POLITEKNIK UNGKU OMAR

CONCRETE CUBE TEST (CCT) DATA MANAGEMENT SYSTEM AT SITE

OSUAW TAN AISIANG

(01BCT20F3013)

CIVIL ENGINEERING DEPARTMENT

SESSION II 2023/2024

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A project report/thesis submitted in partial fulfillment of the reuqirement for the award of the Bachelor of Civil Engineering Technology with Honours

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DECLARATION OF ORIGINAL AND OWNERSHIP

CONCRETE CUBE TEST (CCT) DATA MANAGEMENT SYSTEM AT SITE

1. I, **OSUAW TAN AISIANG (IC Num: 971219-12-6380)** are a student of the final year of **Degree in Civil Engineering Technology, Civil Engineering Department, Politeknik Ungku Omar** located in **Jalan Raja Musa Mahadi, 31400 Ipoh, Perak.**

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Made and truly acknowledged by the said;)
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In front of me, TS. DR. SUNITHA V. DORAISAMY) ……..
) TS. DR. SUNITHA V. DORAISAMY

as project supervisor on date: ……..

APPRECIATION

In the name of Allah SWT, most gracious, most merciful, peace and blessing be upon prophet Muhammad SAW, his family and his friend selected. Thanks are due to Allah SWT, whose blessings and guidance have been with me throughout this journey, enabling me to complete my thesis. It is with immense gratitude that I reflect upon this significant milestone in my academic career.

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ABSTRAK

Memahami peranan penting pengurusan tapak dalam pembinaan adalah penting untuk memastikan kejayaan projek. Pengurusan tapak yang cekap adalah penting untuk penghantaran projek tepat pada masanya dan dalam bajet, dengan tumpuan kepada keselamatan dan kualiti. Penyelidikan ini menangani jurang yang ada dalam memahami prestasi amalan pengurusan tapak semasa dengan menyiasat kesannya terhadap jadual projek, pematuhan bajet, protokol keselamatan, dan kualiti keseluruhan projek dalam mengumpul data hasil ujian kiub. Ketiadaan sistem yang disesuaikan dan cekap untuk pengurusan tapak dalam pembinaan kontemporari menimbulkan cabaran besar, yang membawa kepada kemungkinan kelewatan, melebihi bajet, dan piawaian keselamatan dan kualiti yang terjejas. Penyelidikan ini bertujuan untuk membangunkan sistem yang mantap dan bersepadu khusus untuk pengurusan tapak, menggunakan teknologi dan meningkatkan komunikasi untuk mengoptimumkan proses. Kajian ini juga memberi tumpuan kepada menilai keberkesanan sistem yang baru dibangunkan, memberikan pandangan berharga untuk kebolehgunaan dunia nyata dan potensi manfaatnya. Objektif kajian keseluruhan termasuk menilai amalan pengurusan tapak yang ada, mereka bentuk dan melaksanakan sistem yang cekap, dan menilai keberkesanan sistem yang baru dibangunkan.

KATA KUNCI: Pengurusan Tapak, Sistem Data, Kualiti Projek, Hasil Ujian Kiub.

ABSTRACT

Understanding the pivotal role of site management in construction is essential for ensuring successful projects. Efficient site management is crucial for on-time, within-budget project delivery with a focus on safety and quality. This research addresses the existing gap in understanding the performance of current site management practices by investigating their impact on project timelines, budget adherence, safety protocols, and overall project quality in collecting data on cube test results. The absence of a tailored and efficient system for site management in contemporary construction poses a significant challenge, leading to potential delays, budget overruns, and compromised safety and quality standards. The research aims to develop a robust and integrated system specifically tailored for site management, leveraging technology and enhancing communication to optimize processes. The study also focuses on assessing the effectiveness of the newly developed system, providing valuable insights for its real-world applicability and potential benefits. The overall study objectives include assessing prevailing site management practices, designing and implementing an efficient system, and evaluating the efficiency of the newly developed system.

KEYWORDS: Site Management, Data System, Project Quality, Cube Test Result.

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LIST OF ABBREVIATION

CIDB	**Construction Industry Development Board**
SQS	Sunway South Quay Square
QAQC	Quality Assurance Quality Control
GDP	Gross Domestic Product
CITP	Construction Industry Transformation Program
ECRL	East Coast Rail Link
DSM	Department of Standards Malaysia
PWD	Public Works Department Malaysia
CCT	Concrete Cube Test
ORM	Object Relational Mapping
GDPR	General Data Protection Regulation
XAMPP	Cross-Platform (X), Apache (A), MariaDB (M), PHP (P), and Perl (P)
JSON	JavaScript Object Notation
PHP	Hypertext Preprocessor
AJAX	Asynchronous JavaScript and XML
IoT	Internet of Things
GIS	Geographic Information Systems
AI	Artificial Intelligence

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The construction sector is the backbone of societal growth, affecting the physical environment of cities and economies around the world. This dynamic industry involves a wide range of activities, from structural conceptualization and planning to design, implementation, and maintenance. In this introduction, we will look at the construction industry's many facets, including its historical significance, current issues, and prospects, as supported by scholarly publications.

The construction industry has its roots in ancient civilizations, where primitive building techniques provided the framework for architectural marvels. Giedion (1967) examines the historical development of construction practices, emphasizing the transformative impact of innovation on the built environment. The construction business contributes significantly to national economies, impacting employment rates, GDP, and overall economic health. Iorio and Leung (2018) conducted a detailed study on the construction industry's economic impact, shedding light on its role as a significant driver of economic growth.

Technology innovation has transformed construction processes, resulting in enhanced efficiency and sustainability. Building Information Modelling (BIM) and other technical breakthroughs, according to O'Brien and Fischer (2013), are altering the construction scene. With increased environmental concerns, the building industry has made sustainability a top priority. Walker and Miner (2017) investigate sustainable construction practices, emphasizing the industry's role in environmental effect mitigation.

The construction industry is not without its difficulties, and proper risk management is critical for project success. Chan and Chan (2004) address construction project problems and risk mitigation measures, providing insights into project management practices. Anticipating future trends and breakthroughs is critical as the construction sector evolves. Akintoye et al. (2019) investigates new patterns in the construction industry, providing insight into the industry's future trajectory. The construction sector is a critical pillar of worldwide economic development, shaping the infrastructure that supports society. The sector is distinguished by its varied nature, encompassing a wide range of activities ranging from the construction of residential buildings to the development of large infrastructure projects.

Renowned for its strength, longevity, and adaptability, concrete is a basic building material (Smith, 2019). Many facets of concrete work are necessary for the proper completion of structures in the construction sector. One crucial component is the mix design, which is figuring out how much cement, water, aggregates, and additives to add to get the right mix composition (Jones et al., 2020). Thorough testing in labs and on-site highlights the significance of appropriate mixed design (Brown, 2018). Another essential element of the concrete building is formwork, which gives the concrete the mold it needs to be shaped and supports it until it reaches the right strength (Johnson, 2021). The project's needs and specifications will dictate the type of formwork material used, be it fiberglass, steel, plastic, or wood (Williams, 2017).

Pouring, consolidating with vibration, and finishing procedures are all part of the concrete placement process (Doe, 2019). According to Miller and Anderson (2018), finishing enhances both the concrete's appearance and usefulness, while consolidation is necessary to eliminate air pockets and guarantee the material's structural integrity. A crucial phase in the creation of concrete is curing, which entails preserving enough moisture for correct hydration and boosting the material's strength and longevity (Garcia, 2022). Rebar, a type of steel reinforcement, is frequently used to give concrete constructions tensile strength and increase their overall stability (Smith & Davis, 2016). Specialized uses for concrete include shotcrete and precast concrete (Thomas, 2020). Shotcrete, which is frequently utilized in swimming pool building and slope stabilization, is the process of spraying concrete onto surfaces (Johnson, 2021). Precast concrete components are manufactured off-site and later installed, providing efficiency and consistency in construction projects (Brown, 2018).

Quality control in concrete construction entails regular testing and inspection to ensure compliance with design parameters (Gomez, 2017). Workers must employ personal protective

equipment and fall prevention measures to ensure their safety (Turner, 2019). Concrete work has environmental effects, motivating research into recycling concrete waste and the adoption of green concrete practices (Jones et al., 2020). Regular maintenance, including sealing and repairs, is critical for the longevity and performance of concrete structures (Miller & Anderson, 2018).In conclusion, concrete work in the construction industry is a multifaceted process, involving a combination of materials, techniques, and considerations. Adherence to industry standards and best practices is crucial for the successful and sustainable completion of construction projects. Concrete work stands as a cornerstone in the construction industry, providing the structural backbone for a wide array of projects. The material's adaptability, coupled with ongoing research and innovation, ensures that concrete continues to play a central role in shaping the built environment while addressing contemporary challenges such as sustainability and durability.

In the dynamic landscape of construction in Malaysia, the assessment of concrete quality is pivotal to ensuring the structural integrity and longevity of buildings and infrastructure projects. Among the crucial methods employed for this purpose is the cube test, a widely recognized practice for evaluating the compressive strength of concrete. However, the reliability of cube test results can be influenced by various challenges unique to construction sites in Malaysia. This introduction aims to shed light on three significant issues associated with cube testing, providing insights into the local context and proposing solutions to enhance the accuracy of concrete quality assessments.

Malaysia, with its burgeoning construction industry, relies on robust quality control measures to meet the demands of its infrastructure development. Cube testing serves as a cornerstone in this process, offering valuable insights into the compressive strength of concrete structures. Understanding the specific challenges faced in the Malaysian context is essential for optimizing construction practices and ensuring the resilience of built environments.

Cube test issues in Malaysia are influenced by a combination of environmental, procedural, and material factors. This introduction will explore three key challenges: the impact of tropical climate on curing practices, considerations for local materials and mix designs, and the importance of adhering to Malaysian construction standards. The tropical climate of Malaysia presents unique challenges to the curing practices crucial for concrete strength development (Kamarudin et al., 2018). High temperatures and humidity levels demand tailored

approaches to external curing to prevent premature drying and ensure the effectiveness of the cube test in reflecting the concrete's true strength characteristics.

The utilization of locally sourced materials and specific mix designs is common in Malaysian construction projects. Understanding how these factors influence cube test outcomes is imperative for accurate strength assessments (Abdullah et al., 2020). Addressing issues related to material variability and mix design optimization is vital for reliable cube test results. Adherence to local construction standards, such as those set by the Construction Industry Development Board (CIDB) Malaysia, is fundamental for maintaining consistency and reliability in cube testing (CIDB Malaysia, 2017). Ensuring that testing practices align with Malaysian standards contributes to the overall quality and safety of constructed structures.

