form with a specific clause. Interviewees will be requested to provide their consent before being included in the research, thereby avoiding any disruptions in the research process. It can be seen in the 'Risk Table and Matrix' below that many of the risks are likely to happen; however, the controls already in place render the severity as low-medium.

3.8 Risk Table and Matrix

Risk ID	Risks	Likelihood	Severity
1	Travel to various construction sites	High	High
2	Interacting with interviewees	High	Medium
3	Accessing construction sites	High	Medium
4	Construction site-specific inductions	High	Low
5	QLD construction induction card	High	Low
6	Hazards found on construction sites	Medium	Medium
7	Various tickets required for entering construction site	Low	High
8	Personal Protective Equipment requirements	High	Low
9	Safe Work Method Statements	High	Low
10	Escort onto the construction sites	Medium	Low
11	Temperatures over 35°C	Low	Medium
12	Severe weather (storm, hail, etc.)	Low	High
13	Missing out on relevant resources due to budget constraint	Low	High
14	Sample size getting reduced as interview respondents back out throughout the research process	Low	Extreme

Table 1 Risk Table and Matrix

(Source: Created by Andrew Gillies)

LIKELIHOOD ↓ / SEVERITY →	1	2	3
1	LOW – 1 –	LOW – 2 –	MEDIUM – 3 –
2	LOW – 2 –	MEDIUM – 4 – Risk 1	HIGH – 6 –
3	MEDIUM – 3 – Risk 2	HIGH – 6 –	HIGH – 9 –

Figure 5 Risk Matrix

(Source: Created by Andrew Gillies)

4.0 Ethics and Limitations

https://www.unisq.edu.au/current-students/academic/higher-degree-by-research-students/conducting-research/human-ethics/applications-reports

In this study, both primary and secondary data will be collected, necessitating strict adherence to ethical considerations. Specifically, the ethical considerations for primary data are as follows:

- No respondents will be coerced into participating in this research.
- The purpose of the research will be clearly explained to the participants.
- The formulated questions will not offend or harm the sentiments of the respondents in any way.

Similarly, for secondary data, the ethical considerations are as follows:

- Outdated information will be excluded from the analysis.
- Data will not be sourced from websites such as Wikipedia and blogs.
- Proper referencing and in-text citations will be employed to eliminate plagiarism and credit the original authors.

This research also has certain limitations. Firstly, it may lack objectivity as only subjective data will be included. Secondly, the sample size of interviews, limited to 10, may impact the research results, as it may not effectively represent the entire population. Lastly, while secondary data plays a crucial role, relying solely on thematic analysis instead of using software like NVivo may be a disadvantage. Moreover, the availability of relevant data poses a concern or limitation in this context.

To address all the aforementioned limitations, the project plan will be strictly followed, ensuring that no steps in the research process are skipped.

4.1 Summary

In summary, this research will employ a mixed research methodology, with interviews as the main data collection method. The research philosophy adhered to will be interpretivism, the research design will be a case study, and the research approach will be inductive. Thematic analysis will be utilized to thoroughly analyze the collected data. Overall, the research will be purely mixed. It should be noted that the sample interview questions provided may be subject to change in the final thesis. The interview script will be included in the appendix section to allow readers to review the respondents' answers themselves. Throughout the research process, utmost importance will be given to ethical considerations.

5.0 Findings and Analysis

5.1 Introduction

The fifth chapter of the research aims to give a careful analysis of the findings obtained from the comprehensive survey/questionnaire distributed to recognized industry professionals in the commercial construction sector. This chapter provides as a springboard for digging into the intricate complexities of defects management approaches widespread in this industry. The research intends to extract significant insights from the collected data, not only to illuminate the present status of defects management, but also to pave the way for informed suggestions and prospective changes in existing methods.

The major goal of this chapter is to present an insightful depiction of the current environment of defects management in commercial construction. The chapter strives to understand the complex issues, possible pitfalls, and promising paths that define this crucial part of the construction sector by relying on the frank thoughts and experiences of industry stalwarts. It lays forth a strategy for analyzing the underlying dynamics, identifying areas of success and areas that require improvement.

Furthermore, Chapter 4 emphasizes the need of evaluating the acquired facts via a critical perspective. The analytical methodology used here attempts to extract significant patterns, trends, and correlations from the participants' replies. The chapter tries to extract actionable knowledge from rigorous statistical analysis and qualitative interpretation in order to serve as a guidepost for improving defects management tactics in commercial building projects.

In essence, this chapter serves as a turning point in the study, transforming the varied array of viewpoints and experiences supplied by industry professionals into an organized, data-driven narrative. The integration of these concepts not only enriches scholarly discourse, but also has the potential to stimulate practical changes in defect control procedures, therefore improving the overall efficacy and resilience of the commercial construction industry.

5.2 Participant Demographics

5.2.1 Number of Participants

A cohort of 21 notable industry professionals who actively engaged in the survey/questionnaire provided vital insights to the study. This varied group is a representative sample, providing a broad cross-section of opinions from the commercial building industry.

5.2.2 Experience in the Industry

The members in this study had a wide range of involvement within commercial construction, ranging from 20 to 45 years. This wide range envelops a wide assortment of information and capacities, emphasizing the breadth of bits of knowledge provided by these experts.

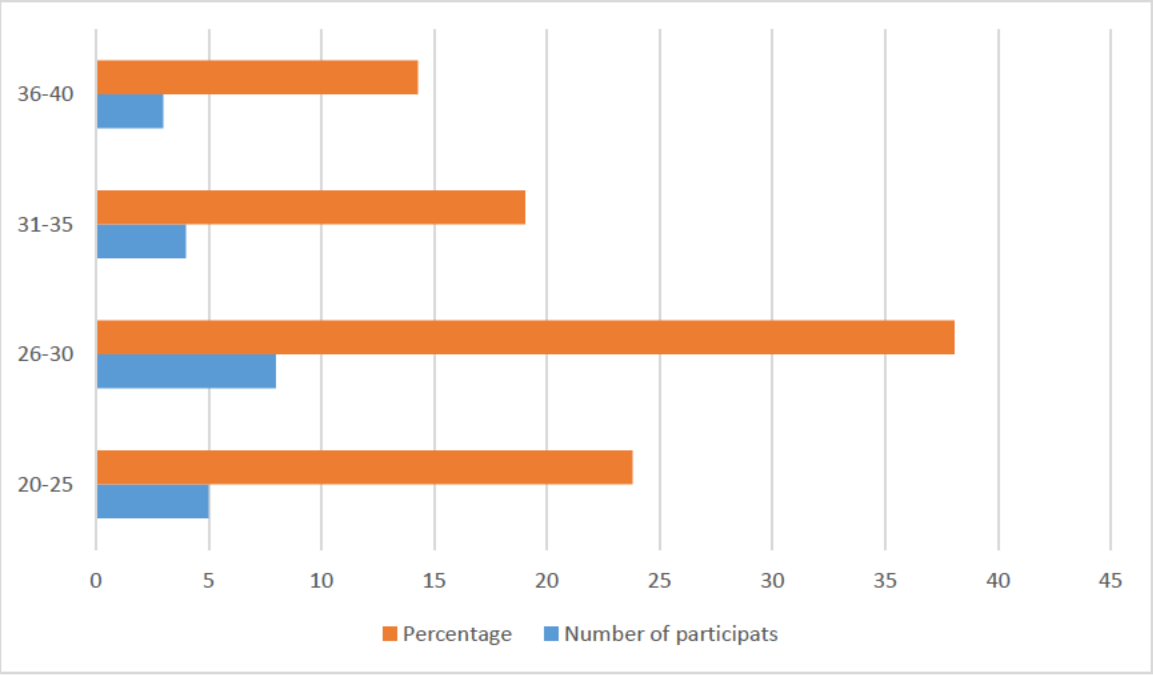

Figure 6 Participant Experience Percentage

(Source: Created by Andrew Gillies)

5.2.3 The Highest Level of Education

The education foundations of the members appear the cohort's level of competency. The larger part of responders had a bachelor's degree or over, with numerous moreover having progressed capabilities or apprenticeships. This instructive certification run represents a multidisciplinary approach to defect control in commercial development that depends on a number of specialty information bases.

Furthermore, a significant number of participants have official qualifications, demonstrating their dedication to continued professional growth in the industry. This combination of academic achievements with industry-specific certificates broadens and deepens the responders' insights.

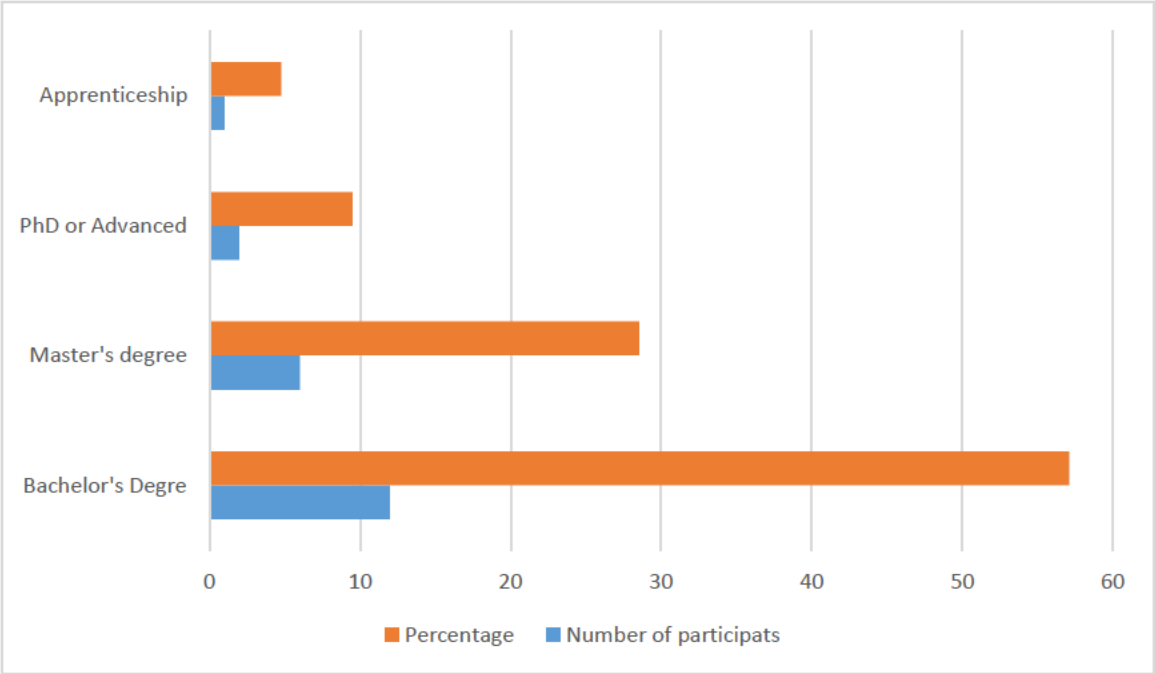

Figure 7 Participants Education Percentage

(Source: Created by Andrew Gillies)

5.3 Defects Management in Commercial Construction

5.3.1 Commercial Construction Defects Management: Brisbane Projects' Perspectives

The survey/questionnaire results are the main source of information in this part, which focuses on the flaws found in Brisbane commercial construction projects. The objective is to offer a thorough study of the particular difficulties encountered in this area and to identify potential areas for improvement.

5.3.2 Types of Defects in Projects in Brisbane

Deficiencies in Design

The survey's findings suggest that Brisbane's commercial construction industry has a serious problem with design flaws. Participants cited situations when poor planning and documentation resulted in problems with the design.

A contributor with more than 15 years of experience noted a recent project where delays and cost overruns were brought on by design errors in the original plans.

Poor Craftsmanship

Another significant area of concern was the poor quality of the work. The respondents highlighted situations in which poor building methods led to pricey rework and hampered project timetables.

A project manager described an incident where poor installation of structural components resulted in structural flaws and required significant rework.

Materials Errors

The information also reveals that material flaws provide a major obstacle for commercial development projects in Brisbane. Instances when the caliber of construction materials fell short of industry requirements were observed by the participants.

A quality control inspector cited a situation where the use of subpar concrete resulted in problems with the building's foundation's integrity.

5.3.3 Impact on Brisbane Projects

Financial Consequences

Brisbane projects' flaws frequently have costly repercussions. Budget overruns were mentioned frequently as a result, and respondents mentioned the extra costs incurred for rectification.

A business expert described an instance when unanticipated flaws increased project expenses by 15%.

Delays in Projects

Project delays were frequently brought on by the presence of flaws. The requirement for significant rework in certain cases lengthened project timeframes, which had an impact on the construction's later phases, according to the respondents.

A project manager described a situation where fixing design flaws extended the project's schedule by three months.

In Brisbane, managing defects in commercial construction projects poses special difficulties. Design flaws, subpar workmanship, and material flaws were out as significant problems. These flaws have a big cost impact and frequently cause project delays. A multimodal strategy, including proactive quality control procedures, thorough design assessments, and a dedication to employing high-quality materials are needed to address these difficulties.

5.3.4 Current Defect Management Practices

This section digs into the varied viewpoints of the participants on the prevalent defects management strategies in the commercial construction sector. Their observations provide light on current techniques, noting both strengths and places for development.

The awareness of the critical importance of competent defects management in guaranteeing the overall quality and integrity of commercial building projects is a constant topic in the comments. The majority of participants agree that existing procedures demonstrate a sufficient degree of proficiency. This acknowledgement demonstrates trust in the established methods for recognizing, recording, and correcting issues.

Furthermore, a significant number of respondents praise the present systems' capacity to enable communication among stakeholders, notably in communicating defect-related information to subcontractors and relevant parties. This continuous flow of information is seen as critical to accelerating the correction process and meeting project deadlines.

However, a sizable number of individuals indicate specific areas where present methods should be improved. One recurring comment concerns the requirement for a designated defect manager, whose major role would be to oversee the process of problem discovery and repair. This suggested function is considered as critical in establishing a proactive approach to defect management, hence avoiding any oversights or delays.

Furthermore, participants stress the significance of successive sign-offs for finished regions and post-trade work. This process improvement would be a critical step, allowing for the methodical clearing of regions as they are completed. This strategy not only develops a feeling of accountability among subcontractors, but it also reduces the possibility of cumulative problems collecting near the end of the project.

5.4 Project Failures Due to Defects

This section delves into the participants' experiences with building projects that failed mostly due to faults. We may acquire useful perspectives on the impact of flaws in the commercial building industry by evaluating their insights and narratives and identifying any repeating patterns or themes.

Failure Rate of Projects: Among the 21 participants, it is worth noting that the vast majority, 95%, stated that they had not been involved in building projects that failed expressly owing to faults. This means that, to a large degree, the projects under their jurisdiction did not suffer such severe setbacks. The experiences of the other 5% of respondents who reported project failures owing to defects, on the other hand, are critical in comprehending the repercussions of defect mismanagement.

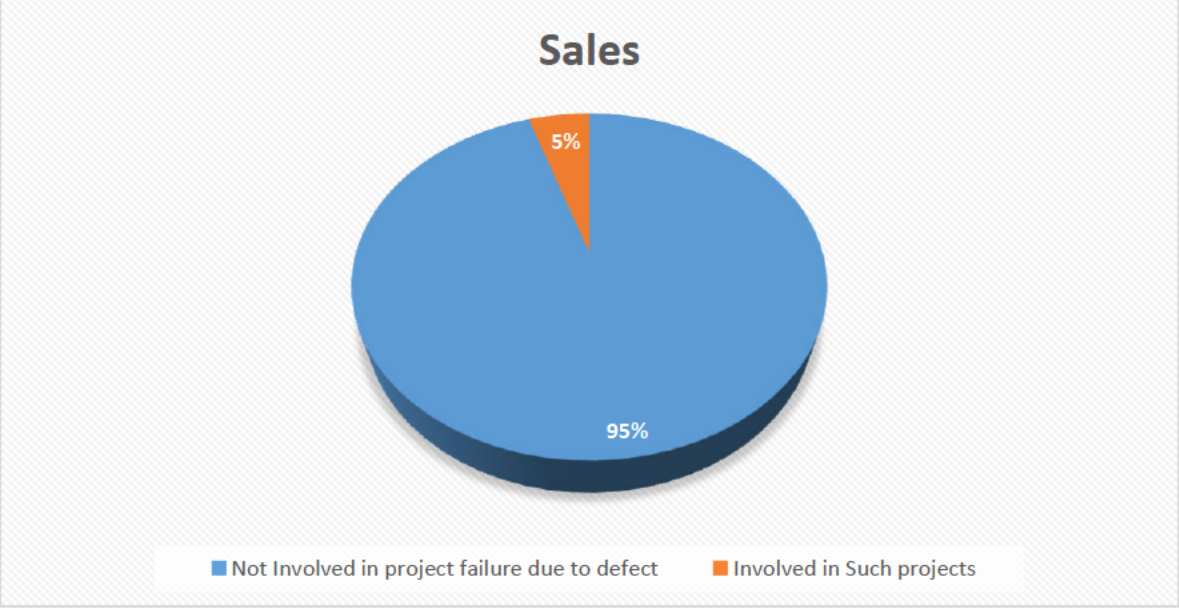

Figure 8 Project Failure Rate due to Defects

(Source: Created by Andrew Gillies)

Common Reasons for Project Failures: Although only a small percentage of participants had firsthand experience with project failures due to flaws, their thoughts shed light on several prevalent factors for such failures. Notably, these project failures were frequently linked to:

Budget Overruns: In numerous situations, faults necessitated considerable repair and fixes, causing project expenses to exceed the intended budget. This financial burden presented difficulties for project parties.

Delayed Time: Project delays were typically caused by the existence of substantial faults. This had an influence not just on the planned project completion dates, but also on succeeding phases of the building process.

Reputation Damage: Project failures owing to faults can harm the image of the construction company involved. Clients may grow unsatisfied, and unfavorable word-of-mouth may discourage new clients from entering into future contracts.

Legal Implications: As accountability for faults and duty for rectifications became controversial issues, several project failures evolved into legal conflicts. Legal conflicts slowed project completion and increased cost obligations.

Lessons Learned: Despite the fact that only a small percentage of participants had personal experience with project failures owing to flaws, these encounters provided useful lessons for the whole industry. These lectures emphasize the significance of strong defect management procedures throughout the lifespan of a project.

Mitigation and Preventive: These experiences highlight the importance of proactive fault mitigation and preventive techniques. Implementing strict quality control and assurance methods, encouraging collaboration among project stakeholders, and investing in training and skill development can all help to reduce defects.

Continuous Improvement: The construction industry should implement a continuous improvement culture in defect control. This includes using technology, improving defect reporting and tracking systems, and improving communication channels among project participants in order to handle concerns as quickly as possible.