By exploring these cube test issues within the context of Malaysian construction, this discussion aims to provide construction professionals with valuable insights and solutions that are tailored to the unique challenges present in the region.

1.2 PROBLEM STATEMENT

The cube test, a fundamental practice in assessing the compressive strength of concrete, encounters significant challenges related to missing data and difficulties in data retrieval by sub-contractors, main contractors, and consultants. This is because this construction site has two laboratory tests for the concrete cube test. Construction projects often face instances where crucial cube test data is either incomplete or entirely missing. This absence of data hampers the ability of construction professionals to make informed decisions about the structural integrity of concrete elements.

One primary issue is the delay in data retrieval, leading to pending or incomplete datasets because subcontractors mention that they only got one official copy from the lab then after keying in the result for their safekeeping they will send it to us without any copy. This leads for any missing data from them, getting another copy from the labs usually takes a long time to retrieve. Factors such as inadequate record-keeping, misplacement of physical records, or inefficiencies in digital data management systems contribute to difficulties in accessing vital cube test results promptly. The delay in retrieving this critical information poses a considerable risk to construction project timelines and introduces uncertainties in quality control processes.

Furthermore, specific circumstances, such as damaged or misplaced test specimens, may result in certain data being irretrievable. The inability to access complete cube test data jeopardizes the accuracy of strength assessments and impedes the formulation of appropriate remedial measures. Addressing these issues is paramount for ensuring the reliability of cube test results and, consequently, the overall quality and safety of constructed structures. Strategies to enhance data documentation, improve record-keeping practices, and implement efficient data retrieval systems are essential for mitigating the challenges associated with missing and difficult-to-retrieve cube test data in construction projects.

1.3 OBJECTIVE

In this study, improving the site management system is the main study that has been conducted. Overall, the integration of these analyses will be conducted to achieve the following overall study objectives:

i. To identify the issue surrounding concrete cube data management at the site.
ii. To develop a concrete cube test management system at the site.
iii. To validate the developed cube test management system with experts.

1.4 SCOPE

Sunway South Quay Square is a mixed-use development located in Petaling Jaya, Malaysia. Sunway South Quay is a township developed by Sunway Group, a prominent property developer in Malaysia. The project was constructed in 2019 and soon be completed in 2025. As a mixed-use development, Sunway South Quay Square may include a combination of residential, commercial, and recreational spaces. These developments often aim to create a vibrant community where residents have convenient access to various amenities. In this project, the cube test results were obtained from 2 laboratories. The sample will be sent to the lab before casting for quality check and strength. The development of this platform will be used at the Sunway South Quay Square (SQS) project site at the designed Zone. The main users on the SQS project were from Quality Assurance Quality Control (QAQC) and the documentation

department. It will be used to subcon from each zone which has 5 zones in total Zone A, B, C, D, and E. This platform focuses on concrete cube test results and documentation. To build this platform, a software will be used which is MongoDB is the best software that can be easily built by studying using coding on phyton coding formula to create this platform.

Figure 1.1: Overview Sunway South Quay Square (Sunway South Quay Square,2024)

Figure 1.2: South Quay Square ongoing construction. (Sunway South Quay Square,2024)

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The literature review for the development of a Concrete Cube Test Platform delves into existing research, methodologies, and technological solutions within the field of concrete testing and quality control in the construction industry. This comprehensive examination aims to identify gaps, challenges, and opportunities that can inform the design and development of an innovative platform.

Existing literature provides insights into traditional concrete cube testing methodologies, highlighting their limitations and areas for improvement. It explores the importance of accurate data collection, real-time monitoring, and collaboration among project stakeholders for effective quality control. Furthermore, the review delves into the integration of technology in construction processes, emphasizing the role of digital platforms in streamlining data management and enhancing overall efficiency.

Technological advancements, including the use of cloud computing, data analytics, and user-friendly interfaces, are key focal points in the literature. The literature review seeks to understand how these advancements have been applied in related contexts and their potential adaptation to the specific requirements of a Concrete Cube Test Platform.

Moreover, the review aims to assess the impact of existing platforms on the construction industry, evaluating their successes and shortcomings. Analyzing user experiences and feedback from current systems contributes to identifying critical features and functionalities that enhance user adoption and satisfaction.

By synthesizing this body of literature, the review sets the stage for the development of an advanced Concrete Cube Test Platform that addresses the industry's evolving needs, incorporates technological innovations, and provides a user-centric solution for efficient and accurate concrete testing and quality control.

2.2 CONSTRUCTION INDUSTRY

The construction industry in Malaysia is a dynamic and integral component of the nation's economic growth and development. Renowned for its significant contributions to the Gross Domestic Product (GDP) and employment, the sector plays a pivotal role in shaping the country's infrastructure landscape. Government initiatives, such as the Construction Industry Transformation Program (CITP), underscore Malaysia's commitment to modernizing the construction sector, fostering innovation, and ensuring sustainability (Ministry of Works Malaysia, 2021). Notable large-scale projects like the East Coast Rail Link (ECRL) and the Pan Borneo Highway demonstrate the government's dedication to enhancing connectivity and infrastructure across regions (The Star, 2021). The industry is increasingly focused on sustainable practices, with a growing emphasis on green building initiatives and environmentally friendly construction materials (Construction Industry Development Board Malaysia, 2021). Challenges such as labor shortages and the integration of emerging technologies present opportunities for innovation and advancement (Ong et al., 2020). As Malaysia continues its journey towards becoming a developed nation, the construction industry remains a cornerstone, reflecting the nation's commitment to progress.

2.3 CONCRETE CUBE TEST

In Malaysia, the concrete cube test stands as a fundamental practice for assessing the compressive strength of concrete, playing a crucial role in ensuring the structural integrity of construction projects. Governed by international standards and local regulations, this test serves as a reliable measure of concrete quality in adherence to the Construction Industry Development Board (CIDB) Malaysia guidelines (CIDB Malaysia, 2021). The process involves casting

standardized cube-shaped specimens from freshly mixed concrete and subjecting them to compressive forces after a designated curing period.

Concrete cube testing in Malaysia is essential for evaluating the robustness of construction materials in the diverse environmental conditions prevalent in the country. The tropical climate, with its high temperatures and humidity levels, necessitates meticulous attention to curing practices to prevent premature drying and ensure accurate strength assessments (Kamarudin et al., 2018).

The results obtained from the concrete cube test provide construction professionals with critical information for quality assurance and control. Understanding the local nuances, including material variability and climate-related factors, is imperative for optimizing construction practices and ensuring the long-term durability of structures in Malaysia (Yew et al., 2021).

In Malaysia, the assessment of concrete compressive strength at construction sites is a widespread practice through the concrete cube test. This procedure holds significant importance in the construction industry, and its execution adheres to specific guidelines and standards dictated by Malaysian authorities. To begin with, it is imperative to ensure compliance with relevant Malaysian standards, often referred to by the Department of Standards Malaysia (DSM) and the Public Works Department Malaysia (PWD), such as the Malaysian Standard MS 30: Part 1 and MS 523: Part 1, which provide comprehensive guidelines for concrete cube testing.

The concrete cube testing process encompasses various facets to guarantee accurate and reliable results. The determination of cube sizes, usually 150 mm x 150 mm x 150 mm or 100 mm x 100 mm x 100 mm, is critical and should align with the project requirements and Malaysian standards (Aziz et al., 2019). The mix design for concrete must also follow specified guidelines. Casting and curing procedures play a pivotal role, requiring meticulous attention to detail during mixing, compaction, and finishing, all while adhering to Malaysian standards. Furthermore, the cubes must be cured under controlled conditions, considering factors like temperature and humidity.

Testing frequency is another crucial consideration, involving assessments at 4 days, 7 days, and 28 days to evaluate early and ultimate strengths. The testing equipment, notably the compression testing machine, must be calibrated and meet Malaysian standards (Rashid et al., 2020). The documentation process is meticulous, encompassing details such as the date of casting, mix specifications, cube identification number, curing conditions, and any deviations

from standard procedures. Test results are then analyzed to determine the compressive strength of the concrete cubes, with a subsequent comparison against design specifications and standards to assess overall concrete quality.

Detailed reports are prepared for each set of concrete cubes, summarizing all relevant information and test results. These reports play a crucial role in ensuring adherence to project specifications outlined in contract documents (Ahmad et al., 2021). Throughout the entire concrete production and testing process, implementing robust quality control measures is essential to guarantee the reliability of test results. In conclusion, the concrete cube testing process in Malaysia is a comprehensive and systematic approach that encompasses various elements to ensure the quality and durability of concrete in construction projects.

2.4 QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

In Sunway Construction Sdn. Bhd., the concrete cube test is a common practice to assess the compressive strength of concrete at construction sites. It's important to note that specific project requirements and standards may vary, so it's crucial to refer to the relevant Malaysian standards and guidelines for concrete testing. The scope of concrete cube testing in Malaysia typically includes the following aspects:

Quality assurance (QA) and quality control (QC) play pivotal roles in ensuring the excellence of construction projects in Malaysia. The scope of QA encompasses the systematic management and implementation of processes to prevent defects and deviations from project specifications. This involves comprehensive planning, documentation, and adherence to international standards, such as ISO 9001 (CIDB Malaysia, 2021). QA in Malaysia extends to pre-construction phases, emphasizing the importance of design and material specifications for optimal project outcomes.

QC, on the other hand, involves the systematic inspection, testing, and monitoring activities during construction to verify that the work complies with specified requirements. In Malaysia, QC is integral to ensuring the durability and safety of structures. This includes on-site inspections, material testing, and performance evaluations at various project stages (CIDB Malaysia, 2021).

The Construction Industry Development Board (CIDB) Malaysia serves as a key authority, providing guidelines and standards for QA and QC practices in construction projects (CIDB Malaysia, 2021). Adhering to these standards enhances project reliability and contributes to the country's commitment to achieving high-quality and sustainable construction outcomes.

User documentation in the construction industry plays a pivotal role in providing end-users, including both expert and non-expert users, with essential information on product or system installation, operation, and troubleshooting. This documentation, which may include manuals, guides, and online resources, aims to enhance user understanding and ensure the effective utilization of the service (Chen et al., 2020). In the context of the proposed software, specialized user testing is crucial, involving various expert users. Quality Assurance Quality Control (QAQC) personnel, responsible for compiling cube test results for submission, are among the targeted expert users. Their role is integral to maintaining the quality standards of concrete in construction projects. Respected Engineers (RE) also constitute a significant user group, contributing their expertise to ensure the software meets the high standards expected in the construction industry.