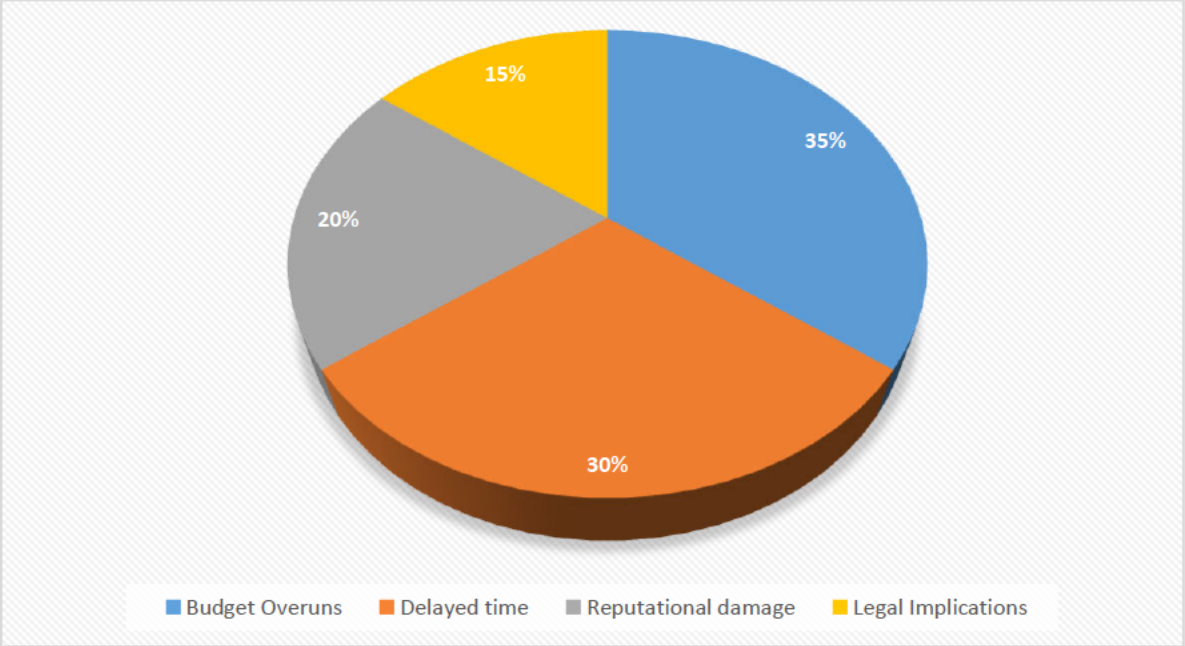

Figure 9 Common Reasons for Project Failure

(Source: Created by Andrew Gillies)

5.5 Ideas for Improving Defects Management

Participants in the poll made a variety of smart comments and ideas for improving defect control in the commercial building industry. These recommendations can be divided into various categories:

Progressive Sign-Off: The adoption of a progressive sign-off mechanism was a repeated recommendation. The need of establishing certain milestones or phases within a project when trades would be accountable for signing off on their finished work was underlined by participants. This method aids in the systematic identification and correction of faults early in the construction process.

Appointment of a Designated Defect Manager: Another popular proposal was the appointment of a designated defect manager. This person would be in charge of supervising and organizing the defects management process throughout the project's lifespan. The defect manager would be in charge of finding, recording, and correcting faults as soon as possible, providing a more streamlined and effective resolution process.

Improved Training and Education: Participants emphasized the need of offering comprehensive defect management training to subcontractors and other stakeholders. This involves teaching them on the value of comprehensive inspections, correct reporting, and quick problem resolution. Investing in the workforce's skills and expertise can help to drastically reduce the occurrence of faults.

Open Channels of Communication: Effective communication has emerged as a vital aspect in defect management. Participants pushed for open and transparent communication lines amongst all project stakeholders. Facilitating open lines of communication between subcontractors, supervisors, project managers, and defect management is part of this. Improved communication ensures that faults are recognized, reported, and rectified as soon as possible.

Use of Defect Management Software: Several participants emphasized the need of using specialist defect management software. Such software solutions make it possible to record, track, and resolve errors in a systematic manner. The ability to assign tasks, give extensive descriptions and images, and track progress on problem correction were among the key features recognized.

Software Customization for Specific Projects: Participants emphasized the need of adapting defect management software to meet the unique needs of each projects. Configuring the program to handle project-specific criteria such as unique levels, zones, or trade-specific concerns may be required. Customizing software results in a more precise and effective defect management procedure.

Defect Prevention Measures: Participants underlined the need of taking a proactive approach to defect prevention. Thorough design evaluations, quality control procedures, and strict adherence to industry standards and best practices are all part of this. The chance of problems appearing during construction is considerably decreased by detecting and correcting possible concerns during the planning and design stages.

5.6 Challenges Faced by Construction Companies

Adoption of New Approaches

Construction firms have a number of problems when it comes to implementing innovative approaches to defect control. These impediments can have a substantial influence on the smooth incorporation of novel methods into existing operations. Here are some of the major issues encountered:

Resistance to Change: One of the key obstacles is the construction industry's innate aversion to change. Long-standing habits and traditions might be firmly embedded, making it difficult to persuade stakeholders such as subcontractors, supervisors, and workers to adopt new defect management procedures. Convincing teams to change their established habits and procedures may be difficult.

Training and Familiarization: Introducing new software or technologies necessitates extensive training for all parties involved. It is critical for the efficient adoption of defects management technologies to ensure that staff are skilled in their use. Allocating time and resources for training sessions, particularly for bigger teams, may be difficult logistically and resource-intensive.

Integration with Existing Systems: Construction firms frequently work with a wide range of existing systems and software applications. The difficulty emerges when attempting to incorporate a new defect management strategy with these pre-existing systems. Compatibility difficulties, data migration, and ensuring that the new technique complements rather than disturbs existing processes may all be daunting challenges.

Cost Considerations: Introducing a new technique to defect control frequently necessitates a financial commitment. This includes the expense of purchasing new software, training employees, and maybe restructuring current procedures. Balancing the initial costs with the projected long-term advantages and improved outcomes can be difficult, particularly for smaller construction firms with limited resources.

Cultural Shift: A concerted effort is required to shift the company culture toward a more proactive approach to defect management. It entails developing a mindset that values quality assurance and problem resolution in a timely manner. To achieve this cultural transition, good leadership, regular communication, and a commitment to building a culture of continuous improvement are required.

Long-term sustainability and scalability: Any new method to defect management should be long-term sustainable and adaptable to handle projects of various sizes and complexities. To ensure that the chosen technique can be followed consistently across a variety of projects without compromising its efficacy, significant planning and thought are required.

Measuring Effectiveness: Determining the success and effect of a new defect management strategy can be difficult. Developing key performance indicators (KPIs) and metrics to assess the efficiency of the method necessitates significant thought and may entail revisions over time.

5.7 Examples or anecdotes from participants' responses.

Resistance to Change: a Senior Contracts Administrator, highlighted the difficulty in getting subcontractors to embrace new defect management procedures. He described a situation in which certain subcontractors were unwilling to modify their established processes, resulting in initial opposition during the implementation phase.

Training and Familiarization: a Project Manager at Hutchinson Builders, shared an anecdote about how adopting new defects management software caused training issues. He said that providing comprehensive training sessions for a large workforce was a logistical challenge that necessitated careful organization and resource allocation.

Integration with current Systems: a Defects Manager at Lendlease, shared an anecdote about the difficulty of integrating a new defects management strategy with current systems. He explained that matching the chosen software with Lendlease's current project management tools necessitated rigorous evaluation and team cooperation.

Cost Considerations: a Director at FTF, shared anecdotes about the cost implications of implementing new defect management procedures. He described an instance in which his organization had to carefully compare the upfront expenses of deploying a new software solution against the expected advantages in terms of improved defect resolution.

Cultural Shift: Anecdote from a Participant: a Project Manager at Besix Watpac, gave a success story about cultivating a culture of proactive defects management within his team. He emphasized

how regular communication and leading by example were critical in creating a quality assurance and defect resolution attitude.

Sustainability and Scalability: a Senior Project Engineer at CPB, shared an anecdote on the necessity of scalability in defect management. He described a project in which the defects management system adopted had to be flexible to diverse project sizes and complexities, emphasizing the requirement for a solution that could be consistently used across multiple settings.

These examples provide significant real-world insights into the problems that construction firms experience when implementing new defect control systems. They provide context for the wider discussion of problems in Chapter 4 by illuminating the practical thoughts and experiences provided by industry professionals.

5.8 Software for Defects Management

5.8.1 Preferred Software and Rationale

Data from the poll provide a thorough picture of industry preferences for defect management software. The top picks are thoroughly examined below:

Procore: 476.0% (10 Responses)

With almost half of all comments, Procore stands out as the most popular option. This firm backing highlights the software's wide acceptability and legitimacy in the field of commercial construction. Its broad range of capabilities, which include seamless communication, rigorous document management, and thorough project tracking, probably have a big impact on its high adoption rate. Additionally, participants may have chosen Procore as a result of its reputation for user-friendliness and versatility.

Aconex Field - 14.31% (3 Responses)

With Excel List in second place, Aconex Field's 14.30% preference level reveals a significant level of satisfaction and trust among respondents. Its prowess in real-time communication, accurate issue tracking, and rigorous quality control probably played a key part in maintaining its position. Perhaps contributing to the software's appeal were its user-friendly design and mobile compatibility

Excel List - 14.30% (3 Responses)

Excel List shows a preference for a more traditional approach to defect management by coming in second position, tied with Aconex Field. While Excel List may lack the specialised features of specialised defect management software, its familiarity and ease of use may appeal to professionals who prefer a straightforward, adaptable solution.

iTWOcx, 9.50% (2 Responses)

A sizable portion of the votes go to iTWOcx, clearly demonstrating the popularity of this programme. According to the preference level of 9.50%, iTWOcx probably has some characteristics or functionalities that appeal to a certain segment of business people. It's possible that the decision to choose it was influenced by its advantages in fields like document management, collaboration, or analytics.

BIM 9.50% (2 Responses)

BIM also receives 9.50% of the responses, which puts it in line with iTWOcx. This is particularly interesting because, although being a powerful tool for design and planning, BIM isn't typically connected to defect control. The mention of BIM in the comments suggests that there may be a move in favour of comprehensive project management approaches that include defect management into the BIM framework.

OmTrak - 4.70 % (1 Response)

OmTrak finishes the list, obtaining a lone response. Despite having received the fewest votes, it is significant that it still represents a preference among some professionals. OmTrak could provide distinctive characteristics or a focused approach that fits with particular projects or organisational needs.

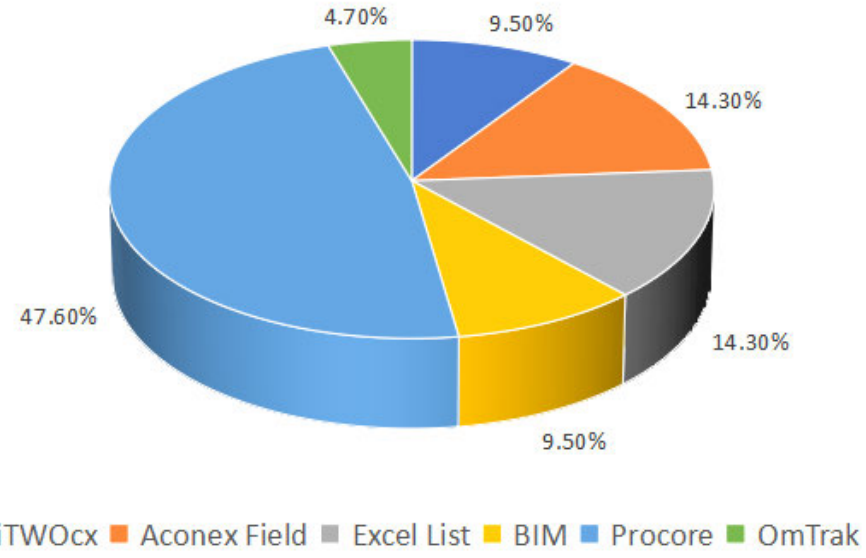

Figure 10 Best Defect Management Software

(Source: Created by Andrew Gillies)

Data show a wide range of preferences for defect management software. Procore wins out as the best option, solidifying its position as the market's top answer. Together, Aconex Field and Excel List occupy the second position, each appealing to different functional and user experience requirements. Indicating certain requirements or integrations, iTWOcx and BIM maintain their places. Last but not least, OmTrak stands out for its applicability to a certain group of industry professionals or project contexts while having the smallest presence. This variety of tastes emphasises how important it is to provide a selection of solutions to meet the various needs of experts in the commercial construction sector.

5.8.2 Fundamentals of Software for Defects Management

Participants shared insightful information about the important attributes and capabilities they feel are necessary for software that manages defects effectively. These principles provide as a framework for choosing or creating software solutions that suit the particular requirements of the commercial construction industry.

Clear Defect Documentation: Participants agreed unanimously on the value of thorough and unambiguous defect documentation. This includes the capability to offer in-depth descriptions, top-notch pictures, and sketches that properly explain the flaws. A shared knowledge of the

problems is ensured through the use of such documentation as a crucial communication tool amongst stakeholders.

Assignment of Responsibilities: Participants emphasized the importance of the software's ability to facilitate the assignment of responsibilities. This function makes it possible to efficiently assign defect resolution duties to the appropriate parties, such as subcontractors, foremen, or project managers. A distinct division of labour helps avoid delays and assures accountability.

Location Tagging: This functionality has grown to be essential. The importance of being able to locate flaws inside a project site with pinpoint accuracy was emphasised by the participants. This avoids confusion or potential mismanagement by ensuring that corrective actions are directed to the appropriate location.

Progressive Tracking and Updates: A dynamic programme for defects management should support progressive tracking and updates. This feature enables real-time monitoring of the status of defect resolution, ensuring that jobs are finished on schedule. The project's progress towards defect resolution is transparently documented via regular updates on the status of problems.

Customization and Adaptability: A number of participants emphasised how the software may be tailored to meet the unique requirements of a project. This entails capabilities for customising variables like project levels, zones, and categories so that the software can take into account the particulars of each endeavour.

User-Friendly Interface: It was found that how simple a programme is to use has a significant impact on how effective it is in managing errors. An intuitive and user-friendly interface encourages greater participation and adoption by subcontractors and project stakeholders, improving the defects management process' overall effectiveness.

The outlined principles offer a useful foundation for assessing and creating software solutions for defects control. Professionals in the construction sector can optimise their approach to defect management, which will lead to better project outcomes, by adding these essential characteristics and functionalities.

5.9 Types of Defects and Their Frequency

Based on their perceived frequency and impact in commercial building projects, participants were asked to evaluate and rank several types of flaws. The following paragraphs provide a comprehensive summary of the participants' ratings and explanations for each type of defect.

Design Deficiencies:

Participant feedback consistently identified design flaws as a common form of fault. These include problems resulting from poor or incorrect project designs. Participants emphasised how frequently these flaws cause expensive rework and building delays. On a scale of 1 to 5, design deficiencies received an average rating of 4.2, which indicates a significant level of concern among the industry.

Poor Workmanship:

Another key worry among participants that arose was shoddy work. This topic includes concerns with construction methods and material use as well as flaws resulting from poor craftsmanship. Participants emphasized that subpar work might have a domino impact on project quality and schedules. The project outcomes were significantly impacted by poor workmanship, which had an average grade of 4.0.

Material Defects:

Issues resulting from poor quality or unsuitable building materials are referred to as material flaws. Participants emphasized that using inferior or incompatible materials can result in structural and functional flaws, which made this category stand out as a significant area of concern. Material Defects had an average grade of 3.8, which indicates a modest level of industry concern.

Communication Lapses:

Participants stated that poor communication can result in construction projects having flaws. Miscommunication or insufficient information exchange among project stakeholders falls under this group of problems. Participants agreed that enhanced communication channels are essential for stopping flaws. The average score for communication breakdowns was 3.6, which indicates the need for improved communication techniques.

Environmental Aspects:

Environmental influences include things like the weather, the soil, and other elements from the outside that can cause flaws. Participants acknowledged that while frequently out of their direct control, these factors can have a big impact on project results. The industry as a whole gave environmental factors an average rating of 3.3, which indicates a modest level of concern.

5.10 Common Defects and Financial Impact

Data on the most common mistakes made in commercial building are carefully examined, and this analysis provides priceless insights into the main problems that professionals in the field face. This thorough investigation not only highlights the frequency of incidents but also highlights the crucial areas that demand focused efforts for improvement.

5.10.1 Poor Workmanship

Poor craftsmanship is unquestionably the leading cause of problems, according to the data, which shows a clear advantage over other categories. This pervasive occurrence suggests a structural problem affecting the entire sector. The widespread occurrence of subpar craftsmanship emphasizes the urgent need for effective quality control procedures, thorough training, and ongoing attention to workmanship standards throughout the construction process.

5.10.2 Design Deficiencies

The significant representation of design deficiencies within reported defects solidifies its position as a critical concern. Although not as common as subpar craftsmanship, the constancy of design-related problems justifies a close examination of design procedures and a strengthened emphasis on rigorous design reviews both before and throughout project execution.

5.10.3 Material Defects

In the building projects examined, material faults pose a significant challenge, earning the 3rd spot. This highlights possible flaws in material quality assurance procedures. To reduce this type of problem, it is essential to thoroughly analyze and improve the sourcing, inspection, and validation processes for building materials.

5.10.4 Structural Defects

Structural defects continue to be a substantial problem, even though they are not as common as the top-ranking categories. This is especially true in the fourth and fifth positions. This underlines

the need for steadfast dedication to structural integrity, emphasizing the importance of thorough inspections and strict quality assurance systems in this field.

5.10.5 Maintenance Defects

The placement of maintenance problems in the fourth and sixth positions indicates that they occur, albeit less frequently than other categories. They do, however, highlight the significance of a preventative maintenance strategy by being in positions of importance. To stop potential faults from getting worse, it encourages business experts to establish routine inspections and preventive maintenance plans.

5.10.6 Water Intrusion:

The fact that water intrusion secured positions 3rd, 5th, and 6th indicates its importance even if it may not be as common as certain other defect kinds. Effective waterproofing techniques and strong moisture management plans become critical factors in construction projects.

In conclusion, a clear understanding of the difficulties faced by professionals in the field is provided by this in-depth examination of typical flaws in commercial buildings. The range of often occurring defects includes subpar workmanship, poor design, material flaws, structural problems, negligent maintenance, and water infiltration. A robust, multifaceted approach that includes stringent design assessments, detailed quality control methods, and proactive maintenance programmes is required to address these difficulties. The level of quality and dependability in commercial construction projects will unquestionably rise with a persistent dedication to fixing these problems.

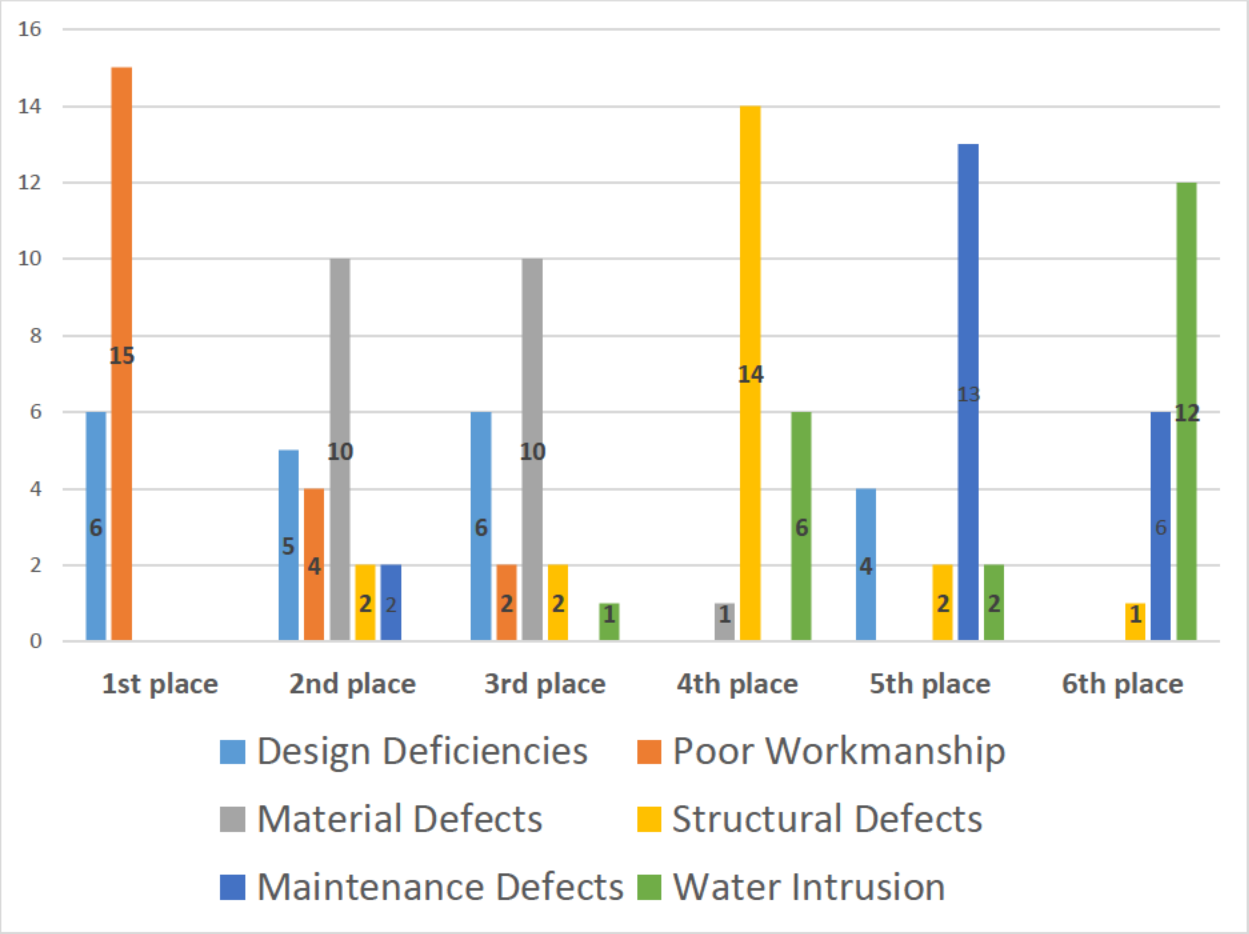

Figure 11 Commonality of Defects from Results

(Source: Created by Andrew Gillies)

5.11 Comparative Analysis

The replies of participants were thoroughly compared in this section with the goal of identifying patterns and trends across various demographic categories. This method enables a comprehensive understanding of how variables like experience levels and educational backgrounds may affect beliefs and routines around defect control in the commercial building industry.