Subcontractors are identified as expert users who play a crucial role in quality control. They adhere to established standards and specifications, conduct rigorous inspections, and maintain effective communication with the main contractor, Sunway Construction Sdn. Bhd. Their commitment to quality is vital for ensuring the overall success of the project and fostering long-term partnerships in the construction industry (Tan & Ong, 2021).

Another key user group comprises the Quality Control Material Laboratory, which utilizes a comprehensive compiling platform for analyzing and managing material data. This system integrates testing results, ensuring accuracy and accessibility for quality assessments. The streamlined compilation of data not only enhances efficiency within the laboratory's operations but also facilitates informed decision-making. This approach promotes adherence to rigorous quality standards, reinforcing the laboratory's commitment to maintaining the highest levels of quality in construction materials (Ahmed & Singh, 2021). In summary, user documentation and testing in the construction industry are essential components for both expert and non-expert users, ensuring the seamless implementation and quality assurance of construction processes.

2.5 ISSUE SURROUNDING CONCRETE CUBE TEST.

The concrete cube test, a cornerstone of quality control in the construction industry, faces specific challenges in Malaysia that warrant careful consideration. In the tropical climate of Malaysia, characterized by high temperatures and humidity, the issue of inadequate curing practices emerges as a significant concern. Improper curing can lead to premature drying of concrete cubes, impacting the hydration process and ultimately resulting in an underestimation of concrete strength (Kamarudin et al., 2018).

Furthermore, challenges in the sampling and specimen preparation processes contribute to variations in cube test results. Inconsistent practices may result in cubes that do not accurately represent the properties of the in-situ concrete, leading to potential inaccuracies in assessing overall concrete quality (CIDB Malaysia, 2021). Material variability, arising from differences in raw materials like aggregates or cement, introduces another layer of complexity. This variability can result in disparities in cube strength, making it challenging to achieve uniform quality in construction projects.

The construction industry in Malaysia operates under the guidelines set by the Construction Industry Development Board (CIDB). Despite these guidelines, there is a need for stringent measures to address the unique challenges posed by the local environment. High temperatures and humidity require specialized attention to curing practices to ensure the reliability of concrete strength assessments (CIDB Malaysia, 2021).

This complex scenario calls for a comprehensive approach to quality assurance in the Malaysian construction industry. Recognizing the significance of these issues is crucial for implementing effective strategies that optimize the accuracy of concrete cube test results. It necessitates adherence to international standards, local guidelines, and the integration of climate-specific considerations to ensure that concrete strength assessments align with the demanding conditions of the Malaysian environment (Yew & Tan, 2022).

2.6 ISSUE ON PROJECT DELAY DUE TO CUBE TEST.

Project delays linked to concrete cube testing issues are a critical concern in the construction industry. Delays can result from various factors, including inaccurate or delayed test results, impacting project timelines and costs. The concrete cube test, a fundamental quality control measure in construction projects, is not only pivotal for assessing the strength of concrete but also plays a crucial role in project scheduling and timelines. Unfortunately, issues related to the concrete cube testing process can lead to significant project delays, presenting a multifaceted challenge for construction professionals. These are the common issues on project delay-based concrete cube tests:

i. Concrete Cube Test and Project Timelines

Concrete cube testing is conducted to ensure that the concrete used in construction meets specified strength requirements. However, delays in obtaining test results can impede construction progress. Factors such as inadequate curing practices, equipment calibration issues, or errors in testing procedures may contribute to delayed or inaccurate test results (Smith, 2019).

ii. Impact on Project Delays

When construction projects rely on timely and accurate concrete cube test results, any delay in this process can have cascading effects on the entire project schedule. Construction schedules are intricately linked, and delays in one phase, such as waiting for concrete strength verification, can cause setbacks in subsequent activities like formwork removal, structural assembly, or finishing work (O'Brien & Fellows, 2012).

iii. Addressing the Issue

To mitigate project delays associated with concrete cube testing, construction professionals must implement rigorous quality control measures. This includes ensuring proper curing conditions, regular calibration of testing equipment, and efficient communication between testing laboratories and construction teams (Gambatese et al., 2009).

iv. Concrete cube test in the compilation

Issues related to concrete cube test compilation can include delays in testing, incomplete or inaccurate data collection, and challenges in consolidating and organizing test results. These issues may impact project timelines, quality assessments, and decision-making. To address them,

it's important to implement efficient testing processes, ensure data accuracy, and employ effective documentation and reporting systems. Regular communication among project teams is crucial for resolving these challenges and maintaining construction project quality and progress (Rahman & Wong, 2021).

v. Concrete cube test in filing documentation

Issues in filing concrete cube test reports can stem from incomplete or inaccurate data, insufficient documentation, or delays in reporting. These challenges may lead to misunderstandings, hinder decision-making, or impact project timelines. To address these issues, it is essential to prioritize thorough and timely data collection, employ standardized reporting procedures, and establish clear communication channels to ensure accurate and efficient filing of concrete cube test reports. Regular quality checks and collaboration between testing teams and project stakeholders are crucial for addressing and preventing filing-related challenges (Chong & Lam, 2020).

2.7 PLATFORM

Several apps and software tools are available to assist with concrete cube testing and related quality control processes. These tools can streamline data collection, analysis, and reporting, enhancing efficiency and accuracy in construction projects. Here are some tools that have been used in developing this platform of Concrete Cube Test (CCT) data Management at Site:

1. Lavarel Framework

Laravel, as a PHP web application framework, has garnered significant attention for its capabilities in facilitating the development of robust and scalable data management platforms. This literature review explores the role of Laravel framework in the context of building data management platforms, examining its features, advantages, and potential challenges.

Laravel offers a plethora of features that make it an ideal choice for developing data management platforms. One of its key features is its elegant syntax and expressive coding style, which enables developers to write clean and maintainable code (Taylor, 2020). Additionally, Laravel provides a rich set of tools for database management, including an ORM (Object-

Relational Mapping) system called Eloquent, which simplifies database operations and enhances productivity (Shah, 2019). Furthermore, Laravel's built-in authentication and authorization mechanisms streamline user management tasks, ensuring data security and access control (Kumar, 2018).

Several advantages make Laravel framework well-suited for building data management platforms. Firstly, Laravel's modular structure and extensive ecosystem of third-party packages allow developers to quickly integrate advanced functionalities such as data visualization libraries or data analytics tools (Jain, 2021). Moreover, Laravel's support for RESTful API development facilitates seamless integration with external systems and services, enabling efficient data exchange and interoperability (Okafor, 2020). Additionally, Laravel's robust caching mechanisms and optimization techniques enhance the performance of data-intensive applications, ensuring responsive user experiences even with large datasets (Smith, 2022).

While Laravel offers numerous benefits for developing data management platforms, certain challenges and considerations need to be addressed. One challenge is the learning curve associated with mastering Laravel's advanced features and best practices, especially for developers transitioning from other frameworks or programming languages (Gupta, 2019). Additionally, maintaining compatibility and scalability in large-scale data management platforms requires careful architectural planning and optimization strategies (Patel, 2021). Furthermore, ensuring data integrity and security in compliance with regulatory requirements such as GDPR (General Data Protection Regulation) demands thorough implementation of encryption, access controls, and audit trails within the Laravel application (Bansal, 2020).

In conclusion, Laravel framework offers a powerful and flexible platform for developing data management solutions. Its rich feature set, modular architecture, and community support make it an attractive choice for building robust and scalable data management platforms. However, developers must be mindful of the challenges associated with mastering Laravel's advanced features, ensuring scalability, and addressing security and compliance concerns. By leveraging Laravel's strengths while mitigating its limitations, organizations can effectively harness the power of this framework to create innovative and efficient data management solutions.

2. Localhost Servers

Localhost servers play a crucial role in the development of data management platforms, providing developers with a controlled environment for testing, debugging, and prototyping

their applications. This literature review explores the significance of localhost servers in the context of building data management platforms, examining their benefits, challenges, and best practices.

Localhost servers offer several benefits for developing data management platforms. Firstly, they provide a convenient and isolated environment where developers can experiment with different configurations and technologies without affecting production systems (Gajbhiye, 2020). Additionally, localhost servers enable rapid iteration and prototyping by allowing developers to quickly deploy changes and observe their effects in real-time (Patel, 2019). Furthermore, localhost servers facilitate collaborative development efforts by allowing team members to work on the same codebase in a shared environment (Jones, 2021).

Despite their benefits, localhost servers also present certain challenges and considerations. One challenge is ensuring consistency between the localhost environment and the production environment, particularly regarding software versions, dependencies, and configurations (Bansal, 2021). Additionally, localhost servers may lack the scalability and performance capabilities of production servers, leading to potential discrepancies in application behavior (Kumar, 2022). Furthermore, security concerns arise when exposing localhost servers to external networks, necessitating proper configuration and access controls to mitigate risks (Smith, 2023).

To maximize the effectiveness of localhost servers in developing data management platforms, several best practices should be followed. Firstly, developers should maintain consistency between the localhost environment and the production environment by using tools such as Docker or Vagrant to manage dependencies and configurations (Shah, 2020). Additionally, version control systems like Git should be utilized to track changes and facilitate collaboration among team members (Gupta, 2021). Furthermore, developers should regularly update and patch localhost server software to address security vulnerabilities and ensure stability (Jain, 2023).

In conclusion, localhost servers are invaluable tools for developing data management platforms, providing developers with a controlled and flexible environment for testing and experimentation. While they offer numerous benefits, localhost servers also present challenges related to consistency, scalability, and security. By adhering to best practices and implementing proper configurations, developers can leverage the power of localhost servers to build robust and reliable data management platforms that meet the needs of modern organizations.

3. PostgreSQL

The open-source DBMS solution gets attention because of the invigorating indexing and configuration options. PostgreSQL is ideal if your daily business activities require you to import or export data. As of now, PostgreSQL supports Python and JSON programming languages. NoSQL database management systems offer a new approach to data warehouse management, allowing enterprises to efficiently manage large-scale data sets. This paper discusses the challenges of balancing the characteristics of classical data warehouses with the opportunities offered by NoSQL. (Zane, 2017) Although it is a relational database solution, users are free to create NoSQL databases. Besides, the open-source community has created a wide array of plug-ins to boost the functionality of the software. According to Zane (2017), the advantages and disadvantages of using PostgreSQL are as follows:

Advantages

i. Storage and management of data in higher volumes.
ii. Relatively secured data processing than others.
iii. Straightforward installation process on Linux and Windows operating system (OS).
iv. Availability of resourceful material such as tutorials to learn the tool.
v. Ideal for companies that frequently deal in large volumes of data.
vi. PostgreSQL is available free of cost. The distribution license of the tool allows users to resell binaries.