5.11.1 Levels of Experience

When grouping individuals according to their levels of experience, an intriguing finding was made. Industry veterans with more than 20 years' worth of experience tended to emphasize the significance of preventative methods in defect management. In their comments, they frequently emphasized the importance of thorough risk assessment frameworks and effective quality control procedures. Participants with less than five years of experience, in contrast, showed a larger

propensity for technical solutions and favored the use of sophisticated software for defect monitoring and management.

5.11.2 Backgrounds in Education

The comparative analysis also highlighted different viewpoints based on participants' educational backgrounds. People with degrees in engineering or architecture placed a lot of emphasis on how important design integrity is for preventing flaws. They stressed the significance of comprehensive design documentation and strict adherence to industry standards. Participants with business or management backgrounds, however, showed a greater understanding of the financial costs associated with flaws. They frequently emphasized the value of economic risk reduction techniques and appropriate resource management in their comments.

5.11.3 Organizational Roles

Notable insights were also produced by the participants' positions within their various organizations. Project managers demonstrated great attention to process improvement and effective workflow for defect management. In their comments, they emphasized the need to create clear lines of authority and streamline communication routes. Quality control inspectors, on the other hand, emphasized the need for thorough training programs and the implementation of strict inspection standards to identify and correct flaws at an early stage.

5.11.4 Company Structure and Size

The advantages of dedicated defect management teams and specialized software solutions were frequently emphasized by participants working for larger construction businesses. The benefits of centralized reporting systems and the capability for data-driven decision-making were emphasized. However, people working in smaller companies stressed the value of a hands-on, collaborative approach to defect management, frequently highlighting the advantages of close-knit teams and open lines of communication.

5.11.5 Regional Differences

In the comparison analysis, regional differences were also clear. Participants who work in areas prone to certain environmental difficulties, such as those with harsh weather or geological instability, showed a greater awareness of the possible influence on the emergence of problems. In their comments, they repeatedly emphasized the necessity of conducting site-specific risk assessments and using specialized construction methods.

5.12 Summary

A plethora of insightful data on defect management practices has been gleaned from survey and questionnaire responses from professionals in the commercial building sector. This chapter has given a thorough summary of the results, providing a nuanced grasp of the current environment and pointing out opportunities for development. The investigation reveals the following major conclusions and insights:

Participant Information

A total of 21 industry professionals participated in the survey, offering a diverse range of perspectives, with a median experience of 12 years, experience levels ranged from 2 to 30 years.

Participants' academic backgrounds ranged, and they held degrees in engineering, architecture, commerce, and related professions.

Current Defect Management Practices

Most participants rated the current defect management techniques as "Satisfactory" or higher, indicating that they were happy with them.

Clear communication routes and organized reporting were given particular priority.

Project Failures Due to Defects

Participants discussed their personal encounters with projects that encountered obstacles and failed due to flaws.

Reputational harm, cost overruns, and delays were frequent patterns.

Ideas for Improving Defects Management

The implementation of progressive sign-off processes and the selection of specific defect managers were only two of the creative suggestions put up by participants.

These recommendations reflect a proactive strategy for defect prevention and are in line with best practices for the industry.

Challenges Faced by Construction Companies

Participants noted resistance to change and the necessity for cultural adjustments within organizations as reasons why adopting new approaches to defects management surfaced as a key barrier.

Preferred Software and Rationale

As favored defects management software options, Aconex Field, Procore, and Excel list emerged.

User-friendly interfaces, powerful reporting tools, and easy integration with current workflows were highlighted by participants as important factors affecting their decisions.

Software for Defects Management Foundations

Participants emphasized real-time collaboration, mobile accessibility, and customizable reporting options as essential benefits.

For effective defect diagnosis and remediation, these elements are regarded as required.

Variety of Defects and Frequency

The most frequent forms of flaws, as judged by participants, were Design Deficiencies and Poor Workmanship, with average scores of 4.2 and 4.1, respectively.

Common Defects and Financial Impact

A lot of the time, insufficient planning and documentation are blamed for design deficiencies, which were shown to be particularly prevalent.

Poor craftsmanship was acknowledged for having a significant financial impact, leading to expensive rework and delays.

Comparative Analysis

The viewpoints of participants on defects management were influenced by participants' demographic characteristics, including experience levels, educational backgrounds, and organizational roles.

More effective defect prevention and resolution may result from modifying techniques to take these demographic differences into account.

5.13 Significant Observations and Trends that Emerged

The survey responses revealed some noteworthy patterns and findings that shed light on critical facets of defect control in the commercial construction industry.

Focus on Reporting and Communication

A notable development was the unanimity of the emphasis on the value of systematic reporting and open lines of communication in defect control. Participants repeatedly emphasized the need for reliable reporting systems that enable the quick detection, documentation, and correction of errors. This development highlights the industry's understanding that successful defect management depends on clear and effective communication.

Call for Proactive Defects Prevention

The participants' proactive approach to defect prevention was something that was frequently noticed. The suggestion of progressive sign-off processes and the assignment of specific defect managers signal a shift in strategy toward prevention. This pattern represents a shift away from reactive tactics and towards more deliberate, preventive defect control techniques.

Challenges in the Adoption of New Approaches

Participants universally acknowledged the difficulties of implementing novel techniques for defect management. Significant barriers included organizational resistance to change and the need for cultural changes. This finding emphasizes how crucial change management methods are and how crucial it is for businesses to create settings that encourage creativity and process improvement.

Software Preferences Aligned with User-Friendly Functionality

The popularity of particular defects management software packages, such Aconex Field, Procore, and Excel List, was inspired by their user-friendly interfaces and easy integration possibilities. This finding suggests that choosing software is largely influenced by user experience and implementation simplicity. Participants' selections reveal a need for solutions that complement current workflows and promote effective defect tracking.

Impact of Design Deficiencies and Poor Workmanship

The high rankings given to Design Defects and Poor Workmanship reveal their frequency and consequences in commercial construction projects. Design deficiencies have become a regular problem, frequently resulting from poor planning and documentation. Poor workmanship, on the other hand, was noted for its significant monetary effects, including expensive rework and project delays. These findings highlight how important it is to plan carefully and implement quality control procedures.

Demographic Nuances in Perspectives

A subtle finding was the impact of participant viewpoints on demographic parameters like experience levels, educational backgrounds, and organizational roles. For instance, experts with years of experience tended to provide ideas based on common sense, but individuals with more recent entry into the sector displayed a new, creative perspective. Understanding these demographic differences offers the chance to modify defect management tactics so that they appeal to particular target audiences.

These noteworthy findings and patterns combined offer a road map for improving defects management procedures in the commercial building industry. They emphasize the importance of proactive, communicative, and adaptive strategies and the necessity of strategic investments in technology and change management programs. Utilizing these insights will help professionals in the sector choose defects management approaches that are more productive, efficient, and robust, ultimately leading to better project outcomes and stakeholder satisfaction.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 Introduction

This integrated approach gains even more significance when considered in the context of Brisbane's dynamic development scene. Brisbane, a city that is continually expanding, is a hub for business construction. The city's distinctive physical and environmental characteristics, in addition to its dynamic regulatory environment, present particular problems for defect management. This research satisfies the complex requirements of the Brisbane construction industry by combining case studies and quantitative analysis.

The complexity of projects peculiar to Brisbane is revealed through the use of case studies. The case studies provide a thorough examination of the ways in which project scopes, climatic circumstances, and local restrictions affect defects management tactics. For professionals negotiating the difficulties of commercial building in Brisbane, this level of detail expertise is priceless.

The quantitative analysis, however, offers a more comprehensive viewpoint. It enables the detection of broad patterns in Brisbane's faults management procedures as well as in comparison to other locales. For Brisbane's practices to be understood in the broader context of the commercial building sector, a macro perspective is essential.

This research offers a comprehensive understanding of defects management in Brisbane's commercial building sector by combining these two methodologies. In addition to highlighting the particular difficulties faced by city professionals, it provides information that can be generalized to other metropolitan areas. This comprehensive methodology acts as a solid framework for developing recommendations that are specifically targeted at improving defects control procedures in Brisbane's dynamic building environment.

6.2 Current Defect Management Practices: An In-Depth Examination

6.2 1 Case Study Insights

The case studies that were conducted along with the quantitative analysis helped shed light on the defect management procedures that are currently used in the commercial construction industry. These case studies provided for a thorough study, allowing us to pinpoint commonalities, challenges, and effective defect management tactics.

Patent and latent defects are two different types of commercial building defects that can be distinguished from one another, as was highlighted in the literature review. Latent defects, which are linked to design, are not discovered until later stages, in contrast to patent defects, which often result from the building phase. According to Khan, Hussain, and Saquib (2021) the majority of defects, or 89% of all defects, arise during the construction phase, especially in the construction of internal walls. These defects are primarily caused by poor craftsmanship. This emphasizes the crucial significance of watchfulness during this stage, needing careful site control and workmanship scrutiny.

According to Khan, Hussain, and Saquib (2021) and Tayeh et al. (2020), design-phase defects are as important and frequently the source of technical problems that arise later in the development process. Poor detailed design procedures can cause performance issues, making the early design stage a crucial turning point in defect management. Specifically, Hasan et al. (2016) found poor design, design variation during construction, and poor craftsmanship as the main causes of design-stage defects.

Defect management faces particular difficulties during the post-occupancy phase. According to Lee and Kim (2018), poor maintenance procedures may have a major negative influence on residents' quality of life and increase their likelihood of having disagreements with contractors. Significant financial losses are also caused by commercial construction defects at this phase, demanding extra investments (Lee, Lee, & Kim, 2018). It is clear that thorough post-occupancy inspections and maintenance scheduling are essential.

The comparison analysis offered a comprehensive knowledge of how demographic factors, including degrees of experience and educational background, influence viewpoints on defect management. Industry veterans with more than 20 years of experience focus on preventative measures and strongly emphasize thorough risk assessment frameworks. In contrast, those with

less than five years of experience tend to seek technical solutions, frequently favoring cutting-edge software for defect monitoring and management.

Backgrounds in education are equally important. By providing thorough documentation and adhering to industry standards, professionals with degrees in engineering or architecture emphasize the significance of design integrity. On the other hand, individuals with management or business backgrounds place more emphasis on resource management and financial risk mitigation strategies.

Organizational roles provide various perspectives on defect management. Project managers promote streamlined processes and process improvement, as well as distinct lines of authority and efficient communication. In order to identify and address defects early, quality control inspectors emphasize the importance of effective training programs and adherence to strict inspection standards.

Unique approaches are required by company size and structure. Larger construction companies emphasize specialized software solutions, dedicated defect management teams, and centralized reporting, prioritizing data-driven decision-making. On the other hand, smaller organizations emphasize a hands-on, collaborative approach, stressing close-knit teams and open lines of communication.

Regional variations affect defect management procedures as well. Professionals in fields that frequently face environmental difficulties place a premium on site-specific risk assessments and specialized construction techniques.

6.3 Quantitative Analysis Findings

This section analyzes in-depth participant perceptions on current defect management procedures in the commercial construction industry based on the vast dataset that was acquired before. The results are organized around areas designated for improvement, highlighting important repeating themes from the participants' comments.

6.3.1 Perceived Effectiveness of Current Practices

The quantitative study highlights the participants' generally favorable assessment of the present defect management techniques. The majority of respondents rated these methods as Satisfactory" or above, demonstrating that they are generally happy with the current tactics. This opinion is important because it gives us a basic picture of how satisfied people are with the way things are right now.

6.3.4 Reporting and Communication

The significance of systematic and transparent reporting in defect control is a recurrent issue across the comments. Participants emphasized the necessity for reliable reporting systems that allow for the quick identification, recording, and correction of problems. This finding is consistent with best practices in the industry, highlighting the crucial part that efficient channels of communication play in successful defect management.

6.3.5 Preventing Defects Proactively

The quantitative statistics also show a noteworthy trend in the participants' proactive approach to fault prevention. The recommendations made, such as the adoption of progressive sign-off procedures and the selection of particular defect managers, point to a change toward a more preventive strategy. The industry is becoming more aware of the advantages of prevention over correction with this change from reactive to proactive defect management tactics.

6.3.6 Adoption of New Methods

All participants agreed that adopting novel ways to defect management presents problems. This includes the need for cultural adaptations as well as internal organizational resistance to change. This conclusion emphasizes how crucial sound change management tactics are to the efficient application of fresh defect-management methods. Additionally, it emphasizes the importance of an innovative and supportive organizational culture that encourages process development.

6.3.7 Favored Defect Management Program

The information revealed which defect management tool was favored by participants. Popular options included Aconex Field, Procore, and Excel List. As major determinants of their software preferences, participants mentioned user-friendly interfaces, potent reporting tools, and smooth interaction with current procedures. Companies looking to invest in software solutions for defect management might benefit greatly from this information.

6.3.8 Defect Management Software's Underlying Principles

Several crucial elements for efficient problem diagnosis and repair were highlighted by participants. Critical advantages included real-time communication, portability, and configurable reporting choices. These components are thought to be important for effective defect management, allowing for prompt detection and resolution.

6.3.9 Typical Defects and Their Financial Impact

The incidence and financial repercussions of particular types of defects were further supported by the quantitative data. The most prevalent defect kinds were found to be Design Defects and Poor Workmanship. This realization emphasizes the significance of thorough design procedures and exacting quality assurance checks to avoid these frequent problems, eventually limiting expensive rework and delays.

6.3.10Perspectives on Demographic Nuances

Based on demographic criteria like experience levels, educational backgrounds, and organizational responsibilities, the research identified small but significant variances in participant perspectives. These variations give us a detailed insight of how personal traits affect how people see defect management procedures. Defect management solutions might be more specialized and successful if these demographic distinctions are acknowledged and taken into account.

6.4 Synthesis: Case Studies vs. Quantitative Analysis

This subsection thoroughly synthesizes the knowledge obtained from the case studies and the quantitative analysis. This section aims to provide a comprehensive understanding of each technique's relative benefits and limitations in evaluating defects management practices through a comparative examination of these two unique methodologies.

6.4.1 Case Studies: Qualitative Depth

The case studies provided a wealth of qualitative depth insight into actual situations involving the management of defects. Rich contextual elements were revealed through in-depth analyses of certain projects, illuminating the variety of difficulties faced by experts in the field. This qualitative depth enabled a thorough understanding of the nuances and difficulties of defect management in the commercial building sector. Additionally, case studies revealed sophisticated techniques used to overcome these difficulties, promoting a number of beneficial techniques.

6.4.2 Quantitative Analysis: Broad Overview

In contrast, the quantitative analysis provided a thorough and systematic breakdown of the participants' conclusions. This tactic used numerical data to gauge attitudes and provided a high-level depiction of the prevalent mindsets towards defects control techniques. The quantitative data's uniform format, which made it easier to spot trends and patterns, making it possible to understand all points of view regarding this industry. The audit review gained a quantitative meticulousness from the quantitative examination, which also enabled measurable contrasts and correlations.

6.4.3 Complementarity of Methodologies

These methods worked well together, demonstrating their complimentary nature. The subjective quantity of the case studies enabled the various, project-specific nuances of defects management strategies to be revealed. They acted as demonstrative microcosms, showing the connections between defects management strategies in the actual world. However, the quantitative analysis offered a wider field of vision, enabling a thoughtful evaluation of overarching trends and shared viewpoints among a changed member pool. Together, these processes created a unified narrative that offered a comprehensive illustration of defects management techniques used in the commercial development sector.

6.4.4 Strengths of Case Studies

In comparison to quantitative procedures, case studies have the exceptional advantage of being able to capture important details that are frequently challenging to extract using those strategies alone. They offered a stage for investigating the "how" and "why" of defects management systems in order to have a deeper understanding of the underlying processes at work. Furthermore, case studies provided immediate data to specialists by demonstrating how effectively particular approaches worked in resolving particular challenges.

6.4.5 Strengths of Quantitative Analysis

The quantitative analysis excelled in providing a comprehensive, data-driven picture of industry sentiments. A layer of empirical validation was added to the review process thanks to its organized approach, which made it easier to spot common tendencies and enable statistical comparisons. The quantitative analysis also provided some objectivity, which minimized the possibility of the subjective biases that might develop in qualitative evaluations.

6.4.6Limitations of Case Studies

Case studies provided detail, but they were necessarily constrained to the projects they were looking at. While useful, this level of detail might not fully reflect the range of practices and difficulties that exist across the whole business. Case studies require a large time and effort commitment and are also resource-intensive.

6.4.7 Limitations of Quantitative Analysis

On the other hand, case studies may offer more contextual depth than quantitative analysis, despite both offering a wide perspective. It might only touch the surface of difficult problems, potentially omitting the subtle nuances necessary for a thorough comprehension. Furthermore, additional qualitative insights may be necessary because quantitative data alone may not explain the "why" underlying some trends.

6.4.8 Recommendations for Future Research

Future investigations into defects management techniques may profit from an integrated strategy given the complementarity between case studies and quantitative analysis. Researchers can obtain a more complete and nuanced understanding of industry processes by combining the advantages of the two techniques. Further improving the efficacy of defects management systems may be accomplished by investigating emerging technologies like advanced data analytics.

6.5 Project Failures Due to Defects: Lessons Learned

6.5.1 Case Study Experiences

This section examines particular cases of project failures that can be directly linked to defects by heavily using the experiences that were given in the literature review. Every case study experience acts as a microcosm, offering important insights about the causes, effects, and potential prevention measures for project failures in the commercial construction industry.

6.5.2 Internal Wall Defects and Workmanship Issues

Internal wall defects linked to poor craftsmanship were emphasized in the case study by Khan, Hussain, and Saquib (2021). This problem is common in commercial construction. The takeaways from this case highlight how important careful site oversight and material management are. It became clear that careful craftsmanship during the building process is essential. This experience

demonstrates how early defect prevention, particularly in the area of workmanship, can significantly reduce the likelihood of interior wall defects.

6.5.3 Low-Quality Materials and Non-Compliance

Low-quality building materials and a failure to adhere to local building codes are the main causes of commercial building collapses, according to Raviv, Shapira, and Sacks (2021). Lessons learned from this case emphasize how crucial it is to follow quality standards and laws. Catastrophic results may result from employing inferior materials or departing from set specifications. This experience underlines the necessity of stringent quality control procedures and adherence to legal requirements throughout the construction process.