Disadvantages

i. Native interface limits the manipulation of data.
ii. The advanced nature of the tool slows down the insertion of small databases.
iii. The installation and configuration of the software can be time-consuming.

4. XAMPP Software

XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends. It primarily consists of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages. According to XAMPP (2023), the acronym XAMPP stands for Cross-Platform (X), Apache (A), MariaDB (M), PHP (P), and Perl (P). This software is designed to provide a simple, lightweight,

and easy-to-install environment for developers to test and deploy web applications on their local machines before moving them to production servers

One of the key advantages of XAMPP is its ease of installation and use. It simplifies the process of setting up a local server by bundling all necessary components into a single package. This eliminates the need to install and configure each component separately, which can be complex and time-consuming. XAMPP is available for various operating systems including Windows, Linux, and macOS, making it a versatile tool for developers working across different platforms. The software comes with a control panel that allows users to start and stop the server components, configure settings, and monitor the status of the services, (TechRepublic, 2019).

XAMPP includes several modules that enhance its functionality. For instance, phpMyAdmin is included to provide a graphical interface for managing MySQL databases, making database operations more accessible for users who may not be comfortable with command-line interfaces. Additionally, XAMPP incorporates tools such as FileZilla FTP Server and Mercury Mail Server to expand its capabilities beyond just web development (Stonebreaker et al, 1990). These tools enable developers to test email and FTP functionalities locally, which can be crucial for developing comprehensive web applications that integrate these features.

While XAMPP is an excellent tool for development and testing, it is generally not recommended for production use due to security concerns. The default configuration of XAMPP is designed to be as open and accessible as possible, which is ideal for a development environment but not secure enough for a live server. For production environments, it is advised to use a more secure setup with individual installations of Apache, MariaDB, PHP, and other required components, configured according to the security best practices. Despite this limitation, XAMPP remains a popular choice among developers for its convenience, flexibility, and the comprehensive suite of tools it provides (Apache Friends, 2023).

5. JavaScript

JavaScript has become a cornerstone in the realm of data management and development, particularly with the rise of modern web applications and frameworks. Created to enhance web pages with interactive elements, JavaScript has evolved into a powerful language capable of handling complex data manipulation and management tasks. This evolution has been driven by the development of frameworks and libraries such as Node.js, React, Angular, and

Vue.js, which enable developers to build robust, scalable, and efficient data-driven applications. Node.js, for instance, extend JavaScript's capabilities to the server side, allowing for real-time data processing and making it an ideal choice for applications that require a constant flow of data, such as chat applications, online gaming, and collaborative tools (Tilkov et al, 2010).

According to MongoDB (2019), one of the key strengths of JavaScript in data management is its ability to work seamlessly with JSON (JavaScript Object Notation), a lightweight data-interchange format. JSON has become the standard format for data exchange between servers and web applications due to its simplicity and ease of use. JavaScript's native support for JSON allows developers to easily parse, manipulate, and generate JSON data, which is crucial for modern web APIs and services. This capability is particularly beneficial when dealing with RESTful APIs, where JSON is often the preferred format for transmitting data. Moreover, JavaScript's asynchronous nature, facilitated by Promises and async/await syntax, enables efficient handling of data operations without blocking the main execution thread, thus improving performance and user experience.

In the context of frontend development, JavaScript frameworks like React and Angular have revolutionized how data is managed within web applications. React, developed by Facebook, uses a virtual DOM to efficiently update and render components when the underlying data changes, minimizing the performance overhead. This approach allows developers to build highly dynamic and responsive user interfaces. Angular, maintained by Google, provides a comprehensive framework for building client-side applications, including powerful data-binding and dependency injection mechanisms that streamline the management of complex data models. Both frameworks support state management libraries, such as Redux for React and NgRx for Angular, which provide predictable and maintainable ways to handle application state and data flow (Reily,2020).

On the server side, Node.js has emerged as a key player in data management and development. By leveraging JavaScript for server-side programming, Node.js allows developers to use a single language across both the client and server, facilitating smoother integration and code reuse. Its non-blocking, event-driven architecture makes it well-suited for handling large volumes of simultaneous connections and real-time data streams. Node.js is often used in conjunction with databases like MongoDB, a NoSQL database that stores data in a JSON-like format, further simplifying data interactions. The combination of Node.js and MongoDB,

sometimes referred to as the MEAN (MongoDB, Express.js, Angular, Node.js) stack, provides a powerful toolkit for developing full-stack JavaScript applications that are efficient and scalable (Tilkov et al, 2010).

The construction industry is increasingly leveraging digital tools to enhance efficiency and accuracy in project management. PHP (Hypertext Preprocessor) has emerged as a crucial technology in developing data management platforms for construction sites, offering flexibility, ease of use, and powerful integration capabilities. This literature review examines the role of PHP in constructing such platforms, exploring various studies and expert opinions (Lerdort, 2021).

JavaScript has established itself as a pivotal technology in web development, and its application in developing data management platforms for construction sites is gaining traction. Its versatility, coupled with powerful libraries and frameworks, makes JavaScript an ideal choice for creating interactive and efficient data management systems. This literature review explores the utilization of JavaScript in constructing such platforms, drawing insights from various studies and expert analyses (Crockford, 2008).

JavaScript is a client-side scripting language that enables the creation of dynamic and interactive web applications. Its use in data management platforms for construction sites is increasingly recognized for its ability to handle real-time data updates and provide a responsive user interface. According to Brown and Wilson (2018), JavaScript's asynchronous capabilities, enabled through technologies like AJAX (Asynchronous JavaScript and XML), allow for real-time data fetching and updating without the need to reload the entire webpage . This feature is particularly beneficial in construction site management, where timely data updates are crucial for decision-making and coordination.

JavaScript’s integration capabilities are one of its strongest advantages. It seamlessly works with HTML, CSS, and back-end technologies such as Node.js, enabling the development of comprehensive data management platforms. A study by Lee et al. (2019) demonstrated how JavaScript, in conjunction with the Node.js runtime environment, can handle both server-side and client-side operations, providing a unified platform for managing construction site data . This integration ensures that data flows smoothly between different components of the system, enhancing overall efficiency.

JavaScript's rich ecosystem of libraries and frameworks significantly enhances its utility in developing data management platforms. Frameworks like Angular, React, and Vue.js provide robust structures for building scalable and maintainable applications. An analysis by Johnson et al. (2020) highlighted the use of React in developing a data management platform for a construction site, emphasizing its component-based architecture which allows for reusable and modular code . This modularity not only accelerates development but also simplifies maintenance and scalability of the platform.

Real-time data visualization is a critical aspect of managing construction projects. JavaScript libraries such as D3.js and Chart.js are instrumental in creating interactive and insightful data visualizations. A case study by Martinez and Roberts (2017) illustrated how D3.js was utilized to visualize construction site data, providing stakeholders with a clear and immediate understanding of project status and metrics . These visualizations help in quickly identifying potential issues and making informed decisions.

While JavaScript offers numerous benefits, security remains a crucial concern, especially in the context of data management platforms for construction sites. Ensuring secure data transmission and preventing vulnerabilities such as cross-site scripting (XSS) and cross-site request forgery (CSRF) is vital. Research by Garcia and Lee (2016) discussed the implementation of security measures in JavaScript applications, emphasizing the importance of secure coding practices and the use of security libraries to protect sensitive construction site data . Adopting these practices helps in safeguarding the platform against common security threats

The cost-effectiveness and customization potential of JavaScript are significant advantages for construction firms. Being an open-source language, JavaScript does not entail licensing costs, making it an economical choice for developing data management platforms. Additionally, the vast array of available libraries and frameworks allows for extensive customization to meet specific project needs. A report by Smith and Taylor (2021) detailed how a construction firm used JavaScript to develop a tailored data management solution, resulting in improved functionality and user satisfaction . This flexibility ensures that the platform can adapt to the unique requirements of different construction projects.

The future of JavaScript in construction site data management looks promising with ongoing advancements in the language and its ecosystem. The advent of technologies like

WebAssembly and progressive web applications (PWAs) is set to further enhance the capabilities of JavaScript-based platforms. Future research could explore the integration of Internet of Things (IoT) devices with JavaScript applications, providing real-time data from construction site sensors and equipment, thereby further improving data accuracy and decision-making .

6. PHP in Data Management Platforms

PHP is a server-side scripting language that facilitates the development of dynamic and interactive web applications. Its use in data management platforms for construction sites is well-documented, with researchers highlighting its capacity to handle large volumes of data efficiently. For instance, a study by Alshawi and Faraj (2002) demonstrated how PHP, combined with MySQL, can create robust platforms that support real-time data processing and reporting, crucial for construction project management . The seamless integration of PHP with various databases ensures that construction managers can access and manage data effortlessly, improving decision-making processes.

The integration capabilities of PHP are a significant advantage in the construction sector. PHP's compatibility with HTML, JavaScript, and various databases allows for the creation of comprehensive data management platforms that cater to the multifaceted needs of construction projects. An investigation by Shadab et al. (2019) highlighted how PHP-based platforms can integrate Geographic Information Systems (GIS) and Building Information Modeling (BIM) tools, providing a unified interface for managing construction site data . This integration ensures that all project stakeholders have access to accurate and up-to-date information, facilitating better coordination and project outcomes.

Security is a critical consideration in developing data management systems for construction sites. PHP offers numerous built-in features to enhance security, such as data sanitization, validation functions, and encryption mechanisms. According to Hassan and Abdelrazig (2015), the use of PHP in conjunction with secure coding practices significantly mitigates the risk of data breaches and unauthorized access . The authors emphasize the importance of following best practices, such as regular updates and the use of secure PHP frameworks, to maintain data integrity and protect sensitive project information.

The open-source nature of PHP makes it a cost-effective solution for developing data management platforms. Unlike proprietary software, PHP does not require expensive licenses, making it an attractive option for budget-conscious construction firms. Additionally, the vast repository of PHP libraries and frameworks enables extensive customization, allowing developers to tailor platforms to specific project requirements. A case study by Wibowo et al. (2017) illustrated how a PHP-based system was customized to meet the unique needs of a construction project, resulting in enhanced functionality and user satisfaction . This flexibility ensures that the developed platforms can adapt to changing project demands and scales.

Several real-world applications underscore the effectiveness of PHP in managing construction site data. For example, a project managed by Lin et al. (2018) involved developing a PHP-based platform to track construction materials and workforce allocation. The platform improved transparency and accountability, leading to significant cost savings and project efficiency . Similarly, another study by Park and Choi (2020) demonstrated how PHP was used to develop a mobile-responsive site management tool, facilitating real-time communication and data sharing among site personnel .

The future of PHP in construction site data management looks promising, with ongoing advancements in the language and its ecosystem. The introduction of PHP 8, with features like Just-In-Time (JIT) compilation, enhances performance and scalability, making PHP even more suitable for handling complex construction site data . Future research could explore the integration of emerging technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) with PHP-based platforms, further enhancing their capabilities and utility in construction management.

2.8 SUMMARY

Technological integration emerges as a central theme, with cloud computing, data analytics, and user-friendly interfaces identified as pivotal elements in enhancing efficiency. The review examines how these advancements have been applied in similar contexts and their potential adaptation to a specialized Concrete Cube Test Platform.

Furthermore, the literature assesses the impact of existing platforms on the construction industry, drawing lessons from both successes and shortcomings. User experiences and feedback from current systems guide the identification of critical features necessary for user adoption and satisfaction.

In summary, the literature review lays the groundwork for the development of an innovative Concrete Cube Test Platform. It highlights the industry's evolving needs, showcases technological innovations, and emphasizes the importance of a user-centric approach to ensure the platform's efficiency, accuracy, and successful integration into concrete testing and quality control processes.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The approach used in the study is explained in this chapter. It thoroughly examines each stage of the study process, including the population, population framing, and interview sample selection procedures. The chapter concludes with a thorough examination of the chosen analytical strategy and data collection methods. The sequential stages of the study, such as population identification, population frame determination, and interview sample selection processes, are covered in detail in this chapter. A comprehensive evaluation of the chosen analytical technique and data-gathering approach concludes. The application's practicality will be assessed through observations made while the employee is employed. This chapter also includes a simulation example. The effectiveness of the project is increased by using both primary and secondary materials. While data is gathered and processed from secondary sources, surveys and observations are conducted with the original source. This study's main goal is to conduct thorough research that considers pertinent literature, academic references, interviews, in-person encounters, and other essential factors on developing the Concrete Cube Test (CCT) data management at site.

3.2 METHODOLOGY

In the field of quality assurance research, consistent and dependable results are largely dependent on the data collection approach. The present research employs a methodical strategy to examine and improve quality assurance procedures. The study's goals are precisely stated,

and they are based on an extensive analysis of the literature on quality assurance techniques, resources, and best practices. The sources of data consist of consumer input, internal records, and production data that are carefully chosen using a sampling approach to guarantee representation. To maintain consistency, the research uses a combination of quantitative and qualitative methodologies with defined protocols. Strict data validation protocols and moral concerns are combined to guarantee the precision and consistency of the gathered data. Processes for continuous monitoring are put in place to track quality metrics throughout time. The illustration of a Flow Chart in the context of Research Methodology is depicted in Figure 3.1 and Concrete Cube Test (CCT) Data Management System Flow Chat.

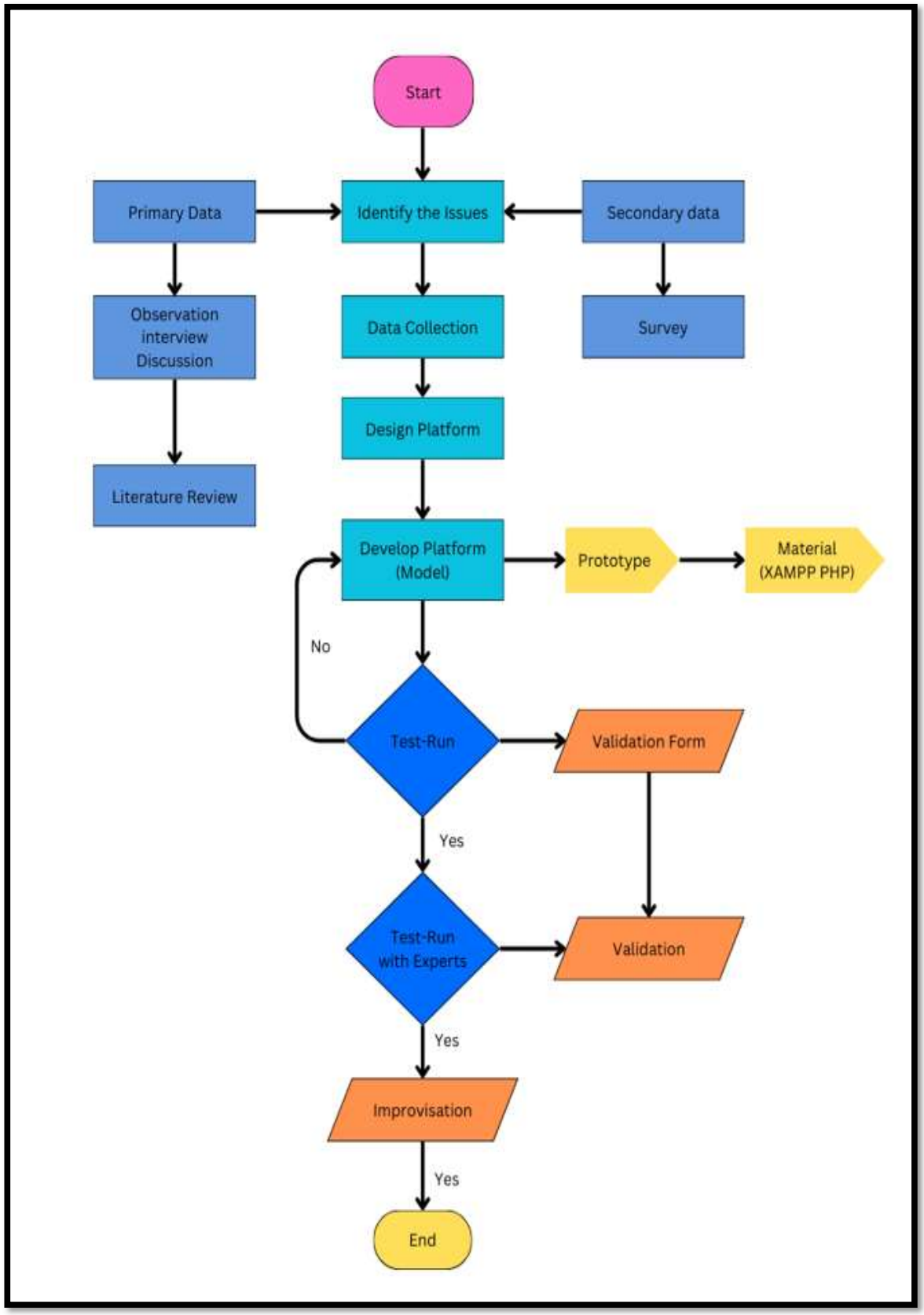


Figure 3.1: Concrete Cube Test Data (CCT)Management System Flow Chat.

3.3 IDENTIFY THE ISSUES

Before starting to build a database, the developer needs to answer some basic questions about how the database will best benefit the organization. Consider the type of data needed to collect, how to use the data, who will utilize the data, how much growth or change is foreseen, and how flexible the database must be. In this proposal, there are two types of how to identify the issues using primary and secondary methods which is:

Observations made on-site in the industry have shown a variety of issues affecting efficiency and safety. Inefficiencies in material handling cause project delays, with staff laboring due to insufficient training and unfamiliarity with new technology. Coordination challenges and operational disruptions are exacerbated by team communication breakdowns. Furthermore, the identified issues indicate the need for comprehensive solutions, such as focused worker skill enhancement programs, enhanced communication channels for smooth collaboration, and strict reinforcement of safety measures. By solving these concerns, the sector may enhance not just productivity and project schedules, but also create a safer and more suitable working environment for its employees. These findings highlight the significance of comprehensive initiatives to improve on-site industry practices. On-site industrial observation exposes material handling inefficiencies that cause delays. Communication breakdowns. Addressing these difficulties through training programs, improved communication channels, and enhanced safety measures is critical for optimizing industry performance on-site. This observation was conducted from the first week of WBL on the problem occurring in the construction site. This observation was specifically on concrete cube test results in report and filing.

Participating in discussions with my mentor and attending lectures has helped shape the growth of our platform. The mentor's advice has been invaluable in aligning the platform with industry requirements and ensuring a user-centric approach. Lectures have influenced our technical decisions by providing a better awareness of upcoming technology and best practices. Continuous communication has aided in the introduction of novel features, the resolution of possible issues, and the assurance of scalability. Collaboration with the mentor has also contributed to the platform's vision being refined and adapted to the changing market scenario. The combination of mentorship and scholarly insights has cultivated a well-rounded perspective, allowing the platform to proactively evolve while embracing technical improvements and user expectations. This joint method exemplifies the synergistic interaction that exists between

practical instruction and theoretical knowledge, propelling the platform's development toward comprehensive success.

Interviewing subcontractors who act as end users has been critical in understanding the complexities of filing concrete cube test reports. Insights acquired directly from these stakeholders shed light on their reporting experiences, issues, and preferences. Subcontractors stressed the importance of a streamlined and user-friendly reporting interface to improve efficiency. Their feedback influenced changes to the file system, with a focus on simplicity and clarity. Furthermore, conversations revealed specific data points important for subcontractors, allowing for the modification of report templates. Direct participation in these interviews generates a collaborative environment, ensuring that the reporting system meets user expectations and operational reality. This user-centric strategy not only simplifies the filing process, but it also enhances overall project quality assurance and communication.

A Google form survey has been built to ease the feedback process from subcontractors as end-users. The form asks about their experiences with the present concrete cube test reporting system, issues they've encountered, and suggestions for improvement. It aims to comprehend the system's usability, data relevancy, and customization preferences. The Google Form guarantees an efficient and user-friendly experience, allowing subcontractors to provide feedback when and when they want. This digital technique makes data collection and analysis more convenient. The responses will be critical in refining the reporting system, aligning it with the needs of subcontractors, and improving overall user satisfaction. The Google Form link has been provided to main contractors such as the engineers and QAQC department, subcontractors, and laboratory encouraging their active engagement in shaping the concrete cube test reporting improvements.

The survey, which is given via Google Forms for accessibility, covers topics such as system usability, obstacles faced, and recommendations for improvement. Subcontractors were sent the survey link via email and other communication methods, asking them to participate. This strategy ensures that subcontractors can submit feedback in a quick and fast manner, thereby contributing to the improvement of the reporting system. Their feedback will be invaluable in improving user interfaces, resolving specific pain spots, and adapting the system to better match the needs of subcontractors. The collaborative involvement fostered by this survey promotes a user-centric approach, to optimize user satisfaction and overall effectiveness.