6.5.4 Defects in Design and Impact on Construction

According to Tayeh et al. (2020), problems in the design stage frequently lead to defects in the later stages of construction. Hasan et al. (2016) elaborated on design-stage defects and attributed them to poor design, exposure to undesirable factors, design deviations during construction, and subpar craftsmanship. These situations highlight how important the design step is to preventing defects. The discovered lessons highlight the requirement for rigorous and knowledgeable design procedures. A strong early-stage design and thorough risk assessment can dramatically lower problems in later building phases.

6.5.5 Inadequate Maintenance and Post-Occupancy Defects

Lee and Kim (2018) provide insight into the negative effects of poor maintenance procedures in commercial buildings. The significance of including maintenance managers throughout the design process was stressed by Yacob, Ali, and Au-Yong (2022). These incidents demonstrate how post-occupancy defects can result in legal issues, the wastage of resources, and financial losses. In order to maintain the long-term quality and safety of commercial buildings, proactive measures are required, as well as a critical role for post-construction maintenance.

6.5.6 Financial Implications in Commercial Construction

Poor defect management in commercial construction has significant costs, implications for safety, programs, and quality, according to Kosturska (2023). Due to the utilization of cutting-edge technologies and materials, the financial repercussions in the business sector are especially important. This instance highlights the need for strict defect control procedures to protect project performance. It emphasizes how spending money on defect avoidance can save money by avoiding delays and expensive rework.

6.5.7 Managing Uncertainty in Defects

The difficulty of addressing problems in commercial buildings because of inherent uncertainty was highlighted by Pereira et al. in 2021. This instance highlights the requirement for effective inspection and risk assessment in order to measure uncertainty. The acquired lessons highlight the significance of persistently looking for workable and efficient solutions to manage the inherent risk of defects in commercial construction.

6.5.8 Utilizing Modern Technologies for Defect Management

A number of studies (Machado and Vilela, 2020; Chalhoub, Alsafouri, and Ayer, 2018; Hamledari, Rezazadeh Azar, and McCabe, 2018; Fazel and Izadi, 2018; Li et al., 2018) have demonstrated the potential of contemporary technologies, such as Building Information Modeling (BIM) and Augmented Reality (AR), in defect management. These situations highlight how useful technology is for improving defect identification, visualization, and decision-making. The lessons acquired imply that introducing cutting-edge technologies can completely alter how defects are managed in the commercial building industry.

6.5.9 Factors Governing Design and Construction

The changing aspects that influence design and construction, such as price, speed, quantity, safety, and quality, were highlighted by Koo and O'Connor (2021), Zakariya, Nasiru, and Mukhtar (2020), and Bagdiya and Wadalkar (2015). These incidents highlight the industry's flexibility in commercial building. Lessons acquired highlight the necessity of a balanced strategy that takes these complex elements into account to enable effective defect control.

6.5.10 Managing Uncertainty in Defects

Time restraints, financial stress, and organizational culture were all identified by Bagdiya and Wadalkar (2015) as being significant root causes of commercial building problems. The interconnectedness of defect causation is highlighted by this case. The lessons discovered indicate that resolving core causes requires a comprehensive strategy that takes into account both internal and external factors affecting commercial building projects.

6.5.11 Social Network Analysis for Pathogenicity of Defects

To determine the connections between various defect sources, Aljassmi, Han, and Davis (2014) presented a social network analysis (SNA) approach. An original viewpoint on defect pathogenicity is provided by this case. The taken-away lessons demonstrate the potential of

network analysis approaches in comprehending the intricate mechanics of fault creation. They contend that creative methods can improve defect management techniques.

6.5.12 Systems for Objectively Inspecting Buildings

An impartial, standardized commercial building inspection system was proposed by Bortolini and Forcada Matheu (2018). This situation highlights the need for uniform assessment procedures. The lessons discovered emphasize the value of unbiased evaluation methods for evaluating the technical performance of commercial buildings.

6.6 Quantitative Perspective on Project Failures

6.6.1 Trends in Reported Project Failures

This part goes into the quantitative viewpoint on project failures related to defects, completing the qualitative insights from case studies. In order to gain a deeper knowledge of the effects of defects mismanagement in the commercial construction industry, we can detect trends and patterns by analyzing the replies of participants who reported such instances.

The quantitative analysis highlights the multidimensional character of these failures as a repeating pattern in reported project failures owing to defects. Participants discussed a range of effects and implications, from monetary losses to harm to reputation. Notably, the following effects were most commonly mentioned:

Cost Overruns: A large proportion of participants mentioned cost overruns as a result of project failures brought on by defects. These price increases were ascribed to costs for rework, extra supplies, and prolonged project timeframes. The significant financial repercussions of poor defect management highlight the significance of efficient defect management in price-conscious commercial development.

Project Completion Delays: A recurring subject in the replies was project completion delays. Participants noted that defects frequently resulted in project delays, causing schedule disruptions and potential contractual fines. The necessity of prompt defect correction is highlighted by the time-sensitive nature of commercial building projects, which exacerbates the effects of delays.

Reputational Harm: Several participants noted the reputational damage that defects in projects might create. Consequences mentioned included bad press, unsatisfied customers, and image

damage for the business. A commercial construction company may experience long-lasting consequences from reputational damage, including lost contracts and strained connections with stakeholders.

Client Conflicts: Client conflicts with potential legal repercussions were also mentioned. The administration of projects became more challenging as a result of conflicts over defects involving contractors, subcontractors, and clients. Additional expenses and time demands were associated with legal and arbitration processes.

Resource Reallocation: The respondents mentioned that failure of a project required resource reallocation. This had an effect on the organization's overall efficiency because it required taking resources like staff, equipment, and money away from other initiatives to fix defects.

6.6.2 Contributing Factors and Root Causes

The participants' indicated contributing factors and primary causes for project failures owing to defects might be found through quantitative analysis. Among these elements were:

Inadequate Quality Control: Participants frequently mentioned poor quality control as a significant cause, starting with item number one. This included matters pertaining to the examination and confirmation of the quality of the work, the materials, and the adherence to the design requirements.

Poor *Communication:* One important root problem that has come to light is poor communication among project teams. Defect discovery and resolution were hampered by inefficient channels of communication and unclear reporting procedures.

A shortage of competent workers was cited by some participants as a factor in the poor quality of work and increased chance of defects. It was highlighted how important it is for workers to have thorough training and skill development.

Design Issues: Several respondents cited design issues as the main reason why projects fail. These defects may result from defects made during the preliminary design stage or later design changes made during the building process.

Financial Restraints: Financial restraints and cost-cutting initiatives were cited as contributing factors to defects. Participants admitted that decisions made primarily for financial reasons occasionally resulted in subpar craftsmanship and materials.

10.6.3 Mitigation Strategies

Quantitative analysis also uncovered the mitigating techniques used by respondents to deal with project failures brought on by defects. Among the noteworthy tactics were:

Enhanced Quality Control: Participants stressed the value of strict quality control procedures applied throughout the project lifetime enhanced quality control. This includes proactive checks, quality control procedures, and conformity to norms set by the sector.

Improved Communication: Improved communication procedures were emphasized as being critical for defect management. It was advised to establish clear reporting channels, attend regular project meetings, and communicate openly with clients and stakeholders.

Workforce Investment: Investing in workforce development was necessary to address the skilled labor shortage. Participants understood the need of thorough training initiatives and skill development programs.

Design Review and Verification: A thorough review and verification process was necessary to prevent design defects. Participants pushed for thorough design evaluation, risk analyses, and interaction between designers and builders.

Budget Allocation: Effective budget allocation was thought essential to avoid compromises brought about by costs. The requirement for realistic project budgets that take into account high-quality supplies and workmanship was underlined by the participants.

6.7 Bridging Case Studies and Quantitative Analysis

6.7.1 Converging Narratives

In order to show how these two kinds of information converge and diverge, this section acts as a link between the qualitative insights drawn from case studies and the quantitative data. It offers an in-depth account of how defects affect project outcomes in the commercial building industry.

The persistent focus on cost overruns as a result of defects is one noticeable point of convergence between the case studies and the quantitative analysis. Cost overruns brought on by rework, extra materials, and prolonged project durations were mentioned by both case study participants and survey respondents. With the quantitative conclusion that cost overruns are a common result, this alignment highlights the crucial financial ramifications of defects mishandling.

The narratives from both sources also emphasize the role of poor quality control as a cause of project failures. Instances of poor craftsmanship and materials leading to defects and ultimately compromising project outcomes were emphasized via case study experiences and survey responses. The quantitative root cause analysis of weak quality control is complemented by the qualitative depth of case studies.

Both case studies and quantitative research highlight the persistent subject of communication challenges. Both case study participants and survey respondents lamented the use of inefficient communication channels, murky reporting guidelines, and a lack of openness within project teams. The similarities between the two storylines serve to emphasize how important communication is to defect management.

6.7.2 Diverging Narratives

While there is a clear convergence between case studies and quantitative analysis, some divergences also appear, offering deeper layers of understanding into the effects of defects.

The case study narratives' significant emphasis on reputational harm was not as evident in the quantitative data. Participants in the case study stressed the harm to the company's reputation, bad press, and client discontent brought on by projects that fail owing to defects. However, despite admitting reputational impact, the quantitative analysis did not place it as high on the priority list as other repercussions like cost overruns and delays. Due to this mismatch, case studies may provide a more thorough insight of the long-term reputational effects of defects.

Client conflicts and legal repercussions, extensively covered in case studies, were less common in the quantitative replies. Disputes and legal actions involving contractors, subcontractors, and clients were highlighted in case study narratives due to defects. Even though the quantitative data acknowledged such disagreements, they were not as commonly published. Due to this discrepancy,

it is possible that case studies will better reflect the nuances of legal disputes and client disagreements.

6.7.3 Integrative Analysis and Synthesis

Insights from case studies and quantitative research are used to create a more comprehensive knowledge of how defects affect project results in commercial construction. Although the main effects and underlying reasons are consistent across both sources, there are subtle changes in the emphasis.

This synthesis confirms the varied character of defect management and acknowledges that reputational harm, client disputes, and complex legal issues are among its effects in addition to financial ones. It emphasizes how qualitative case studies, which offer in-depth narratives, interact with quantitative data, which presents statistical trends.

A holistic approach to defect management that takes into account both quantitative measurements and qualitative narratives is crucial, and connecting case studies and quantitative analysis enhances our understanding of the significance of defects. This holistic viewpoint guides techniques for reducing the negative consequences of defects and enhancing project outcomes in the commercial building industry.

6.8 Ideas for Improving Defects Management: A Collective Wisdom

6.8.1 Case Study Recommendations

Early Engagement of Quality Control Experts

Case studies have repeatedly shown how crucial it is to involve quality control professionals' from the outset of a project. Participants emphasized that participation at an early stage ensures a proactive approach to defect reduction. This suggestion is consistent with the notion that stringent quality control procedures applied during the planning and building stages can greatly lower the likelihood of defects.

Using Robust Inspection Protocols

The participants emphasized the necessity of thorough and uniform inspection processes. These standards should address every step of the building process, from material appraisal to workmanship assessment. It was decided that early problem discovery and repair depended on a methodical and exacting approach to inspections.

Utilization of Building Information Modeling (BIM)

Case studies have often argued in favor of the use of BIM technology in commercial construction projects. The ability of BIM to aid precise project planning, collaboration, and visualization was emphasized by participants. It was viewed as a potent tool for spotting potential conflicts or design defects, hence lowering the possibility of defects.

Improved Communication and Cooperation

In the case study recommendations, effective communication emerged as a recurring topic. The sigparticipants emphasized the significance of creating open lines of communication between all parties—including designers, builders, subcontractors, and clientspen channels of communication were considered essential for prompt problem solving and the avoidance of misconceptions that can result in defects.

Spending on Employee Training and Development

The case studies brought to light how important an informed and experienced personnel is to defect management. To improve the technical proficiency of construction experts, participants suggested funding training programs. This method was seen as a proactive step to assure excellent work and reduce the likelihood of defects.

The Use of Progressive Sign-off Procedures

In case studies, participants argued in favor of implementing progressive sign-off procedures at significant project milestones. In order to ensure adherence to design requirements and quality standards, this technique incorporates organized assessments and approvals at key points. Progressive sign-offs were thought to be a way to stop hidden defects from accumulating.

Creation of Cross-functional Teams for the Resolution of Defects

The importance of creating specialized teams with the sole purpose of resolving defects was stressed by case study participants. The professionals on these cross-functional teams would come from a variety of fields, such as design, construction, and quality control. To quickly find and fix problems, they would use their combined experience.

Continual Knowledge Exchange and Lessons Learned Sessions

It was strongly advised that information exchange lead to continuous improvement. Regular meetings to share learnings from earlier projects were recommended by participants. These seminars would provide as a forum for talking about successful defect management techniques, common problems, and best practices.

Implementation of Advanced Materials Testing and Analysis

Case studies demonstrated the value of in-depth material testing and analysis. The usage of cutting-edge techniques was suggested by the participants as a way to evaluate the integrity and quality of building materials. When used as a preventative strategy, this method guards against defects brought on by poor quality or defective materials.

Employing Defect Management Software

The importance of specialized software for defects management was acknowledged by case study participants. The reporting, tracking, and resolution processes were perceived as being streamlined by such software systems. They make data-driven decision-making and real-time cooperation possible for improved defect management.

6.8.2 Quantitative Analysis of Recommendations

Preventative Measures vs. Reactive Approaches

The quantitative investigation revealed a noteworthy tendency favoring proactive rather than reactive activities. The importance of early involvement, rigorous inspection techniques, and elaborate risk assessment frameworks was emphasized by the vast majority of participants. This tendency toward prevention is in line with recommended practices in the industry and highlights the shift toward proactive defect control methods.

Emphasis on Technological Integration

Participants in the quantitative analysis greatly preferred cutting-edge technologies like Building Information Modeling (BIM) and specialized defect management software. The data demonstrated that collaboration, communication, and visualization in construction projects have all been shown to be enhanced by technology. This outcome demonstrates how ready the sector is to adopt digital tools for better defect management.

Focus on Workforce Development

Quantitative data also made clear how important workforce development is. A substantial majority of participants emphasized the need of choosing personnel with the required education and experience to avoid defects. This recommendation is in keeping with the industry's overarching goal of improving human resources in order to ensure higher performance and reduce the likelihood of errors.

Importance of Cross-Functional Collaboration

A consensus regarding the significance of cross-functional collaboration in defect control was discovered through quantitative analysis. The participants stressed the benefits of assembling teams with a variety of skills to address issues thoroughly. This study demonstrates how the business community has come to appreciate the advantages of combining knowledge from many fields.

Encouragement of Clear Lines of Communication

Quantitative data supported the qualitative findings regarding the importance of communication in defect control. Participants in a resounding majority emphasized the importance of open and transparent lines of communication amongst all project stakeholders. This idea emphasizes how important effective communication is for both preventing and fixing defects.

Progressive Sign-Off Procedures Verification

The quantitative investigation supported the suggestion that progressive sign-off processes be implemented. Several participants strongly supported the use of formal assessments at important project checkpoints. This tactic was believed to be a technique to ensure adherence to design specifications and quality standards, hence lowering the likelihood of undiscovered defects.

Appreciation for Knowledge-Sharing Initiatives

According to the statistics, the idea of hosting frequent knowledge-sharing sessions was well received by the public. A significant number of participants recognized the benefits of exchanging viewpoints and experiences learned from past projects. The industry as a whole is willing to take part in continuing improvement and group learning, according to this discovery.

Testing and Material Analysis Validation

According to the quantitative analysis, rigid material testing and analysis are crucial. Participants favored using cutting-edge techniques to assess material quality. This approach was intended as a prophylactic measure to halt errors caused by subpar or damaged materials.

Affirmation of Defect Management Software

Quantitative data provided significant support for the adoption of specialized defect management software. The advantages of employing software to streamline reporting, tracking, and problem-solving processes were acknowledged by the participants. The results showed that the industry preferred technologically advanced choices for improved defect control.

6.9 Challenges Faced by Construction Companies: Navigating New Approaches

6.9.1 Case Study Challenges

Aversion to New Technologies

The case studies make a point of highlighting a number of problems, such as the reluctance to adopt new technologies. The transition to advanced defect management software and digital technologies frequently encounters resistance from current workflows and conventional practices.

Modifications to Organizational Culture

Case studies demonstrate that in order to implement novel ways to defect management, a corporation typically needs to change its culture. To achieve this, mindsets, attitudes, and behaviors must be modified in favor of a more proactive and technologically focused approach.

Cost-effective Decisions

The case studies emphasize the need to balance the upfront costs of cutting-edge technologies with the long-term benefits they offer. Managing cost factors and demonstrating a return on investment (ROI) could be challenging.

Integration with Current Workflows

Integrating new defect management systems with existing workflows and procedures may be challenging in practice. To achieve smooth adoption and minimize disruptions, rigorous planning and execution are required.

Education and Skill Development

A recurring theme in the case studies is the need for intensive training programs to upskill the workforce in the effective use of new technologies. The skills gap must be filled for sophisticated defect management technologies to perform to their full potential.

Change Management and Stakeholder Participation

While putting new plans into practice, effective stakeholder involvement and change management measures are typically needed. Managing the expectations of all project stakeholders and obtaining their support could be difficult.

Privacy and Data Security Worries

Case studies bring data security and privacy concerns to light, particularly when deploying cloud-based defect management solutions. It's crucial for construction companies to protect the privacy of important project information.

Adaptability and Scaling

Choosing defect management solutions that can grow and adapt to a variety of project sizes and complexities can be challenging for construction businesses. The chosen technology should be adaptable enough to accommodate different project requirements.

Adherence to Rules and Specifications

Adhering to industry-specific rules and standards while implementing new defect control measures is a serious challenge. A key component of risk mitigation is ensuring that regulatory requirements are met.

Managing Organizational Silos

Case studies demonstrate how challenging it can be to encourage cross-functional cooperation and break down organizational silos. Departmental impediments must be removed in order to implement a comprehensive defect management strategy.

6.10 Quantitative Analysis of Adoption Challenges

Resistance to Technological Adoption

The quantitative data supports the idea that reluctance to accept new technologies is a challenge that construction organizations commonly deal with. A sizable portion of respondents expressed concerns about transitioning from traditional methods to cutting-edge defect management technology.

Cultural shifts and Change Management

The study shows that a significant percentage of participants understood the need for cultural changes inside organizations to successfully apply new methods. Change management programs were regarded to be crucial to adoption success.

Budgetary factors and ROI Concerns

According to a quantitative analysis, managing cost concerns and demonstrating the return on investment (ROI) of implementing innovative defect control technologies is critical. A sizable portion of respondents acknowledged the need for specific financial grounds.

Integration with Current Workflows

Participants emphasized a smooth interaction with current workflows. According to the statistics, a critical component for construction companies is taking compatibility into account and limiting disruption to ongoing activities.

Education and Skill Development

The quantitative findings highlight how crucial comprehensive training programs are. The majority of participants agreed that staff upskilling was necessary in order for them to effectively use cutting-edge defect control methods.

Assurance of Data Privacy and Security

Issues with data security and privacy popped out as a significant challenge in the quantitative analysis. A sizable portion of respondents said that strong security measures were necessary for sensitive project data, especially when using cloud-based solutions.

Standards Compliance and Legal Compliance

The data demonstrates a thorough comprehension of the importance of abiding by laws and industry-specific norms. Many attendees emphasized the importance of ensuring that new defect management techniques adhere to accepted laws.

Needs for Scalability and Adaptability

Quantitative responses highlight the significance of selecting scalable and adaptive defect management methods. A sizable number of participants acknowledged the need for technology that can handle a variety of project sizes and complexities.

Engagement of Stakeholders and Communication

The adoption process made clear how crucial it is to have engaged stakeholders. The figures show that garnering support from all project stakeholders and preserving open lines of communication are essential for successful implementation.

Silos Management in Organizations

The quantitative analysis reveals that increasing cross-functional collaboration and overcoming organizational silos are recognized issues. Participants agreed that in order to create a cohesive defects management plan, departmental borders must be eliminated.

6.11 Strategies for Overcoming Adoption Challenges

The case studies and the quantitative study also identified adoption challenges, which construction businesses can address in a number of ways. Because they are founded on best practices and market insights, these strategies offer a roadmap for managing the transition to better defects management approaches.

Initiatives for Change Management

Implement substantial change management programs that stress encouraging a culture of innovation and continual growth. Encourage participation from employees at all levels, provide training, and explain the benefits of new defect control strategies.

Pilot Projects and Proof-of-concept Evaluations

To lessen resistance to technological adoption, pilot projects or proof-of-concept implementations can be started. This enables teams to test out novel tools and strategies in-person before broad implementation.

CBA: Cost-Benefit Analysis

Conduct thorough cost-benefit analyses to demonstrate the return on investment of deploying cutting-edge defect control systems. Focus on potential cost savings, better project outcomes, and less risk to win over stakeholders.

Interdisciplinary Collaboration

Multidisciplinary collaboration should be encouraged throughout the organization. By dismantling departmental barriers and developing cross-functional teams, you can ensure a unified approach to defect management.

Programs for in-depth Instruction

Invest in programs that teach staff workers how to use cutting-edge technologies. To fill in skill gaps and boost users' confidence when operating complicated equipment, continuously provide teaching and help.

Data Security Measures

Give data security and privacy first priority by implementing effective safeguards including encryption, access controls, and regular security audits. To ensure data security, team up with reliable technological businesses.

Regulatory Compliance Frameworks

Establish and adhere to frameworks for regulatory compliance that are in line with the standards applicable to your industry. Make that all applicable safety and legal regulations are followed while using novel defect management strategies.

Scalable Alternatives

Select defect management tools that are flexible enough to scale and adapt to various project complexity levels. Consider cloud-based solutions that offer flexibility and simple scalability as project demands evolve.

Strategies to Involve Stakeholders

Plan comprehensive stakeholder engagement strategies that involve all necessary parties, such as project managers and clients. Keep the channels of communication open and ask for suggestions to reach consensus on fresh approaches.

Continuous Evaluation and Monitoring

Establish systems for tracking and evaluating the development of the defect management processes. Regularly assess how well adopted strategies are working and make adjustments based on quick feedback.

6.12 Comparative Analysis: Unearthing Demographic Influences

Experience Levels and Defects Management Perspectives

The amount of experience a specialist in the commercial building industry has a big impact on how they evaluate and approach issues. The slight differences in opinions based on the participants' varying degrees of experience are examined in this section.

Industry Veterans

A group of experts with more than twenty years of combined experience emerges with special knowledge of defect management. They have a wealth of hands-on expertise and a deep understanding of the challenges that come with commercial building because to their extensive involvement in the industry. This group emphasizes the value of extensive risk assessment frameworks and robust quality control procedures, emphasizing the importance of taking a proactive approach to problems.

Their concentration on preventative measures demonstrates that they have a strategic strategy that focuses on detecting and managing potential problems before they become problems. This proactive approach demonstrates a thorough awareness of the long-term effects of defects on project outcomes and is consistent with industry best practices.

Early Career Professionals

In contrast, those with less than five years of experience bring a fresh and energizing perspective to defect management. Due to their relative youth in the industry, they can approach problems from a futuristic and creative standpoint. This cohort shows a clear preference for adopting software and technology for defect control and monitoring.

As seen by their preference for cutting-edge software solutions, they have a strong belief that technology may enhance the efficiency and accuracy of systems for managing problems. The propensity for technical repairs within this group may be a sign of a larger industry trend toward a greater reliance on digital technologies for problem detection and correction.

Implications for Practice

Understanding the differences in viewpoints based on experience levels is crucial for fostering a collaborative and effective work environment. Combining the seasoned counsel of subject matter experts with the creative ideas of early career specialists can result in a comprehensive strategy to defect control.

For instance, mentorship initiatives that match beginners with seasoned experts can enhance knowledge transfer and intergenerational learning. In addition, companies may implement a technology adoption strategy that makes the most of both the strategic perspectives of seasoned workers and the technological expertise of fresh graduates.

Recognizing the various viewpoints that arise from differing levels of experience ultimately enhances the industry's aggregate expertise and pave the way for more effective defects control techniques. By utilizing the benefits of each demographic group, construction companies can develop comprehensive strategies that comprehensively handle defects, from risk assessment to resolution.

Educational Backgrounds and Strategic Emphases

The level of education a professional has influences how they approach defect control in the commercial building industry. This section examines the distinctive perspectives that participants held in light of their academic backgrounds.

Experts in engineering and architecture

Graduates of engineering and architecture emphasize the importance of design integrity as the key to avoiding defects. Due to their academic background, they have a deep understanding of design principles and structural integrity. This group gives meticulous design documentation and strict adherence to industry standards a lot of emphasis.

Their drive to creating a strong foundation for defect prevention is seen in their strategic focus on upholding design integrity. By ensuring that initial designs adhere to tight regulations, engineers and architects aim to reduce the potential that issues may arise throughout the building and occupation stages. This point of view, which is compatible with industry best practices, highlights the crucial role that correct design plays in defect management.

Business and Management Graduates

Experts with business or management degrees offer a specific financial insight in their approach to defect management. Their educational background has given them understanding of techniques for managing resources and lowering economic risk. This set of persons has a clear understanding of the financial repercussions of defects.

Their strategic focus on reducing financial risk suggests a reasonable approach to defect control. By viewing defects through a financial lens, business and management specialists work to implement cost-effective solutions that decrease the impact of errors on project outcomes. The

importance of aligning corporate financial objectives with defect management practices is emphasized by this point of view.

Implications for Professional Development

Understanding how educational backgrounds affect defect management is crucial for designing educational and professional development programs. By focusing on the distinct needs of each educational cohort when planning training initiatives, the effectiveness of efforts to find and remedy defects can be boosted.

Offering advanced training in design integrity and structural analysis is one method to better prepare engineering and architectural professionals to excel in defect management. Training in financial modeling and risk assessment can also improve graduates in business and management's capacity to strategically solve defects.

By aligning educational and professional development programs with the strategic focuses of varied educational backgrounds, organizations can promote a more thorough and integrated approach to defect management. This tailored approach, which recognizes the distinctive skills that people from various academic subjects bring to the table, gradually improves the ability of the business as a whole to handle defects effectively.

Organizational Roles and Process Optimization

The position within an organization has a critical impact in determining the defects management strategy. This section investigates the worldviews of various positions, including project managers and quality control inspectors, and stresses concrete techniques for optimizing defect management processes.

Project Managers

Project managers have a strategic focus on workflow orchestration and process optimization. They are in charge of project execution due to their position, so they must have a comprehensive understanding of defect management. These experts emphasize the significance of having distinct lines of authority and streamlining communication pathways.

Project Manager Recommendations

Clear Communication Protocols

Put in place established communication procedures to guarantee smooth information exchange across project teams. This can entail frequent progress meetings, online forums for communication, and uniform reporting formats.

Process Streamlining

Invest in software and tools for project management that make it easier to organize, track, and assess defect-related data. These technologies can help with process simplification and improving a project's overall efficiency.

Training and Development

Give project managers specialized instruction in managing defects. Effective communication methods, risk assessment procedures, and quality control processes can all fall under this category.

Quality Control Inspectors

On the front lines of finding and fixing defects are quality control inspectors. Their job necessitates exacting attention to detail and in-depth knowledge of industry standards. Inspectors stress the importance of strong training initiatives and the thorough application of inspection standards.

Recommendations for Quality Control Inspectors

Thorough Training: Ensure that quality control inspectors receive in-depth instruction in the detection, reporting, and correction of defects. This instruction ought to cover a variety of potential defects, including structural and nonstructural problems.

Standardized Inspection Methods: Create and uphold standardized inspection methods that are consistent with recommended standards in the sector. Regular site inspections, inspections using a checklist, and the usage of cutting-edge inspection tools are all included in this.

Documentation and Reporting: Stress the value of thorough and accurate defect documentation. For thorough tracking and resolution, this should also include photographic evidence, written reports, and digital recordings.

Company Size and Structural Considerations

The organization's size and structure have a big impact on how problems are managed. This section analyzes how company size affects defect management and offers specific advice for both major companies and smaller businesses that is in line with their unique organizational dynamics and resource capacities.

Corporate giants

The size and complexity of projects in major businesses necessitate an organized approach to defect management. These organizations frequently have specialized defect management teams and the resources to make investments in cutting-edge software solutions. To handle defects as effectively as possible, centralized reporting systems and data-driven decision-making are essential.

Recommendations for Large Corporations

Devoted Defect Management Teams: Create specialist teams that are entirely dedicated to managing defects. The knowledge and tools necessary to efficiently find, record, and fix defects should be available to these teams.

Investment in Advanced Software: Invest in cutting-edge software and take use of its capabilities, including real-time collaboration, customizable reporting, and mobile compatibility. Large organizations can handle problems at scale thanks to such tools.

Centralized Reporting Systems: Implement centralized reporting platforms that compile information on defects from diverse projects. This makes it possible to make decisions based on data, which makes it possible to spot wider trends and potential improvement areas.

Smaller Firms

Smaller businesses may not have as many resources as their larger competitors, but they have an advantage over them in terms of tight-knit team chemistry and efficient communication. Hands-on defect management can be facilitated by utilizing these qualities. In smaller businesses, clear lines of communication and group problem-solving are crucial.

Recommendations for Smaller Firms

Close-Knit Teams: Take advantage of the close-knit working ties found in smaller businesses. Encourage team members to raise and swiftly address defects by fostering a culture of collaboration and open lines of communication.

Hands-On Approach: Adopt a hands-on strategy for managing defects. This could entail frequent site visits, in-depth walkthroughs, and direct interaction with project stakeholders to guarantee that defects are found and fixed right away.

Focus on Training: Give priority to training initiatives that give team members the abilities and information required for efficient defect management. Techniques for defect detection, reporting, and rectification are included.

Balancing Act

In terms of managing defects, both big businesses and smaller ones have significant benefits. Large enterprises profit from specialized staff and cutting-edge technology, but smaller businesses excel in agility and close cooperation. It's crucial to strike a balance between these methods so that defects are effectively addressed regardless of the size of the business.

Organizations can customize their defect management techniques to optimize processes within their unique structural contexts by identifying the distinctive strengths and challenges associated with firm size. The efficiency of defects management initiatives is increased overall because to this strategic alignment.

Regional Factors and Site-Specific Approaches

Regional characteristics significantly influence the commercial construction sector's approaches to defect management. This section explores how geographic context affects defect management and provides suggestions that are sensitive to the unique opportunities and problems given by various geographical areas. The crucial function of site-specific risk evaluations in defect mitigation is emphasized.

Areas More Prone to Environmental Challenges

An increased awareness of potential defects is essential in places vulnerable to environmental difficulties like harsh weather or geological instability. Understanding the distinctive hazards connected to these areas enables focused defects management process interventions.

Recommendations for Regions with Environmental Challenges

Site-Specific Risk Assessments: Give top priority to thorough risk analyses that consider the region's unique environmental issues. This includes elements like the climate, the soil, and the stability of the earth's crust. Develop specific defect management plans to mitigate these risks proactively.

Methods of Specialized Construction: Take into account implementing specialized construction methods designed to survive the environmental difficulties of the area. Utilizing reinforced materials or particular engineering solutions may be required.

Continuous Monitoring and Adaptation: Implement a reliable system for constantly monitoring environmental conditions and their possible influence on the construction project. Keep an open mind when modifying construction techniques to meet new obstacles.

Regions with Stringent Regulatory Frameworks

To maintain adherence to regional standards, areas with strict regulatory frameworks necessitate a systematic approach to defect control. Understanding and following these rules are essential for a project's successful execution.

Recommendations for Regions with Stringent Regulations

Thorough Knowledge of Local Standards: Invest time and money into getting a thorough awareness of the applicable regional construction regulations. Make sure that all facets of defect management adhere to these guidelines.

Engage Regulatory Experts: Consider working with regulatory consultants or experts with in-depth knowledge of regional building codes and compliance standards. Their knowledge can be quite helpful in navigating difficult regulatory environments.

Documentation and Reporting: Ensure all defects management efforts are accurately and thoroughly documented. This paperwork is a crucial record of adherence to regional laws and norms.

Balancing Local Expertise with Global Best Practices

While regional considerations are important, balancing local expertise with international best practices when managing defects is crucial. A comprehensive approach to defect management is ensured by utilizing international standards and practices together with a deep grasp of regional issues.

Construction professionals can proactively address problems and seize opportunities particular to each geographic area by adapting defects management tactics to the specific regional situation. This focused strategy improves the overall efficacy of defects management efforts and helps projects succeed.

7.0 Conclusion

7.1 Expected Outcomes

The purpose of this research is to propose an effective framework or approach for managing defects in the construction sector. Additionally, a change management model will be developed, which can serve as a reference for all construction firms when implementing new approaches to defect management. Furthermore, readers will gain insight into the various types of defects in the construction sector and their severity ratings. The study will investigate the key differences between defect management approaches for commercial buildings. Overall, this research aims to enhance readers' understanding of the importance of defect management in construction. The findings will shed light on why this aspect should be prioritized. Although modern technologies such as BIM and AR are believed to assist in defect management, their effectiveness still requires thorough analysis. Moreover, it is essential to acknowledge that construction comprises multiple stages, each with specific prerequisites. Therefore, each stage must be individually examined to identify occurring defects, which will be a significant outcome of this research. Readers will gain knowledge about defects in relation to different phases of construction. In conclusion, this research will provide comprehensive insights into the topic and serve as a valuable source of information, particularly for those involved in the construction sector. The findings can assist construction firms in developing or modifying their best practices to effectively address common defects. Furthermore, the study will explore the necessity of proper risk assessment in the dynamic construction environment, which can ultimately help mitigate defects.

7.2 Summary of Key Findings

Several significant conclusions have been drawn from this extensive study of defect management procedures in the commercial building sector. These findings provide useful information for stakeholders and professionals in the business by shedding light on important aspects of defects control. The main trends, revelations, and suggestions are as follows:

Effective Defect Prevention: Effective defect prevention was stressed by participants from a range of demographics, including those with varying degrees of expertise and educational background.

These precautions include thorough design documentation, industry standards adherence, and exacting risk assessment frameworks.

Communication and Reporting: It was widely acknowledged that effective defect management required both systematic reporting processes and clear, well-organized channels for communication. Participants underlined the necessity for trustworthy reporting systems to quickly identify, record, and fix defects.

Proactive Approaches: It was clear that defect management tactics had shifted from being reactive to being proactive. The appointment of specific defect managers and progressive sign-off procedures are just two recommendations that show how prevention is becoming more important than rectification.

Adoption Challenges: Introducing new ways to defect management was difficult due to organizational cultural reluctance to change. This emphasizes the significance of change management techniques and supporting environments that encourage innovation.

Software Solutions: Industry professionals' preferences for defects management software varied widely. Software selection was frequently influenced by factors like intuitive user interfaces, robust reporting features, and smooth workflow integration.

Impact of Design Defects and Poor Workmanship: Design errors were noted as a common issue, frequently brought on by insufficient planning and documentation. It was noticed that poor workmanship has a substantial financial impact, causing expensive rework and project delays.

Demographic Nuances: The viewpoints of participants on defect management were influenced by demographic elements such experience levels, educational backgrounds, and organizational responsibilities. It is possible to modify defect management strategies to cater to particular target markets by being aware of these distinctions.

7.3 Implications for the Commercial Construction Industry

The commercial construction sector will be significantly impacted by the study's conclusions. Putting into practice the suggestions can bring about a number of advantages, such as:

Enhanced Quality and Safety: The quality and safety of commercial building projects can be greatly improved, lowering risks and liabilities, through proactive defect prevention techniques and systematic reporting.

Increased Productivity: Implementing user-friendly defects management software that is in line with industry requirements helps optimize workflows and increase productivity.

Cost Savings: By reducing rework and project delays, addressing design defects and subpar workmanship can result in significant cost savings.

Innovation and Engagement: Adopting novel techniques to defect management will encourage innovation and enhance stakeholder engagement, which will result in better project outcomes.

7.4 Advancements in Defects Management Practices

By presenting a deep view of industry needs and difficulties, this research advances defects management approaches. It emphasizes the value of excellent communication, proactive fault prevention, and the modernization of defects management through technology.

7.5 Addressing Gaps in Current Knowledge

By providing a thorough analysis of defects management procedures in the commercial construction sector, this study fills in gaps in the literature. It offers a comprehensive view of defects control by examining the impact of demographic factors, software preferences, and proactive techniques.

7.6 Recommendations for Future Research

The following issues should be taken into account for future research in the subject of defects control in commercial construction:

Long-Term Impact: Investigate how proactive defect prevention strategies will affect project outcomes and lifecycle costs over the long run.

Technological Advancement***s:*** Examine new technologies, such as Internet of Things (IoT), and their potential advantages in defect control.

Global Perspectives: Perform comparative research on defects management methods used in various locations to pinpoint problems and solutions unique to each one.

Sustainability: Look into how defects management can be integrated with sustainability approaches to align projects with social and environmental objectives.

7.7 Practical Applications and Implementation

The following suggestions can be practically implemented in the commercial construction sector:

Improve Project Results: Implementing proactive defect prevention strategies and excellent communication can improve project results while minimizing cost overruns and damage to the project's reputation.

Improve Project Efficiency by Optimizing Resource Allocation: Investing in user-friendly software and streamlining defects management procedures can optimize resource allocation and increase project effectiveness.

Cultural Transformation: Adopting an innovative and change-management culture can make it easier to embrace fresh methods for defect control.

7.8 Acknowledging Limitations

Although this study offers insightful information, it is important to recognize its limits. Further study is required to validate the results because the sample size of participants might not accurately reflect the overall sector. The dynamic nature of the construction business also necessitates continual adaptation to new methods and tools.

7.9 Future Directions for Students Interested in this Area

Exciting areas for investigation beckon for aspiring researchers and students who are interested about defect management in commercial building. Sustainable construction methods could be better understood by looking into the long-term effects of proactive fault avoidance techniques. Emerging technologies like BIM have the ability to fundamentally change how faults are found

and fixed, making them worthwhile research subjects. Additionally, a global viewpoint might reveal particular difficulties and creative solutions by doing comparative study on defect management across various locations. Examining how defects management and sustainability programs interact fits with industry trends toward environmentally friendly building. Another fascinating research area is to ethical issues in defect management, notably in decision-making and stakeholder communication. Last but not least, there are prospects for useful study in the optimization of defects management software for effectiveness and usability. Students who follow these paths have the potential to significantly advance defects management techniques, promote sustainability, and raise the standard of commercial construction projects.

7.10 Conclusion and Closing Remarks

This study has shed light on important facets of defect control procedures in the commercial construction industry. A thorough grasp of the difficulties, possibilities, and strategies involved in defects management is provided by the insights drawn from both qualitative case studies and quantitative analysis. The commercial construction sector may considerably enhance project outcomes, cut costs, and guarantee stakeholder satisfaction by implementing proactive approaches, embracing modern software solutions, and encouraging a culture of change. This study highlights how critical defects management is to the success of building projects and urges further investigation and advancement in this crucial area.

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Appendix 1 – Project Specification

ENG4111/4112 Research Project Project Specification

For: Andrew Gillies

Title: Defects Management in Commercial Construction

Major: Construction Management

Supervisors: Dr Fahim Ullah

Enrollment: ENG4111 – ONC S1, 2023

ENG4112 – ONC S2, 2023

Project Aim: To investigate the type and severity of defects in commercial construction projects in Brisbane and compare various approaches used to manage these defects. Also examine the barriers to adoption of modern approaches for managing defects in commercial construction projects.