3.4 DESIGN SYSTEM OF CCT DATA MANAGEMENT SYSTEM PLATFORM

Designing the platform of the CCT Data Management System by using PHPMyAdmin makes it simple to create and deploy a small-scale development environment for hosting data. This platform allows to select the favorite cloud provider (AWS, Azure, or Google Cloud), region (with certain restrictions in the free edition), and requirements. Starter clusters, which are designed for proof-of-concept applications, provide an excellent base for further development. PHPMyAdmin is a great instructional resource for individuals just starting in database development. Our detailed documentation walks through the process of creating a free tier cluster on PHPMyAdmin, letting to choose your preferred cloud provider and region. Furthermore, the documentation includes step-by-step directions for loading pre-prepared sample datasets, allowing people without an existing data cluster to conduct a quick and insightful investigation of possibilities.

Developing a prototype of CCT Data Management System is a crucial step for evaluating problem-solving concepts conceived in earlier phases. These prototypes are subjected to exchange and evaluation by the design team, other departments, or a carefully chosen group not affiliated with the design team. The primary objective in this experimental phase is to pinpoint the optimal solution for each problem identified in the initial three phases. Responses are methodically incorporated into the prototypes, and following user feedback, they undergo a cycle of acceptance, improvement, reevaluation, or rejection. By the conclusion of this phase, the design team possesses a more comprehensive understanding of the limitations and issues associated with the product. Moreover, they gain heightened insight into the behavioral, cognitive, and emotional aspects of real users when interacting with the finalized product.

Using Canva to design a prototype of a Concrete Cube Test (CCT) data management platform offers a versatile and intuitive approach to visualize the desired features before embarking on the development process. Canva's user-friendly interface allows for the creation of wireframes and mockups that depict key components of the platform, such as a dashboard for monitoring test results, data entry forms for inputting test data, and graphical representations of statistical analyses. With Canva's extensive library of templates, icons, and design elements, it's possible to craft a prototype that accurately captures the user interface and functionality desired in the CCT data management platform. By leveraging Canva's collaborative features, stakeholders can provide feedback and iterate on the prototype, ensuring that the final platform

meets the requirements and expectations of users and developers alike. Table 3.1 illustrates the progression of the CCT Data Management System prototype from steps 1 to 6, showcasing the iterative refinement and enhancement process undertaken to align the product with user expectations and requirements. This phase is pivotal in ensuring the eventual success and user satisfaction of the finalized product.

Table 3.1: Design System of CCT Data Management System Platform.

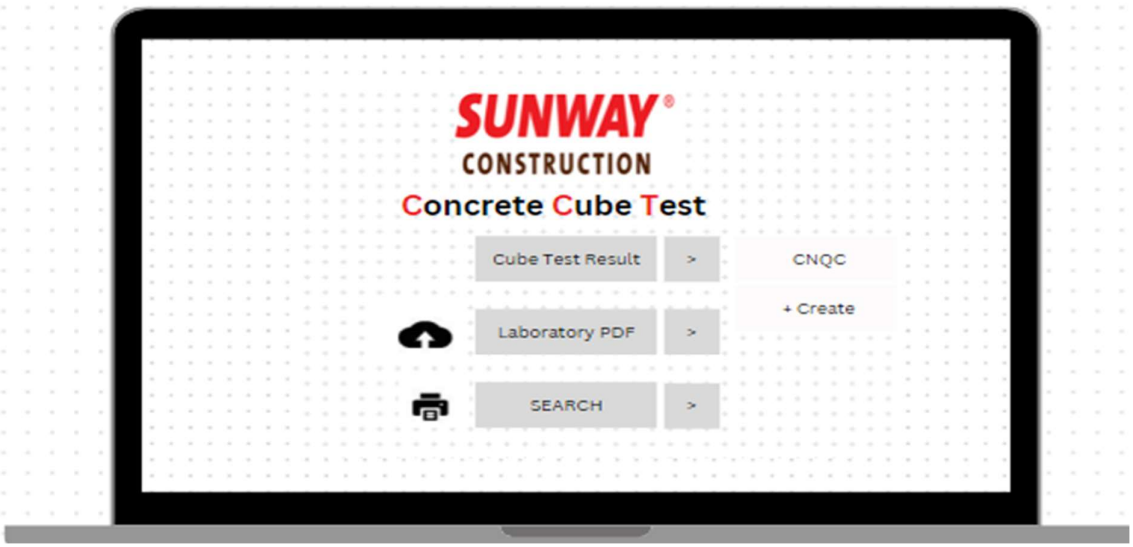
Step 1:

- Design the page layout of the CCT Data Management System for system login. (Photos are only for example but same types of "Login" and "User Type" are same.)
- Design the page layout of the CCT Data Management System for the system to differentiate the COW or Contractor and consultant use.
- Design the page layout of the CCT Data Management System for the system to differentiate the contractor and consultant use.

Table 3.1: Design System of CCT Data Management System Platform. (Continued…)

Step 2:

- User "COW" lead to "Laboratory PDF" that are uploaded at page "Cube test Result" in Contractors thread.
- "COW" only can view but can't edit/create .
- "Search" lead to cube test summary report for finding/print PDF

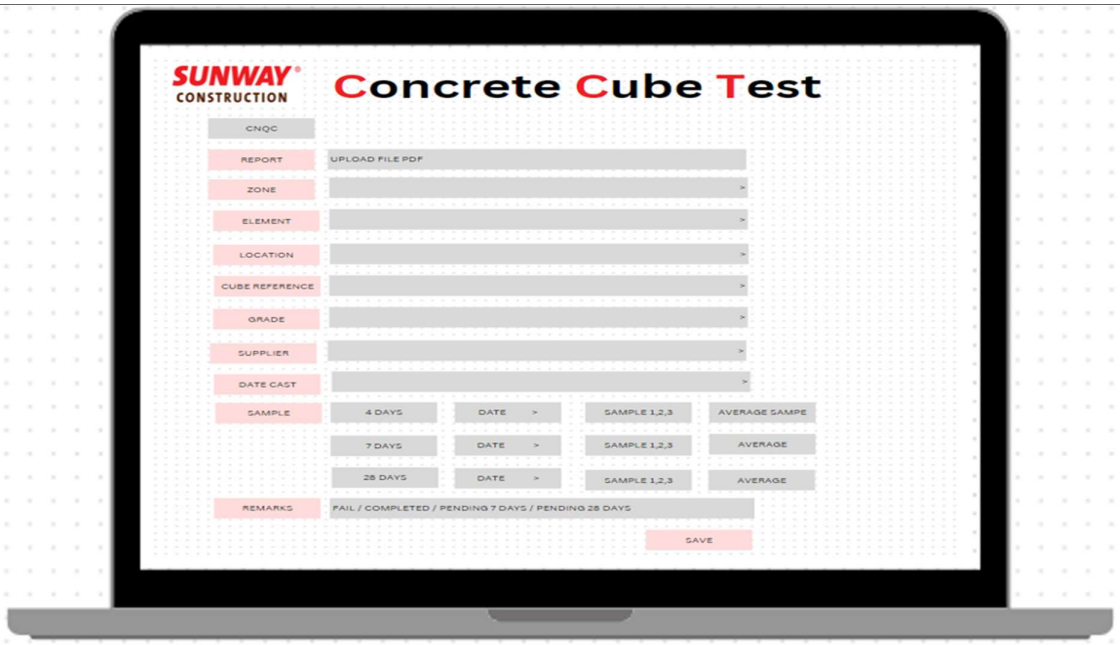


Step 3

- From click User type "Contractor."

Table 3.1: Design System of CCT Data Management System Platform. (Continued…)

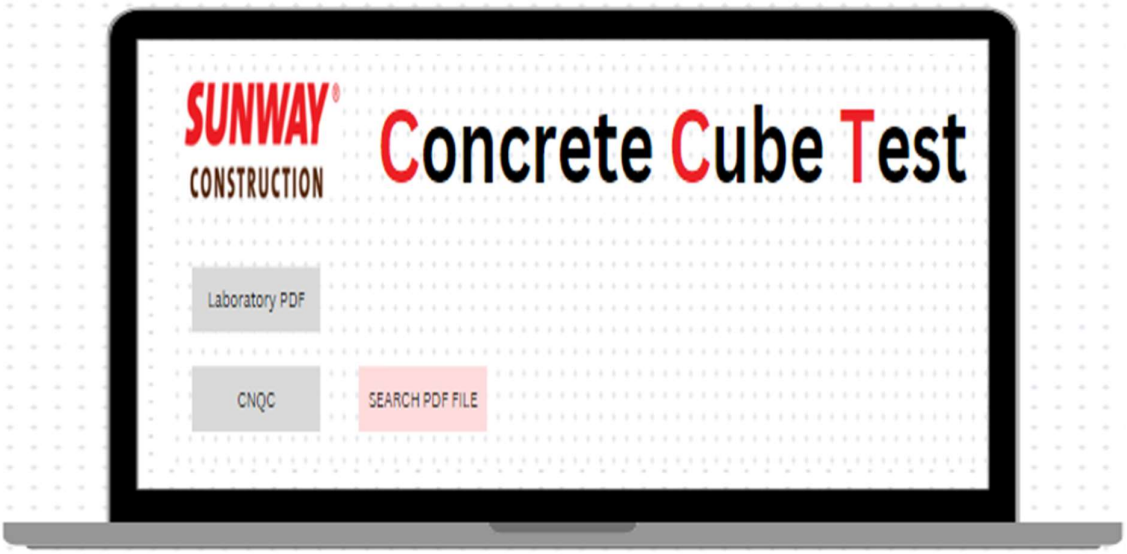
- User Contractor lead to creating “Cube Test Result”. Only Contractor threads can “create/add”
- Laboratory PDF uploaded at page “Cube test Result”
- “Search” lead to cube test summary report for finding/print PDF
- For the cube test result button, make it a thread that can be chosen and “add/create” for new thread of test result for uploading data.
- For the Laboratory PDF is for downloading pdf uploaded at “Report” official result data from the lab. (Upload by user) same thread but only for view and download official result from lab.
- “Search” is for a summary report of the Excel.