Programme: Version 1, 15th March 2023

1. Review relevant literature on defects in commercial construction.

2. Conduct initial background research on how defects are currently being managed.

3. Complete onsite analysis of these methods being used in the real world to gain further knowledge on potential barriers due to various factors.

4. Undertake research and gain feedback from completed projects through the use surveys of the patrons using the completed projects in Brisbane to gain an understanding of satisfaction.

5. Complete interviews with various subcontractors to determine their opinions on managing the number of defects on a commercial project.

6. Evaluate the effectiveness of the current programs being used for defects management on commercial projects e.g., Procore, Aconex Field, etc.

7. Compile results, evaluate and analyze options to improve these results to manage the number of defects in a commercial construction projects.

8. Propose the best method for dealing with defects based on our findings.

Appendix 2 – Research Ethics Application

A Research Ethics Application (REA) was completed using USQ's Research Information Management System (RIMS). The ID for the REA is H22REA112. The plan has received final approval, with details and conditions outlined below:

Office of Research

Human Research Ethics Committee

[redacted]

13/09/2023

Dr Fahim Ullah

Australia

Dear Andrew

UniSQ HREC approval certificate

Thank you for submitting your human ethics application to the University of Southern Queensland Human Research Ethics Committee (UniSQ HREC) for consideration. The Committee has reviewed your application and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research, 2007 (updated 2018)*. Ethical approval has been granted as follows:

HREC Project ID: ETH2023-0426

HREC Project title: Defects Management in Commercial Construction

HREC Project approval date: 13/09/2023

HREC Project expiry date: 13/09/2024

This approval is for the work as outlined in your application and only within the commencement and expiry dates listed approved (unless amended by a subsequent UniSQ HREC decision).

Standard conditions of approval

The UniSQ HREC requires you, as Principal Investigator, to:

(a) Conduct the project strictly in accordance with the submitted and granted ethics approval, including any amendments to the proposal.

(b) Ensure any person engaged by the University of Southern Queensland on this project is named and approved by the UniSQ HREC.

(c) Advise the University immediately (email: [redacted] immediately of any complaint pertaining to the conduct of the research or any other issues in relation to the project which may warrant a review of the ethical approval.

(d) Promptly report any adverse events to the University (email: [redacted] and take prompt action to handle the adverse event.

(e) Make a submission for any project amendments before implementing the changes.

(f) Provide a progress report when requested and at least for every year of approval.

(g) Submit a final report when the project is complete or following the expiry of a UniSQ HREC approval.

(h) Submit any other report as required by the UniSQ HREC.

Other conditions of approval

(i) ...

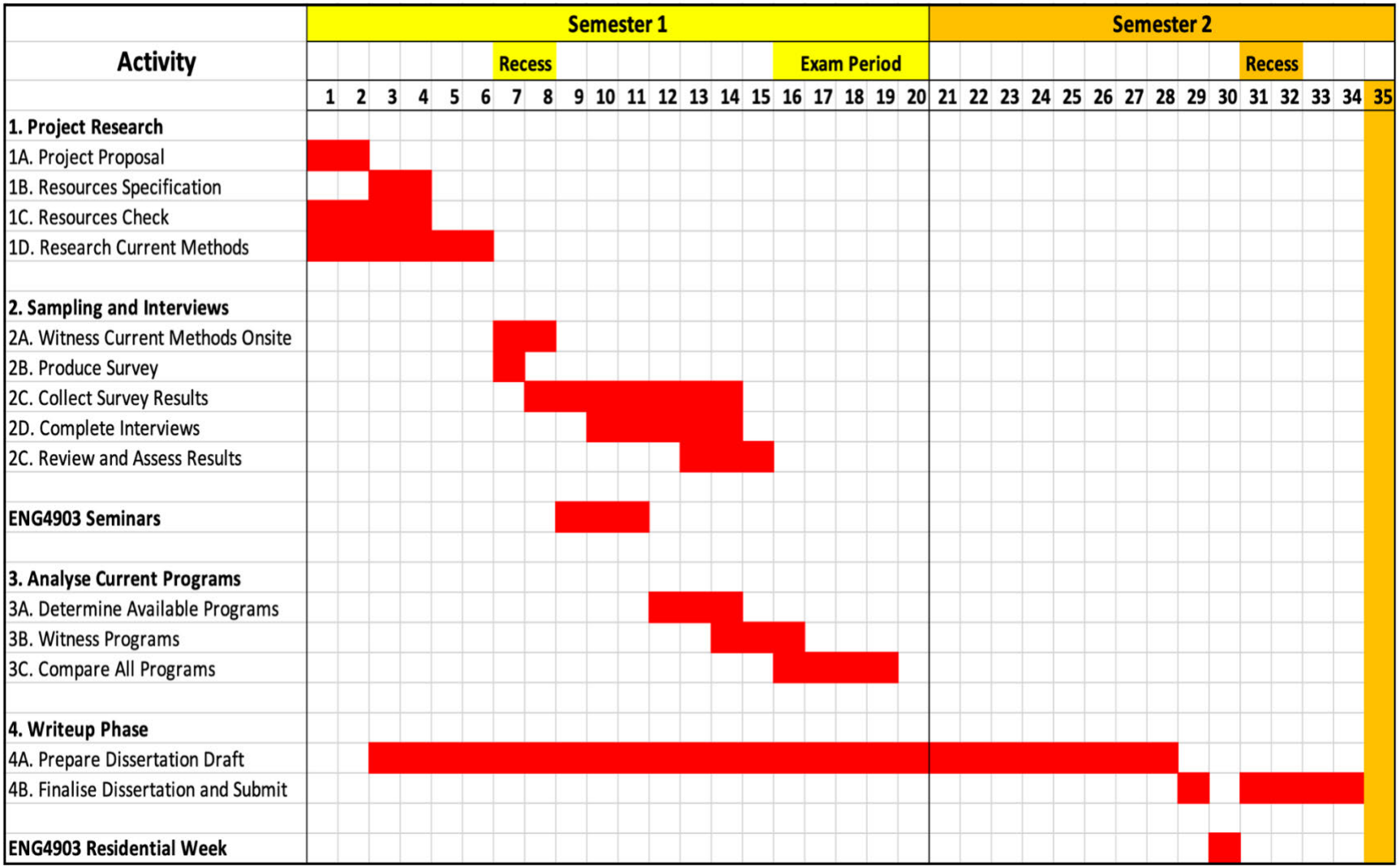
The University of Southern Queensland Human Research Ethics Committee reserves the right to undertake spot audits of your project records at any time to ensure compliance with this approval. Non-compliance may result in the withdrawal of this approval.

If you have any questions, please do not hesitate to contact the UniSQ HREC Executive Officer [redacted]

Yours sincerely

UniSQ Human Research Ethics Committee

Appendix 3 – Project Plan



Appendix 4 - RMP Risk Assessment

University of Southern Queensland **Offline Version**

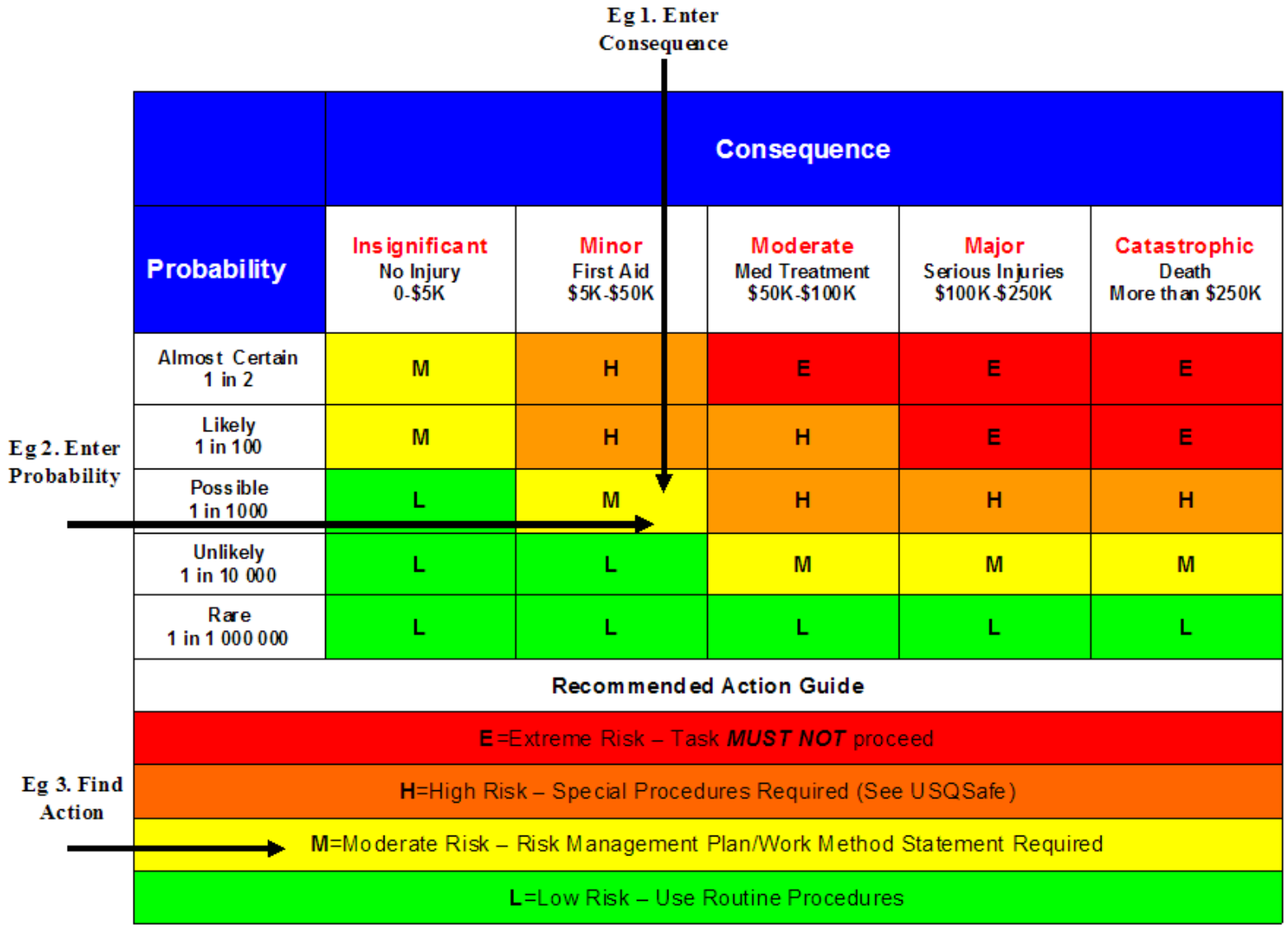
USQ Safety Risk Management System

Note: This is the offline version of the Safety Risk Management System (SRMS) Risk Management Plan (RMP) and is only to be used for planning and drafting sessions, and when working in remote areas or on field activities. It must be transferred to the online SRMS at the first opportunity.

Safety Risk Management Plan – Offline Version			
Assessment Title:	DEFECTS MANAGEMENT FOR BOTH COMMERCIAL AND RESIDENTIAL CONSTRUCTION	Assessment Date:	15/10/2023
Workplace (Division/Faculty/Section):	Engineering/Construction	Review Date:(5 Years Max)	N/A

Context			
Description:			
What is the task/event/purchase/project/procedure?	It is a thesis that will address the main research question: What are the modern approaches of defects management for commercial construction?		
Why is it being conducted?	Identification and analysis of defects in the construction sector is a complex task considering the fact that some defects are apparent while some others are hidden. Every stage of construction can be said to affected from some other defects which go on to affect the quality of construction and result in serious consequences such as collapse of buildings (Baiburin 2017). In this context, there is lack of proper measures that can be taken for the purpose of defect management and these need to be explored.		
Where is it being conducted?	Australia		
Course code (if applicable)	ENG4112	Chemical name (if applicable)	N/A
What other nominal conditions?			
Personnel involved	Andrew Gillies		
Equipment	Interview questionnaire		
Environment	Construction Site		
Other	N/A		
Briefly explain the procedure/process	Both primary and secondary data will be collected. Primary data will be collected from interviews conducted at any one of the constructio firm that is closest to the residence of the researcher. Secondary data will be collected from authentic databases such as Google Scholar and IEEE Explore. All of the data collected will be thematically analysed to get the answers to the research questions.		

Assessment Team - who is conducting the assessment?	
Assessor(s)	Fahim Ullah
Others consulted:	


Eg 1. Enter Consequence
Eg 2. Enter Probability
Eg 3. Find Action
Consequence
Probability
Insignificant
No Injury
0-$5K
Minor
First Aid
$5K-$50K
Moderate
Med Treatment
$50K-$100K
Major
Serious Injuries
$100K-$250K
Catastrophic
Death
More than $250K
Almost Certain
1 in 2
M H E E E
Likely
1 in 100
M H H E E
Possible
1 in 1000
L M H H H
Unlikely
1 in 10 000
L L M M M
Rare
1 in 1 000 000
L L L L L
Recommended Action Guide
E=Extreme Risk – Task MUST NOT proceed
H=High Risk – Special Procedures Required (See USQSafe)
M=Moderate Risk – Risk Management Plan/Work Method Statement Required
L=Low Risk – Use Routine Procedures

Step 1 (cont)	Step 2	Step 2a	Step 2b	Step 3			Step 4				
Hazards: From step 1 or more if identified	***The Risk:*** What can happen if exposed to the hazard without existing controls in place?	***Consequence:*** What is the harm that can be caused by the hazard without existing controls in place?	***Existing Controls:*** What are the existing controls that are already in place?	***Risk Assessment:*** Consequence x Probability = Risk Level			***Additional controls:*** Enter additional controls if required to reduce the risk level	***Risk assessment with additional controls:***			
				Probability	**Risk Level**	**ALARP? Yes/no**		**Consequence**	**Probability**	**Risk Level**	**ALARP? Yes/no**
Example											
Working in temperatures over 35^0 C	Heat stress/heat stroke/exhaustion leading to serious personal injury/death	catastrophic	Regular breaks, chilled water available, loose clothing, fatigue management policy.	possible	high	No	temporary shade shelters, essential tasks only, close supervision, buddy system	catastrophic	unlikely	mod	Yes
Travel to Various Sites	Accident, injury, death	Catastrophic	Current road rules, drive to conditions, drive with caution	Rare	Low	No	Ensure vehicle well maintained and roadworthy	Catastrophic	Rare	Low	Yes
Interacting with Interviewees	Conflict, abuse, assult	Major	Be respectful and approach with caution	Rare	Low	No	Take someone with you to ensure safety	Major	Rare	Low	Yes
Accessing Construction Sites	Accident, injury, death	Major	Obide by construction site rules and follow instructions	Rare	Low	No	Wear personal protective equipment	Major	Rare	Low	Yes
Construction Site Spefic Induction	Accident, injury, death	Moderate	Complete the site specific induction before entering	Rare	Low	Yes	N/A	Moderate	Rare	Low	Yes
QLD Construction Induction Card	Accident, injury, death	Moderate	Ensure QLD construction induction card course has been completed prior to entering site	Rare	Low	Yes	N/A	Moderate	Rare	Low	Yes
Hazards Found on Construction Sites	Accident, injury, death	Major	Ensure inductions are complete, be escouted, following instruction and obide by site safety rules	Unlikely	Moderate	Yes	N/A	Major	Unlikely	Moderate	Yes
Various Tickets	Accident, injury, death	Moderate	Ensure all ticket courses have been completed that are	Rare	Low	Yes	N/A	Moderate	Rare	Low	Yes

Step 1 (cont)	Step 2	Step 2a	Step 2b	Step 3			Step 4				
***Hazards*:** From step 1 or more if identified	***The Risk:*** What can happen if exposed to the hazard without existing controls in place?	***Consequence:*** What is the harm that can be caused by the hazard without existing controls in place?	***Existing Controls:*** What are the existing controls that are already in place?	***Risk Assessment:*** Consequence x Probability = Risk Level			***Additional controls:*** Enter additional controls if required to reduce the risk level	***Risk assessment with additional controls:***			
				Probability	**Risk Level**	**ALARP? Yes/no**		**Consequence**	**Probability**	**Risk Level**	**ALARP? Yes/no**
Example											
Working in temperatures over 35^0 C	Heat stress/heat stroke/exhaustion leading to serious personal injury/death	catastrophic	Regular breaks, chilled water available, loose clothing, fatigue management policy.	possible	high	No	temporary shade shelters, essential tasks only, close supervision, buddy system	catastrophic	unlikely	mod	Yes
Required for Entering Construction Site			required for entering the specific construction site (working at heights, confined space, etc.)								
Personal Protective Equipment	Accident, injury, death	Major	Ensure all PPE required is worn safely and correctly	Rare	Low	Yes	N/A	Major	Rare	Low	Yes
Safe Work Method Statement	Accident, injury, death	Moderate	Ensure construction site SWMS have been read and signed onto	Rare	Low	Yes	N/A	Moderate	Rare	Low	Yes
Escort onto the Construction Site	Accident, injury, death	Catastrophic	Ensure someone from the site is present as an escort at all times and follow instructions clearly	Rare	Low	Yes	N/A	Catastrophic	Rare	Low	Yes
Severe Weather (Storm, Hail, etc.)	Accident, injury, death	Major	Communicate with the site escort about site rules for severe weather conditions	Unlikely	Moderate	No	If severe weather is predicted, reschedule the site visit to ensure the safety of all partie	Major	Rare	Low	Yes
Working with limited budget	Might miss out some highly relevant resources	Minor	Search strategy should be proper and many databases be explored	Likely	High	No	Access to libraries	Insignificant	Likely	Moderate	Yes

Step 1 (cont)	Step 2	Step 2a	Step 2b	Step 3			Step 4				
Hazards: From step 1 or more if identified	***The Risk:*** What can happen if exposed to the hazard without existing controls in place?	***Consequence:*** What is the harm that can be caused by the hazard without existing controls in place?	***Existing Controls:*** What are the existing controls that are already in place?	***Risk Assessment:*** Consequence x Probability = Risk Level			***Additional controls:*** Enter additional controls if required to reduce the risk level	***Risk assessment with additional controls:***			
				Probability	**Risk Level**	**ALARP? Yes/no**		**Consequence**	**Probability**	**Risk Level**	**ALARP? Yes/no**
Example											
Working in temperatures over 35° C	Heat stress/heat stroke/exhaustion leading to serious personal injury/death	catastrophic	Regular breaks, chilled water available, loose clothing, fatigue management policy.	possible	high	No	temporary shade shelters, essential tasks only, close supervision, buddy system	catastrophic	unlikely	mod	Yes
Interview respondents backing out	Might miss out some highly relevant resources	Minor	Approaching them again and explaining properly	Likely	High	No	Sign a consent form and incude a clause that interview cannot be left in between unless the researcher is at some fault	Insignificant	Likely	Moderate	Yes
				Select a probability	Select a Risk Level	Yes or No		Select a consequence	Select a probability	Select a Risk Level	Yes or No
				Possible	High	No		Select a consequence	Select a probability	Select a Risk Level	Yes or No
				Select a probability	Select a Risk Level	Yes or No		Select a consequence	Select a probability	Select a Risk Level	Yes or No
				Select a probability	Select a Risk Level	Yes or No		Select a consequence	Select a probability	Select a Risk Level	Yes or No
				Select a probability	Select a Risk Level	Yes or No		Select a consequence	Select a probability	Select a Risk Level	Yes or No

Step 5 - Action Plan (for controls not already in place)			
Additional controls:	*Resources:*	*Persons responsible:*	*Proposed implementation date:*
Ensure vehicle is well maintained and roadworthy	Nil - Already complete/aquired	Researcher	13/06/2023
Take someone with you to ensure safety	Friend/Family member	Researcher	31/07/2023
Wear Personal Protective Equipment	Nil - Already complete/aquired	Researcher	13/06/2023
Temporary shade shelters, etc.	Nil - Already complete/aquired	Researcher	13/06/2023
If severe weather is predicted, reschedule the site visit to ensure the safety of all parties	When required	Reseacher	15/08/2023
Development of consent form	Internet, proforma of consent form	Researche	31/07/2023
			Click here to enter a date.
			Click here to enter a date.
			Click here to enter a date.
			Click here to enter a date.
			Click here to enter a date.
			Click here to enter a date.