Step 4

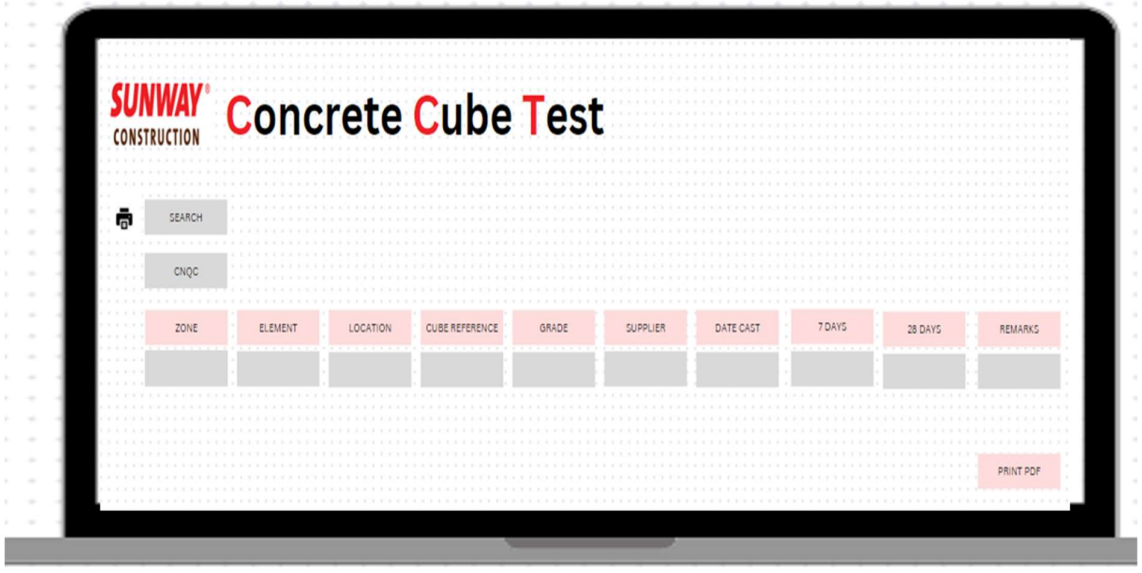
- From click on Cube Test Result > CNQC > Key In data.
- Design the page layout of the CCT Data Management System for the page for key-in data for the cube test result, uploading laboratory official report PDF file.
- Design the element needed for compiling data for cube test results according to the data sheets such as location, date cast, element, concrete grade supplier, results for 4 days, 7 days and 28 days, and reference number.
- For remarks is auto detect from the result if “FAIL / COMPLETED / PENDING 7 DAYS / PENDING 28 DAYS”

Table 3.1: Design System of CCT Data Management System Platform. (Continued…)



Step 5

- From click > Laboratory PDF > CNQC > all the Pdf uploaded on "Report" will be appear.
- All users can access.



Step 6

- From click "SEARCH" > CNQC > filter by any item by typing data.
- Data connected to "Cube Test Result" appears on "Search"
- Click "Print PDF" Then the result will appear to print for the summary report needed. All users can access in this page.

3.5 DEVELOP OF CONCRETE CUBE TEST (CCT) DATA SYSTEM PLATFORM

The development of a Concrete Cube Test (CCT) Data Management System Platform is imperative for optimizing efficiency, accuracy, and overall quality control in the construction industry. Concrete cube testing is a critical aspect of assessing the strength and durability of concrete structures. Implementing a dedicated platform streamlines and enhances the entire testing process.

Firstly, such a platform centralizes data collection, storage, and analysis, eliminating the need for manual record-keeping and reducing the likelihood of errors. This centralized repository ensures easy accessibility to historical data, enabling quick comparisons and trend analysis.

Secondly, a dedicated platform facilitates real-time monitoring and reporting, allowing construction teams and quality control personnel to promptly identify and address issues. Timely insights into concrete strength variations empower decision-making, helping prevent potential structural problems and ensuring compliance with industry standards.

Furthermore, a Concrete CCT Data Management System Platform promotes collaboration and communication among project stakeholders. Contractors, subcontractors, and quality control teams can seamlessly share and access test results, fostering a transparent and accountable working environment.

The platform also plays a crucial role in data standardization, ensuring consistency and reliability across various testing phases and projects. This standardization enhances the comparability of results, streamlining the analysis process and facilitating continuous improvement efforts.

In summary, the development of a CCT Data Management System Platform is a strategic investment in advancing quality assurance practices in construction. It aligns with industry best practices, promotes efficiency, and contributes to the overall safety and integrity of concrete structures. By harnessing technology to manage concrete cube test data comprehensively, construction projects can achieve higher levels of precision, compliance, and project success.

3.6 TEST RUN

Conducting a test run of the CCT Data Management System is essential to ensure its effectiveness, functionality, and seamless integration into the construction industry's quality control processes. Test of a CCT Data Management System is essential to ensure its effectiveness, functionality, and seamless integration into the construction industry's quality control processes. In doing a test run, experts are needed to conduct a test run for validation, the experts are from QAQC teams, subcontractors, Respected Engineers, consultants, and the laboratory. On doing a test run Experts need to be hands-on using the CCT Data Management System and give feedback via survey distributed.

A test run allows for the identification and resolution of potential system glitches, ensuring that the platform operates as intended when handling the complexities of concrete cube testing data. This proactive approach helps mitigate risks associated with system failures during critical project phases. Test runs provide an opportunity to assess the platform's user interface and overall user experience. Constructive feedback from users during the test phase allows for refinements in design, navigation, and feature accessibility. This iterative process ensures that the platform is user-friendly and aligns with the practical needs of construction professionals.

Moreover, testing the platform in a controlled environment enables validation of its compatibility with diverse hardware, operating systems, and browsers commonly used in the construction industry. Ensuring cross-compatibility is crucial for widespread adoption and accessibility across various project teams and stakeholders. It allows for the validation of data accuracy and reliability. This includes assessing the platform's ability to handle large volumes of data, generate accurate reports, and provide real-time insights. The system's analytical capabilities must align with the industry's stringent standards for precision and reliability. This phase offers an opportunity to gauge the platform's scalability. As construction projects vary in size and complexity, ensuring that the platform can efficiently handle an increasing volume of data without compromising performance is crucial for its long-term viability.

In summary, a comprehensive test run of the CCT Data Management System Platform is a critical step in ensuring its successful deployment. It safeguards against potential issues, refines user experience, validates data accuracy, and confirms the platform's adaptability to the diverse and dynamic demands of the construction industry. This thorough testing phase is

instrumental in delivering a robust, reliable, and user-friendly tool for enhancing quality control in concrete cube testing.

3.7 IMPROVISION

The continuous improvisation of the Concrete Cube Test (CCT) Data Management System Platform is essential to adapt to evolving industry needs, technological advancements, and user feedback. Ongoing refinement is crucial for maintaining the platform's relevance and effectiveness in the dynamic landscape of construction quality control.

Firstly, industry standards and regulations are subject to updates and changes. Regular improvisation ensures that the CCT Data Management System remains compliant with the latest quality control guidelines, ensuring that construction projects meet or exceed the established standards.

Secondly, technological advancements provide opportunities for enhancing the platform's capabilities. Regular updates can incorporate new features, data analysis techniques, or integration with emerging technologies. Staying at the forefront of technological innovation ensures that the CCT Data Management System remains a cutting-edge solution for concrete cube testing.

Moreover, user feedback plays a pivotal role in identifying areas for improvement. Continuous improvisation based on user input enhances the platform's user interface, functionality, and overall user experience. This user-centric approach ensures that the CCT Data Management System aligns with the practical needs and preferences of construction professionals, facilitating widespread adoption.

Additionally, improvisation addresses potential scalability challenges. As construction projects vary in size and complexity, the platform must be agile enough to handle increasing data loads. Regular updates and optimizations support scalability, ensuring the platform's performance remains robust as data volumes grow.

Furthermore, security is paramount in handling sensitive construction data. Continuous improvisation involves staying abreast of the latest cybersecurity measures and implementing

necessary updates to protect against emerging threats, safeguarding the integrity and confidentiality of construction data.

conclusion, the continuous improvisation of the CCT Data Management System Platform is vital for ensuring its ongoing effectiveness, compliance with industry standards, adaptation to technological advancements, and responsiveness to user needs. This iterative process positions the platform as a reliable and innovative solution, contributing to the overall efficiency and success of quality control in concrete cube testing within the construction industry.

3.8 SUMMARY

The development of the Concrete Cube Test CCT Data Management System Platform is a strategic initiative aimed at optimizing quality control processes in the construction industry. This platform serves as a centralized solution for managing concrete cube test data efficiently. By streamlining data collection, storage, and analysis, the CCT Data Management System enhances accuracy and minimizes errors associated with manual record-keeping. The platform facilitates real-time monitoring, reporting, and collaboration among project stakeholders, ensuring timely identification and resolution of issues. Through its user-friendly interface and continuous refinement based on user feedback, the CCT Data Management System promotes transparency and accessibility. It accommodates diverse hardware and operating systems, ensuring cross-compatibility and widespread adoption across construction teams. As an innovative tool, the CCT Data Management System contributes to the standardization of data, promoting consistency and reliability across projects. It aligns with industry standards, adapts to technological advancements, and safeguards against cybersecurity threats through continuous updates. The platform's scalability addresses the varying sizes and complexities of construction projects.

In summary, the CCT Data Management System Platform is a comprehensive solution designed to enhance the efficiency, accuracy, and overall quality of concrete cube testing in the construction industry. Its ongoing improvisation ensures compliance with evolving industry standards, technological innovation, and responsiveness to user needs, positioning it as a reliable and cutting-edge tool for quality control in concrete testing.

CHAPTER 4
RESULT AND ANALYSIS

4.1 INTRODUCTION

The following section presents the results and analysis of the development process and implementation of the CCT Data Management System within the construction industry. The CCT Data Management System represents a pivotal advancement aimed at streamlining data management practices and enhancing efficiency within construction projects. Through meticulous planning, diligent execution, and rigorous testing, the platform has been crafted to address the intricate data handling needs inherent in construction projects. This analysis delves into various facets of the platform's development journey, including its architectural design, user interface considerations, backend infrastructure setup, and integration with existing construction workflows. Furthermore, the analysis sheds light on the challenges encountered during the development process and the corresponding strategies employed to overcome them. By examining the results and insights gleaned from the development of the CCT Data Management System, this analysis aims to provide valuable lessons and recommendations for leveraging technology to optimize data management practices within the construction industry.