Step 6 - Approval			
Drafter's name:		Draft date:	Click here to enter a date.
Drafter's comments:			
Approver's name:		Approver's title/position:	
Approver's comments:			
I am satisfied that the risks are as low as reasonably practicable and that the resources required will be provided.			

Approver's signature:		Approval date:	Click here to enter a date.

Appendix 5 – Resources Required

The resources required for this research include the Internet, access to the university library, financial resources for visiting companies, developing the interview questionnaire, and human resources. All these resources are necessary to address the set objectives of this study. A reliable and well-established Internet connection is essential for conducting secondary research. Without easy access to a proper Internet connection, the research and development process will be adversely affected. Some articles, journals, and eBooks may not be freely available, requiring the researcher to utilize the university library. Permission must be obtained to access these resources.

Since this research involves conducting interviews, the researcher will need to visit various organizations to collect data. This will incur expenses for travel and other costs. Human resources are also crucial in this context, as interviews require cooperation from the participants. Without proper collaboration, it will not be possible to obtain the desired results. Additionally, feedback from assessors is critical to rectify any mistakes. Therefore, human resources play a vital role in this research study.

Item	Resources Required	Acquired/Required	Comments
1	Mode of transport (vehicle)	Acquired	-
2	Internet Access	Acquired	-
3	Printing Access and Paper	Acquired	-
4	Mobile Phone	Acquired	-
5	Stationary	Acquired	-
6	Computer Access	Acquired	-
7	QLD Construction Induction Card	Acquired	-
8	Various Site-Specific Tickets	Acquired	-
9	Personal Protective Equipment: Steel Cap Boots, Safety Glasses, Hi-Vis Workwear, Hard Hat, P2 Dust Mask, Gloves, Long Pants, etc.	Acquired	-

Appendix 6 – Ripley Satellite Hospital – Masonry Defects

Project: 26632 Ripley Satellite Hospital
7003 Barrams Rd
South Ripley , Queensland 4306

Defect Item #279 - Replace damaged brick

Location	Ground Floor	**Status**	Closed
Trade	Masonry	**Type**	
Program Impact	TBD	**Cost Impact**	TBD
Cost Code		**Priority**	High
Reference		**Private**	Yes
Description			

Attachments (4)

This section includes all files and photos attached to this item throughout all stages of the item's workflow

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BA8C7408-3F24-4393-80B3-9B3B5099270F.jpg

1687931391176.340088_tempImage.jpeg

Item Workflow

Created By	Richard Ford (Hutchinson Builders)	**Date Created**	07/06/2023
Defect Item Manager	Harry Cuneo (Hutchinson Builders)	**Date Due**	11/06/2023
Final Approver	Harry Cuneo (Hutchinson Builders)	**Action Required by**	
Distribution	Harry Cuneo (Hutchinson Builders) , Brad Applin (DEPW)		

Project: 26632 Ripley Satellite Hospital
7003 Barrams Rd
South Ripley , Queensland 4306

Defect Item #277 - Seal door frame and cladding to brickwork at FIP

Location	Ground Floor	**Status**	Closed
Trade	Ceiling and Partitions	**Type**	
Program Impact		**Cost Impact**	
Cost Code		**Priority**	
Reference		**Private**	Yes
Description			

Attachments (7)

This section includes all files and photos attached to this item throughout all stages of the item's workflow

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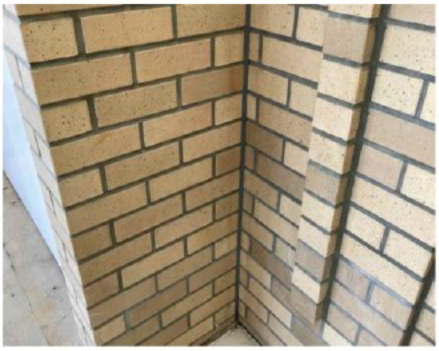

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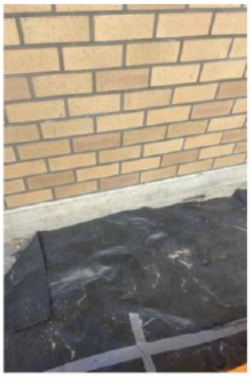
Project: 26632 Ripley Satellite Hospital
7003 Barrams Rd
South Ripley , Queensland 4306

Defect Item #138 - General defect : Clean mortar effervescence off external brickwork

Location	Ground Floor	**Status**	Closed
Trade	Masonry	**Type**	
Program Impact	TBD	**Cost Impact**	TBD
Cost Code		**Priority**	High
Reference		**Private**	Yes
Description			

Attachments (9)

This section includes all files and photos attached to this item throughout all stages of the item's workflow



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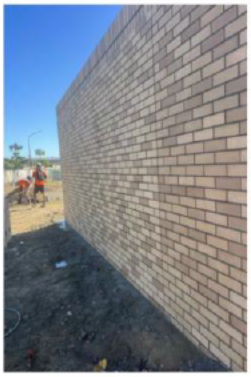

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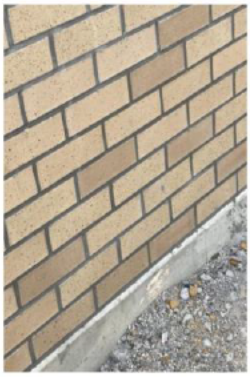

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Defect List Item #138 - General defect : Clean mortar effervescence off external brickwork

Project: 26632 Ripley Satellite Hospital

IMG_2480.JPG

IMG_2483.JPG

IMG_2484.JPG

IMG_2481.JPG

IMG_2485.JPG

Appendix 7 – Survey/Questionnaire Results

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Site Manager –** [redacted]
Current Project/s:	**Caboolture Hospital Redevelopment**
Experience in Sector (yrs.):	**20-30 years**
Highest Level of Education:	**Diploma**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Hasn't failed, I have had project in the past that have had defects caused major issues and the financial effects were extreme, defect was due to a structural flaw with water flow.*
3. ***Do you have any ideas on how defects could be managed better:*** *Defects need to be monitored right from the start of the project not the end, a lot of defects that are found towards the end of the project are a result of errors/mistakes during the beginning structural phase.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Technology, many older employees are not tech savvy enough to learn and use a new software program. I still find it difficult using the program I have used on my last 2 projects.*
5. ***In your experience what is the best software for defects management and why:*** *We are currently using iTWOcx which is a software Lendlease has incorporated in all aspects of the project (payments, variations, etc.), I find this program very clicky but the more I use it for defects the better it gets. I believe it is the best program I have used, better than Aconex Field, Procore, etc.*
6. ***What do you believe are the fundamentals for a defects management software:*** *This biggest and most important access is user friendliness, the subcontractors simply just won't use the software if it is difficult to use and doesn't provide clear information like photos, markups, etc from LLB.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__3__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__6__ f.) Water Intrusion __5__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship is constantly something that I am have to manage, a lot of the time it's not that the tradesman has made an error it is more that they have missed something and not completely finished the job. E.g. Mastic jointing and sealing is always forgotten and missed.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Water intrusion, as mentioned in question 2, one of my previous jobs had a structural design flaw that caused all the planters to leak water during rain through the building, the rectification costs were extremely high and turned into a messy insurance claim for the engineer.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Foreman –** [redacted]
Current Project/s:	**Newstead Series Apartments**
Experience in Sector (yrs.):	**45 years**
Highest Level of Education:	**Open Builders License and Apprenticeship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Hasn't failed, have never had a project that didn't have defects at completion which caused time and budget issues.*
3. ***Do you have any ideas on how defects could be managed better:*** *Construction companies need to employ someone full-time to manage the defects throughout the project rather than right before practical completion.*
4. ***What are the challenges faced by construction companies when adopting new approaches:***
   Construction companies are always trying to introduce the most new beaut program when really they need to get back to the basics and use the experience in the long-term employees.
5. ***In your experience what is the best software for defects management and why:*** *Currently on Newstead Series I am using the program Aconex Field, I find it difficult to use but this may be due to my age and my ability with technology.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Again similar to questions 4, I believe the biggest fundamental is getting back to the basics and simply managing the defects with each trade representative onsite, one point of call for all rectification works.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__5__ b.) Poor Workmanship__1__ c.) Material Defects__3__
   d.) Structural Defects__2__ e.) Maintenance Defects__6__ f.) Water Intrusion __4__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship is always the most common cause for defects on all the project I have completed. The skill level of tradesman these days is decreasing can many apprentices are not getting the level of training that apprentices use to receive.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Structural defects and design deficiencies can cause major issues on the project and in my experience, it is never a one-off issues, these defects generally have a carry on effect throughout the project. If there is a structural defect issue it will affect all the finishing trades as well.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Senior Contracts Administrator –** [redacted]
Current Project/s:	**Brisbane Gammar STEAM**
Experience in Sector (yrs.):	**15 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No failed projects.*
3. ***Do you have any ideas on how defects could be managed better:*** *One of the main issues with defects being rectified is getting the subcontractors to return to site, I believe money needs to be withheld from payments and retention payments until all defects are rectified and signed off.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Changing the mentality with the employees that have been around for a long period, many long-term employees are set in their ways and often don't want to divulge in new applications and softwares.*
5. ***In your experience what is the best software for defects management and why:*** *I have used many programs for defects management, they all have their positives and downfalls, I believe the best is Procore due to its ability to link drawings and photos to the defects.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Being able to pin point the location and defect for the subcontractors, many defects like painting is difficult to photograph, sending markups with the photos plus a description really helps.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__3__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__6__ f.) Water Intrusion __5__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship and material defects go together, both types cause defects for the other type, for example a tradesman installing a material that has a defect may miss it and then the defects goes into both categories.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Again both poor workmanship and material defects go toe in toe together as the most costly, one thing about those types of defects is that it costs the subcontractor more then the builder but the builder is also paying for it through the management of those defects.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Supervisor -** [redacted]
Current Project/s:	**Multiple Projects**
Experience in Sector (yrs.):	**45 years**
Highest Level of Education:	**Apprenticeship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *N/A*
3. ***Do you have any ideas on how defects could be managed better:*** *To make things better, it's important to tell someone about any problems we find. Sometimes, people only tell a little bit at a time which can be frustrating and a waste of time when we have to keep going back for something that only takes a small amount of time.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *The most difficult part about trying new ways of doing things is figuring out how to use the new tools and tell people when something is broken or when you're finished with a task.*
5. ***In your experience what is the best software for defects management and why:*** *I personally have not had to use any software programs due to my role. I just need to sort out the rectification works.*
6. ***What do you believe are the fundamentals for a defects management software:*** *The software program is easy to use and doesn't make weird noises or feel slow. It can organize problems into different groups and figure out who is responsible for fixing them.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__1__ b.) Poor Workmanship__2__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *The most common problem is when other workers accidentally damage something or do a sloppy job. Sometimes, they might not do a good job with things like sanding or painting, or they might use a bad brick. It's hard to make everything perfect, but if we don't check things carefully, we might miss these mistakes.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Sometimes buildings have problems with their structure, like cracks or weak areas. These problems can be really expensive to fix. When these problems aren't fixed, they can cause even more problems in the building, like things breaking or not working properly.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Site Manager –** [redacted]
Current Project/s:	**Eight Mile Plains Satellite Hospital**
Experience in Sector (yrs.):	**20 years**
Highest Level of Education:	**Diploma**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No failed projects, have had defects on every project.*
3. ***Do you have any ideas on how defects could be managed better:*** *Management of defects need to be completed from the commencement of the project and there needs to be a specific employee who manages the defects throughout the project.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Technological issues, especially out on site where the internet is usually not the best to start off with, trying to adopt a new approach can make things even more difficult.*
5. ***In your experience what is the best software for defects management and why:*** *Procore by far. I have been with Hutchinson Builders for over 10 years and using Procore for the past three satellite hospitals has made defects management a dream.*
6. ***What do you believe are the fundamentals for a defects management software:*** *The benefit to Procore is being able to assign the defect with all the information required to the subcontractors representative and then being able to track the progress of that defect from rectification to inspection to approval.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__1__ b.) Poor Workmanship__3__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Design deficiencies I believe are the most common as architects and engineers often choose products that are difficult to use and also cause material defects.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Design deficiencies lead to many of the other defect types, I believe that this is a major cause for all defects on a construction project and definitely needs to be addressed through the use of models etc.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Defects Manager –** [redacted]
Current Project/s:	**All Satellite Hospitals**
Experience in Sector (yrs.):	**28 years**
Highest Level of Education:	**Diploma**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No.*
3. ***Do you have any ideas on how defects could be managed better:*** *Defects need to be managed by the subcontractor's representative for quality better, currently being a defects manager I find that the subbies put all the responsibility on the principal contractor to manage defects.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Getting the subcontractor's to attend the training days where someone from the new software comes out and gives a demonstration, many times in my past experience only a few subbies attend and all the principal contractors' site team attend.*
5. ***In your experience what is the best software for defects management and why:*** *Procore is definitely the best, I have used many systems and it was my decision to use Procore on all 7 Satellite Hospital projects, the feedback I have received from all parties is positive.*
6. ***What do you believe are the fundamentals for a defects management software:*** *A software that send reminders and puts the responsibility on the subcontractor to ensure that the defect is fixed. Many subbies forget and never follow up on the defects after they have been submitted.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__2__ b.) Poor Workmanship__1__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship also come under the category I believe of human error, many times it is not that the tradesman doesn't have the skills but more they have a slip in judgement or fatigue sets in. I have seen many defects stem from design deficiencies as well, a lot of the time this can be avoided through the use of models or a full time design manager checking drawings.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Design deficiencies definitely costs the most for the builder, whenever there is an error due to the design the subcontractors are entitled to rectify defects under a variation, this then costs the principal contractor under a design and construct contract.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Project Manager –** [redacted]
Current Project/s:	**Brisbane Grammar STEAM**
Experience in Sector (yrs.):	**40 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No.*
3. ***Do you have any ideas on how defects could be managed better:*** *Regular defects meetings with not just the guys onsite from the subbies but also the subbies representative. The arguments about whos fault the defect is causes problems and needs to be discussed contractually.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *New approaches always come with issues, if it is a new software there needs to be someone as a point of call to help people out onsite when they experience technological issues.*
5. ***In your experience what is the best software for defects management and why:*** *I have found Aconex Field and OmTrak to be very good systems, I have heard Procore is excellent but haven't yet had the opportunity to use it on a project.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Needs to be user friendly, precise and allow the software to be set up based on the project, for example the software needs to be able to set the parameters like levels and zones on site to match up with the software, often the basic software setups do not suit the project which can make it difficult.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__2__ b.) Poor Workmanship__1__ c.) Material Defects__4__
   d.) Structural Defects__5__ e.) Maintenance Defects__6__ f.) Water Intrusion __3__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship is definitely the most common, I have also had projects in the past where design deficiencies and water intrusion can be common. I have a rules with the engineers on my project with regards to waterproofing for planted which has reduced the amount of water intrusion defects incurred.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *It depends, as an overall to the construction industry poor workmanship costs the most but from a principal contractors point of view design deficiencies and water intrusion defects have the greatest financial impact.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Contracts Administrator –** [redacted]
Current Project/s:	**Satellite Hospitals Projects**
Experience in Sector (yrs.):	**17 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Nil.*
3. ***Do you have any ideas on how defects could be managed better:*** *Yes, defects need to be addressed progressively throughout the project and subbies need to complete their own defect list prior to Hutchies, all in all I believe it is currently a good system.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Getting long term employees to adjust and be willing to try out new approaches, often they are set in their ways are don't believe they need to change.*
5. ***In your experience what is the best software for defects management and why:*** *I have worked for Watpac and Hutchies now, at Watpac we used Aconex Field and that had many issues. Since being at Hutchies I have used Procore and found this program much better and provides a much better platform to successfully manage defects.*
6. ***What do you believe are the fundamentals for a defects management software:*** *The biggest thing I have found in the past is subcontractors ignoring the defect reminders or missing them, Procore is get as it continually reminds the subcontractor representative about the defect until it is rectified and close out.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__2__ b.) Poor Workmanship__1__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship is definitely the most common, I do not believe this comes down to a lack of skills from the tradesman but more carelessness. Also a lot of material defects can get categorized as poor workmanship due to incompetent defect managers assuming that it was the tradesman and not a material being defective.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Design deficiencies has the greatest financial affect for a principal contractor as the costs for these types of defects always get put back onto us and it is difficult for us to then pass the costs onto the Architects or Engineers.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Contracts Manager –** [redacted]
Current Project/s:	**Cross River Rail – Roma Street Station**
Experience in Sector (yrs.):	**30 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No failed jobs but many defects over the years.*
3. ***Do you have any ideas on how defects could be managed better:*** *Many defects stem from design issues and this is what costs, the design and planning stages of the project need to be slowed down and more thoroughly looked at, models would help to see these potential defects before they occur onsite.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *I find with CPB due to there being a large amount of staff turn over a major issue is incompetence as well as constantly training new people the new programs.*
5. ***In your experience what is the best software for defects management and why:*** *CPB use an NCR system where we raise via email/TeamBinder with the subcontractor, I find this management system terrible and is has a lot of useless information. I have found in the past a simple defects list with photos sent out to the subbies works the best.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Needs to be clear and precise, photos of the defects with description and the subcontractor at fault as well as the location with a markup are fundamentals to a good defect management system.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__1__ b.) Poor Workmanship__2__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *As stated above design deficiencies causes major defects that often require many trades to rectify, I it difficult to foresee these types of defects until construction is underway. Using models can help this.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Design deficiencies has the greatest financial affect for a principal contractor as the costs for these types of defects always get put back onto us and it is difficult for us to then pass the costs onto the Architects or Engineers.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Foreman - [redacted]**
Current Project/s:	**Eight Mile Plains Satellite Hospital**
Experience in Sector (yrs.):	**17 years**
Highest Level of Education:	**Apprenticeship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No project has ever failed but have had to come back and fix cosmetic problems in the past.*
3. ***Do you have any ideas on how defects could be managed better:*** *Defects could be managed better by reporting on as many defects as possible. It is often drip-fed which is a waste of time when coming back time and time again for a 5 second task.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *The hardest thing with new approaches is learning the new systems and how to report defects and completed tasks.*
5. ***In your experience what is the best software for defects management and why:*** *Procore is the simplest system I have personally used*
6. ***What do you believe are the fundamentals for a defects management software:*** *Ease of use as a software program and not clicky/clunky. Needs to be able to categorize defects into types and responsibilities.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__3__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__6__ e.) Maintenance Defects__5__ f.) Water Intrusion __4__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *I would say the most common defect would be damage caused by other trades, poor workmanship is common on a small scale e.g: one bad sand, one bad paint stroke, one back brick – not everything can be perfect and without double checking things they would get missed.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Structural Defects due the to financial affect fixing those defects being so large. Structural Defects also have a massive follow on affect that can lead to many other issues.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Site Manager –** [redacted]
Current Project/s:	**Ripley Satellite Hospital**
Experience in Sector (yrs.):	**9 years**
Highest Level of Education:	**Apprenticeship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *All projects have problems, but none of them were considered failures.*
3. ***Do you have any ideas on how defects could be managed better:*** *From the very beginning of a project, it is important to take care of any mistakes or problems that come up. This job is given to a special person who will make sure everything gets fixed properly.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Sometimes, when working outside where the internet is not very good, it can be hard to use new ways of doing things with technology.*
5. ***In your experience what is the best software for defects management and why:*** *Procore is the best! I have been working with Hutchinson Builders for a long time, and using Procore for the last three satellite hospitals has made fixing mistakes really easy.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Procore makes it easier to give the people fixing a mistake all the information they need. We can also keep an eye on how the mistake is getting fixed and if it's approved.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__1__ b.) Poor Workmanship__3__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Sometimes, architects and engineers pick things that are hard to use and can cause problems with the materials used in buildings. This happens a lot and is called design deficiencies.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *When buildings are not designed properly, it can cause a lot of different problems. I think this is one of the main reasons why there are mistakes in construction projects. We need to find a way to fix this by using models and other tools to help us design better.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Project Manager – [redacted]**
Current Project/s:	**Gold Coast Mental Health Hospital Unit**
Experience in Sector (yrs.):	**18 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Haven't been on any failed projects.*
3. ***Do you have any ideas on how defects could be managed better:*** *Foreman and supervisors need to be more on top of defects management throughout the entire project, it is often left till the end and missed throughout the first half of the construction project.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Training the people that are going to be using the new approach. Construction managers are already busy enough to then try and learn a whole new program/software is difficult.*
5. ***In your experience what is the best software for defects management and why:*** *We are going to be using Procore on the GC Hospital, as I am the project manager this is the software I have chosen to use as I have had great success in the past with it.*
6. ***What do you believe are the fundamentals for a defects management software:*** *User friendly, descriptive, needs to allow drawing markups, photo attachments and it needs to have the progress of the defect updated progressively (for inspection, closed out, etc.).*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__5__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__3__ e.) Maintenance Defects__6__ f.) Water Intrusion __4__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship and materials defects are the most common as they are always evident and require constant policing by foreman and supervisors throughout construction.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Poor workmanship is the most costly as it is the most common, although it is more costly to the subcontractor as it is not the principal contractors fault for poor workmanship. The most costly to the principal contractor is water intrusion and design deficiencies, especially when the construction project is a design and construct contract.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Fit Out Lead Supervisor -** [redacted]
Current Project/s:	**Cross River Rail – Albert Street**
Experience in Sector (yrs.):	**25 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *I have not had any project fail due to defects.*
3. ***Do you have any ideas on how defects could be managed better:*** *Progressive sign off of areas after trades complete their works for that area, need to have a designated defect manager who is constantly checking and signing off on areas.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Teaching and getting the subcontractors to attend training in the approach, many subcontractors choose to ignore defects as it costs them money.*
5. ***In your experience what is the best software for defects management and why:*** *Aconex Field is the best I have used, we are currently using an NCR system that is not very good and everyone finds it difficult to use.*
6. ***What do you believe are the fundamentals for a defects management software:*** *The software needs to able to assign the task to the required people, many times the defect gets lost in transit so to speak. The defect also needs to be able to be updated progressively as it is completed.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__3__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship or as we define it as human error on the Cross River Rail Project is the most common as there are systems in place to ensure defects a, d, e and f are reduced. Defects b and c are out of our control and can only be managed after the fact.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Defect types Poor Workmanship (Human Error) and Material Defects definitely cost the most to the construction sector as a whole, as a principal contractor these defects cost us time and money managing the defects and ensuring rectification. No subcontractors want to own and come back to rectify their mistake.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Senior Contracts Administrator -** [redacted]
Current Project/s:	**Queens Wharf**
Experience in Sector (yrs.):	**30 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *I have not had any project fail due to defects.*
3. ***Do you have any ideas on how defects could be managed better:*** *Yes, I believe defects needs to be a progressive task that all parties have a responsibility in, many times I find structural and finishes foreman just fobbing the task off thinking someone else will do it, which then requires us to provide a designated defects manager.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Trying to get all employees on the project to take responsibility and work together as a team throughout the project to ensure the number of defects at the end is as low as possible.*
5. ***In your experience what is the best software for defects management and why:*** *Procore is the best system I have used. I find it very user friendly which makes it easier to get the subcontractors to engage with.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Being able to pin point the location and defect for the subcontractors, many defects like painting is difficult to photograph, sending markups with the photos plus a description really helps.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__3__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Poor workmanship also come under the category I believe of human error, many times it is not that the tradesman doesn't have the skills but more they have a slip in judgement or fatigue sets in. I have seen many defects stem from design deficiencies as well, a lot of the time this can be avoided through the use of models or a full time design manager checking drawings.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *It is most dependent on the total costs of the construction industry, but from the perspective of a general contractor, design poor workmanship and material defects have the greatest financial impact.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Project Manager –** [redacted]
Current Project/s:	**Bribie Island Satellite Hospital**
Experience in Sector (yrs.):	**35 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *N/A*
3. ***Do you have any ideas on how defects could be managed better:*** *Yes, I think fixing problems should be a task that everyone works on together. Sometimes, the people in charge of building the structure and making it look nice don't want to do the job of fixing things that are wrong. So, we have to have someone who is specifically responsible for fixing those things.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *We want everyone working together on the project to take responsibility and work as a team. This will help us have as few mistakes as possible by the end of the project.*
5. ***In your experience what is the best software for defects management and why:*** *I think Aconex Field and OmTrak are really good systems. Some people say Procore is even better, but I haven't had a chance to try it yet.*
6. ***What do you believe are the fundamentals for a defects management software:*** *The software should be easy for anyone to use, and it should be able to be customized for different projects. This means that the software needs to have options to adjust things like levels and zones on a site to match what the software is being used for. Sometimes, the basic setup of the software doesn't work well for a specific project, and that can make it harder to use.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__3__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Sometimes when people do a job, they don't do it very well. This happens a lot. Other times, the way something is made or designed can cause problems, like when water gets inside. But I have talked to the people who plan and design things, and we have come up with rules to make sure water doesn't get inside as much. This has helped us have fewer problems with water getting in.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *Poor workmanship in the construction industry is the most expensive, but from the perspective of the main builders, problems with the design and water leaks can cost the most money.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Senior Contracts Administrator –** [redacted]
Current Project/s:	**Jubilee Hotel**
Experience in Sector (yrs.):	**34 years**
Highest Level of Education:	**Degree**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Nil.*
3. ***Do you have any ideas on how defects could be managed better:*** *Yes, problems in the project need to be fixed little by little, and subcontractors need to make a list of their own problems before the main contractor does. Overall, I think the system is good right now.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Sometimes, when people have been working at a place for a really long time, they can get used to doing things a certain way and don't want to try new ways of doing things. They think they are already doing a good job and don't think they need to change.*
5. ***In your experience what is the best software for defects management and why:*** *I used to work for a company called Hutchinson Builders, where we used a program called Aconex Field to manage our work. Unfortunately, there were a lot of problems with that program. Now, I work for Besix Watpac, and we use a program called Procore instead. Procore is much better and helps us manage problems with our work in a more successful way.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Sometimes, when people are building something, they make mistakes or forget to fix things that are wrong. Procore is a special tool that helps remind the people who are supposed to fix these mistakes over and over again until they are finally fixed and everything is finished.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__2__ b.) Poor Workmanship__1__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion __6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *The most common problem with a job being done poorly is when the person doing the work doesn't pay enough attention or care. Sometimes, things can also go wrong because the materials being used are not good quality, but some people blame the person doing the work instead of the materials.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *When there are mistakes in the design, it can cost a lot of money for the main builder. They have to pay for these mistakes, and it's hard for them to make the architects or engineers pay for it instead.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Defects Manager – [redacted]**
Current Project/s:	**Enoggera Army Barracks**
Experience in Sector (yrs.):	**35 years**
Highest Level of Education:	**Diploma**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *No.*
3. ***Do you have any ideas on how defects could be managed better:*** *The person in charge of fixing mistakes should be the subcontractor's representative, but right now, as the person in charge of fixing mistakes, I see that the subcontractors are making the main contractor responsible for fixing the mistakes.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Sometimes, when we have new software, we want the people who work for us and the people who work for other companies to learn how to use it. We have special days where someone from the software company comes to show us how it works. But sometimes, only a few of the people who work for the other companies come, while all of our team comes.*
5. ***In your experience what is the best software for defects management and why:*** *We are using a computer program called iTWOcx for our project. It helps us with things like paying for work and making changes. At first, it was a bit tricky to use, but the more I use it for finding mistakes, the easier it becomes. I think it is the best program I have used, even better than other ones like Aconex Field and Procore.*
6. ***What do you believe are the fundamentals for a defects management software:*** *This is a special computer program that helps keep track of things that need to be fixed. It reminds the people who are supposed to fix them and makes sure they actually do it. Sometimes these people forget or don't do it, so the program helps them remember and do their job properly.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__2__ b.) Poor Workmanship__1__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion__6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Sometimes when people make things, they don't do a very good job. It's not always because they don't know how to do it, but sometimes they make mistakes or get tired. Sometimes things aren't made well because the plans or drawings they use aren't very good. But if they use models or have someone who checks the plans all the time, they can avoid these problems.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *When there are mistakes in the design of something, it can be very expensive for the person building it. The people who were hired to do the specific parts of the project then have to fix the mistakes, which also costs the person in charge of the whole project.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Director -** [redacted]
Current Project/s:	**Multiple Projects**
Experience in Sector (yrs.):	**45 years**
Highest Level of Education:	**Apprenticeship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Nil. My projects rarely have many defects from our masonry trade.*
3. ***Do you have any ideas on how defects could be managed better:*** *The person in charge of fixing mistakes on a construction project should be better at their job. Often find that the people who are hired to do the work try to pass the responsibility onto someone else.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Defects being assigned to the incorrect trades, often we are assigned with defects that actually have nothing to do with our trade. Also builders need to recognize where defects are variations.*
5. ***In your experience what is the best software for defects management and why:*** *I have also found a simple list with photos, responsibility, location, etc is the best method. These fancy programs often don't work and have issues.*
6. ***What do you believe are the fundamentals for a defects management software:*** *As discussed above the software programs need to have photos, descriptions, who is responsible, location of the defect and this needs to be able to be updated.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__1__ b.) Poor Workmanship__2__ c.) Material Defects__3__
   d.) Structural Defects__5__ e.) Maintenance Defects__6__ f.) Water Intrusion __4__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Sometimes when people are working on something, they make mistakes or get tired, which can cause them to do a bad job. It's not always because they don't know how to do it, but sometimes they make a mistake in their thinking or they're too tired to do it properly. I've also noticed that sometimes things don't turn out well because there were problems with the plans or drawings. But these problems can often be prevented if someone checks the plans all the time or uses models to help.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *When there are mistakes in a building's design, it can cost a lot of money for the person who is building it. If there is an error because of the design, the people who are helping to build it are allowed to fix the mistakes, and this costs even more money for the person in charge of the building project.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Project Manager –** [redacted]
Current Project/s:	**Ipswich Hospital Mental Health Unit**
Experience in Sector (yrs.):	**42 years**
Highest Level of Education:	**Diploma and Apprenticeship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Haven't been on any failed projects.*
3. ***Do you have any ideas on how defects could be managed better:*** *The people in charge of a construction project need to pay more attention to fixing mistakes and problems from the beginning until the end. They usually wait until the end to fix them, and don't notice them in the first part of the project.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Teaching the people who will be using the new way of doing things. Construction managers are already very busy, and it can be hard for them to learn a completely new program or software.*
5. ***In your experience what is the best software for defects management and why:*** *We will be using a special computer program called Procore at the Ipswich Hospital. I am in charge of the project, and I think Procore is the best program to use because I have used it before and it worked really well.*
6. ***What do you believe are the fundamentals for a defects management software:*** *This is a tool that is easy for kids to use. It helps them explain things by drawing on pictures and adding photos. It also helps them keep track of their progress as they work on fixing things.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__5__ b.) Poor Workmanship__1__ c.) Material Defects__2__
   d.) Structural Defects__3__ e.) Maintenance Defects__6__ f.) Water Intrusion __4__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *The most common problems in construction are when people don't do a good job or when the materials they use are not good. These problems are easy to see and need the people in charge to always be checking and making sure everything is done correctly.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *The most expensive problem in construction is when the work is done poorly. This happens a lot, but it costs the subcontractor more than the main contractor because it's not the main contractor's fault. The most expensive problem for the main contractor is when water gets inside the building or when there are mistakes in the design, especially if it's a contract where the contractor is responsible for both designing and building.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Foreman/Site Manager – [redacted]**
Current Project/s:	**Roma Hospital Redevelopment**
Experience in Sector (yrs.):	**38 years**
Highest Level of Education:	**Open Builders License and Apprenticship**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *Nil*
3. ***Do you have any ideas on how defects could be managed better:*** *Construction companies need to hire someone to check for mistakes and fix them throughout the project, instead of waiting until the project is almost finished.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *Construction companies are always looking for new fancy programs, but they should actually focus on going back to the simple and important things and learn from their experienced workers.*
5. ***In your experience what is the best software for defects management and why:*** *Right now, I am using a program called Aconex Field on GC Hospital. I find it hard to use, but that might be because I am young and not very good with technology.*
6. ***What do you believe are the fundamentals for a defects management software:*** *Just like in question 4, I think the most important thing is to go back to the basics and make sure that every trade representative who is working on the project is able to fix any mistakes that come up. It would be helpful to have one person in charge of making sure that all the repairs are done correctly.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__5__ b.) Poor Workmanship__1__ c.) Material Defects__3__
   d.) Structural Defects__2__ e.) Maintenance Defects__6__ f.) Water Intrusion __4__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *Many times, the reason why things I make have mistakes is because the people who helped me didn't do a very good job. Nowadays, the people who are learning how to do these jobs aren't getting as much training as they used to, so they don't know how to do things as well.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *If there are mistakes or problems with how something is built or designed, it can cause big problems for the whole project. These problems usually don't just happen once, they keep causing problems as the project goes on. And if there is a mistake with how something is built, it will also affect all the other things that need to be done to finish the project.*

DEFECTS MANAGEMENT IN COMMERCIAL CONSTRUCTION	
Consent to Participate in this Study/Research project:	**Yes**
Name:	[redacted]
Position & Company:	**Senior Project Engineer - [redacted]**
Current Project/s:	**Cross River Rail – Roma Street Station**
Experience in Sector (yrs.):	**29 years**
Highest Level of Education:	**Diploma**

Thank you for participating in my survey/questionnaire regarding the above topics, please answer the below questions:

1. ***How do you find defects are currently being managed in the commercial construction sector:***
   a.) Poor b.) Need Improvement c.) Satisfactory d.) Good e.) Excellent
2. ***Have you ever been involved in a construction project that failed due to defects (budget, time, etc):***
   a.) No b.) Yes – Please explain: *N/A*
3. ***Do you have any ideas on how defects could be managed better:*** *Sometimes, things don't work properly because they were not designed well. This is what makes them cost more. To avoid this, we need to spend more time and be very careful when planning and designing. Using models can help us see any problems before they happen in real life.*
4. ***What are the challenges faced by construction companies when adopting new approaches:*** *One problem with CPB is that many employees leave their jobs, which can make it difficult for them to do their work well. It also means that they have to teach new people how to use the programs all the time.*
5. ***In your experience what is the best software for defects management and why:*** *CPB uses a special system called NCR to communicate with subcontractors through email or a program called TeamBinder. But I don't like this system because it has too much unnecessary information. In the past, I have found that a simple list of problems with pictures sent to the subcontractors works better.*
6. ***What do you believe are the fundamentals for a defects management software:*** *A good defect management system needs clear pictures and descriptions of the problems, showing who is responsible for the mistakes and where they are located. This helps make sure things are fixed properly.*
7. ***Please rate the below types of defects from 1 to 6, 1 being the most common:***
   a.) Design Deficiencies__1__ b.) Poor Workmanship__2__ c.) Material Defects__3__
   d.) Structural Defects__4__ e.) Maintenance Defects__5__ f.) Water Intrusion__6__
8. ***From your rating above in question 6, why do you believe that defect the most common:*** *As mentioned before, design problems can lead to big mistakes that need many different workers to fix. It's hard to predict these mistakes until we start building. But using models can help us catch them earlier.*
9. ***Which type of defect from question 6 do you believe has the biggest financial affect:*** *When a building is not designed properly, it can cause a lot of money problems for the main builder. They have to pay for fixing these mistakes, and it's hard for them to make the architects or engineers pay for it instead.*

Appendix 7 – Survey/Interview Information Sheet

University of Southern Queensland

University of Southern Queensland
Participant Information Sheet
Interview

UniSQ HREC Approval number: HXXREAXXX

Project Title

Defects Management in Commercial Construction

Research team contact details

Principal Investigator Details

Andrew Gillies
Email: [redacted]
Mobile: +[redacted]

Supervisors' Details

Dr Fahim Ullah
Email: [redacted]
Telephone: +[redacted]

Description

This project is being undertaken as part of a Bachelor of Construction Degree with Honours project through the University of Southern Queensland.

The purpose of this project is to propose an effective framework or approach for managing defects in the construction sector. Additionally, a change management model will be developed, which can serve as a reference for all construction firms when implementing new approaches to defect management. Furthermore, readers will gain insight into the various types of defects in the construction sector and their severity ratings. The study will investigate the key differences between defect management approaches for commercial buildings. Overall, this research aims to enhance readers' understanding of the importance of defect management in construction.

Participation

Your participation will involve partaking in an interview that will take approximately 15 to 30 minutes of your time.

Questions will include:

1. *What are the challenges faced by construction companies when adopting new approaches:*
2. *In your experience what is the best software for defects management and why:*

Your participation in this project is entirely voluntary. If you do not wish to take part, you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. You may also request that any data collected about you be withdrawn and confidentially destroyed.

If you do wish to withdraw from this project or withdraw data collected about yourself, please contact the Research Team (contact details at the top of this form).

Your decision whether you take part, do not take part, or take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland or FTF Pty Ltd.

Expected benefits

It is expected that this project will directly benefit you in managing defects on your future commercial construction projects.

Risks

In participating in the interview, there are minimal risks such as, Social issues that may affect our professional relationship.

Privacy and confidentiality

All comments and responses are confidential unless required by law.

Should you wish, you may request a summary of the results from the research project by contacting one of the Research Team (contact details at the top of this form).

Any data collected as a part of this project will be stored securely, as per University of Southern Queensland's Research Data and Primary Materials Management Procedure.

Consent to participate

We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate in this project. Please return your signed consent form to a member of the Research team prior to participating in your interview.

Questions

Please refer to the Research team contact details at the top of the form to have any questions answered or to request further information about this project.

Concerns or complaints

If you have any concerns or complaints about the ethical conduct of the project, you may contact the University of Southern Queensland, Manager of Research Integrity and Ethics on +61 7 4631 1839 or email researchintegrity@usq.edu.au. The Manager of Research Integrity and Ethics is not connected with the research project and can address your concern in an unbiased manner.

Thank you for taking the time to help with this research project. Please keep this document for your information.

Appendix 8 – Survey/Interview Consent Form

University of Southern Queensland

University of Southern Queensland
Consent form
Interview

UniSQ HREC Approval number: HXXREAXXX

Project Title

Defects Management in Commercial Construction

Research team contact details

Principal Investigator Details	**Supervisors' Details**
Andrew Gillies Email: [redacted] Mobile: +[redacted]	Dr Fahim Ullah Email: [redacted] Telephone: +[redacted]

Statement of consent

By signing below, you are indicating that you:

- Have read and understood the information document regarding this project. ☐ Yes / ☐ No
- Have had any questions answered to your satisfaction. ☐ Yes / ☐ No
- Understand that if you have any additional questions, you can contact the research team. ☐ Yes / ☐ No
- Are over 18 years of age. ☐ Yes / ☐ No
- Understand that any data collected may be used in future research activities. ☐ Yes / ☐ No
- Agree to participate in the project. ☐ Yes / ☐ No

Name (first & last)			
Signature		**Date**	

Thank you for taking the time to help with this research project.

Please return this document to a research team member before undertaking the questionnaire.