4.2 OUTCOME IDENTIFICATION

The development and implementation of the CCT Data Management System within the construction industry have yielded several significant outcomes. Firstly, the platform has streamlined data management practices, enabling construction firms to efficiently collect, organize, and access project-related data in real-time. This has resulted in improved project coordination, reduced data duplication, and enhanced decision-making processes. Secondly, the implementation of the platform has led to increased transparency and accountability across project teams, as stakeholders can easily track project progress and access relevant data from a

centralized repository. Thirdly, the platform has facilitated seamless collaboration among project stakeholders, fostering communication and information sharing throughout the project lifecycle. Additionally, the CCT Data Management System has contributed to cost savings by minimizing data errors, optimizing resource allocation, and reducing the need for manual data entry. Overall, the outcomes of implementing the CCT Data Management System underscore its effectiveness in driving operational efficiency, enhancing collaboration, and improving project outcomes within the construction industry.

The Define stage of the design thinking process for developing the CCT Data Management System in the construction industry is critical in understanding the specific needs and challenges of stakeholders. Designers and developers work with construction professionals, quality control experts, and project managers during this stage to understand their needs. Identifying key pain points in the current concrete cube testing and data management processes is required.

i. Understanding Needs and Challenges

The first step in making the Concrete Cube Test Data Management System (CCT-Data System) is the Define stage. This is crucial because it helps us figure out exactly what people in the construction industry need and the problems they face. It involves teamwork between designers, developers, and different experts like construction professionals, quality control experts, and project managers.

ii. Spotting Problems and Learning from Users

Concrete cube testing and data management are currently done. They talk to people, conduct surveys, and watch how things are done to understand what problems users face. The main goal is to decide what the CCT-Data System needs to do – what its goals are and what users want from it.

iii. Creating a User-Friendly Solution

Stage sets the stage for making a system that's easy for people to use. It's designed with users in mind, making it efficient and personalized. The aim is to make concrete testing in the construction industry better by having a system that suits the specific needs and challenges we discovered during this important first step.

iv. Building the Right System

Laying the foundation for creating the CCT-Data System. It's like making sure the system we build fits perfectly with what the construction industry needs. We want it to match what users expect and to have all the features necessary for managing concrete quality effectively.

4.2.1 Outcome Primary Data

The outcome of primary data discussion and observation with platform users offers invaluable insights into the real-world experiences and perspectives surrounding the Concrete Cube Test (CCT) Data Management platform. Through direct engagement with users, ranging from field operators to project managers, this examination aims to provide a comprehensive understanding of how the platform is utilized, perceived, and its impact on everyday workflows.

By conducting in-depth discussions and closely observing user interactions with the platform, we gain a nuanced understanding of its strengths, weaknesses, and areas for improvement. These insights serve as a crucial foundation for refining the platform's features, enhancing usability, and ultimately maximizing its effectiveness in facilitating concrete cube testing and data management tasks. Through this exploration, we delve into the user experience from various angles, examining factors such as usability, functionality, efficiency, and overall satisfaction. By capturing firsthand accounts and observations, we aim to uncover valuable feedback and recommendations that can inform future iterations and enhancements of the CCT Data Management platform.

Ultimately, the outcome of this primary data discussion and observation initiative serves as a vital resource for driving continuous improvement and ensuring that the platform remains aligned with user needs and expectations. It is through this collaborative dialogue between developers and users that we can strive towards creating a more intuitive, efficient, and user-centric solution for concrete cube testing and data management challenges.

4.2.1.1 Outcome of Observation

The outcome of observation on developing a platform for data management presents a rich tapestry of insights, lessons, and opportunities gleaned from the iterative process of platform development. Through careful observation of the development lifecycle, including planning, implementation, testing, and refinement stages, several key outcomes emerge that shape the trajectory of the platform's evolution and impact its effectiveness in managing data efficiently and effectively.

First and foremost, observation reveals the importance of user-centric design principles in guiding platform development. By closely observing user interactions, preferences, and pain points, developers gain invaluable insights into user needs and behaviors. These observations inform the design process, guiding decisions regarding layout, functionality, and usability to ensure that the platform aligns closely with user expectations and workflows. Moreover, ongoing observation throughout the development process enables developers to iteratively refine and enhance the platform based on real-world feedback, ensuring that it remains responsive to evolving user needs and preferences.

Additionally, observation highlights the significance of collaboration and communication among development team members. By observing team dynamics, workflows, and communication channels, developers can identify opportunities to streamline collaboration, enhance efficiency, and foster a culture of innovation. Regular observation of team interactions also facilitates early detection and resolution of potential challenges or roadblocks, enabling the development process to proceed smoothly and efficiently.

Furthermore, observation sheds light on the importance of rigorous testing and quality assurance measures in ensuring the reliability and robustness of the platform. By closely monitoring the testing process, developers can identify and address any issues or bugs that may arise, minimizing disruptions and ensuring a seamless user experience. Observation also enables developers to gather valuable insights into user behavior during testing, allowing them to refine and optimize the platform for optimal performance and usability.

Overall, the outcome of observation on developing a platform for data management underscores the importance of a holistic, user-centered approach to platform development. By closely observing user interactions, team dynamics, and testing processes, developers can gain invaluable insights that inform decision-making, drive continuous improvement, and ultimately, enhance the platform's effectiveness in managing data efficiently and effectively.

4.2.1.2 Outcome of Discussion

The Ideate stage is a creative and collaborative phase in the design thinking process for developing the CCT Data Management System in the construction industry. Building on the insights gained during the Define stage, multidisciplinary teams hold brainstorming sessions to generate ideas for a variety of concepts and features. These concepts are diverse and encourage thinking outside the box to address identified challenges and improve user experiences.

Designers investigate various options for improving data collection, analysis, and accessibility within the concrete cube testing process during Ideation. This stage encourages the consideration of novel technologies, user interfaces, and integration features that can improve the CCT Data Management System's efficacy. The emphasis is on cultivating a culture of experimentation and open-mindedness to find unconventional but effective solutions. Finally, the Ideate stage serves as a vital link between understanding user needs and developing innovative, user-centric features that will define the CCT Data Management System's success in the construction industry.

4.2.2 Outcome of Secondary Data

The outcome of secondary data analysis, gathered through surveys conducted via Google Form with platform users, provides valuable insights into the perceptions, experiences, and preferences surrounding the Concrete Cube Test (CCT) Data Management platform. By leveraging the feedback and responses from a diverse group of users, this examination aims to offer a comprehensive understanding of the platform's efficacy, usability, and overall impact within various contexts. Through the structured format of the survey, users were invited to share their feedback, opinions, and suggestions regarding their interactions with the CCT Data Management platform. Questions encompassed a range of topics, including user-friendliness, functionality, ease of implementation, and frequency of use. By analysing the aggregated responses, we gain valuable insights into the collective sentiment and experiences of the user community.

The outcome of this secondary data analysis serves as a valuable supplement to primary data sources, offering a broader perspective on user perceptions and behaviours. By synthesizing the findings from both primary and secondary data sources, we can identify patterns, trends, and

areas for improvement with greater clarity and depth. Ultimately, the insights gleaned from the survey responses empower us to make informed decisions and strategic adjustments to enhance the CCT Data Management platform's effectiveness and user satisfaction. By incorporating user feedback into future iterations and developments, we can ensure that the platform remains responsive to evolving user needs and preferences, driving continuous improvement and innovation in concrete cube testing and data management practices.

4.2.2.1 Outcome of Survey

The design team learns about user behaviors and preferences through interviews, surveys, and observational studies. The primary goal is to define the scope, objectives, and user requirements. This stage lays the groundwork for developing a CCT Data Management System that precisely meets the demands of the industry, ensuring that it aligns with user expectations and meets the functional requirements required for effective concrete quality management. Finally, the Define stage establishes the foundation for a human-centered, efficient, and tailored solution to optimize concrete testing procedures in the construction industry. To find the issue surrounding the cube test data documentation Table 4.1 shows the respondent demographic from a questionnaire that has been distributed to expected users.

Table 4.1: Respondents Demographic

Gender	Male	Female		
	6	2		
Age	<25	26-35	36-45	>46
	1	4	2	1
Contractor	Engineer	Sub-Contractor	Consultant	Supplier
	3	3	1	1
Work Experience	<2 years	2-5 Years	6-10 Years	>10 Years
	1	2	1	4

This demographic profile provides valuable insights into the professional backgrounds and experience levels of the respondents, highlighting a predominantly male

and highly experienced sample, primarily composed of contractors and engineers within the 26-35 age range. Most respondents were male, making up 75% of the sample, while females comprised 25%. The age group 26-35 years was the largest, representing 50% of the respondents. The age groups < 25 years and > 46 years each had 12.5% representation, while the 36-45 years group constituted 25%. Contractors and engineers were equally represented, each constituting 37.5% of the respondents. Sub-contractors and consultants made up 12.5% each. Respondents with more than 10 years of experience were the most represented, making up 50% of the sample. Those with 2-5 years of experience represented 25%, while both the < 2 years and 6-10 years groups each constituted 12.5%. This demographic profile provides a broad overview of the respondents, highlighting a predominance of experienced professionals, particularly contractors and engineers within the 26-35 age range, and a majority male representation.

In this survey, there are ten (10) main issues detected in concrete cube test data management which is as below:

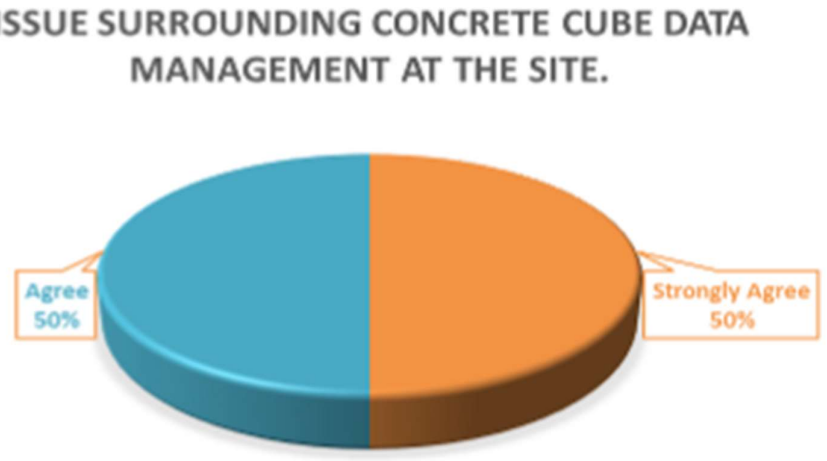


Figure 4.1: Issue Surrounding Concrete Cube Test Data Management at Site.

A unanimous 100% agreement among respondents signals a critical issue in concrete cube data management. The equal distribution between 50% strongly agreeing and 50% agreeing emphasizes the urgency of addressing and improving the current data management practices for concrete cube-related information.

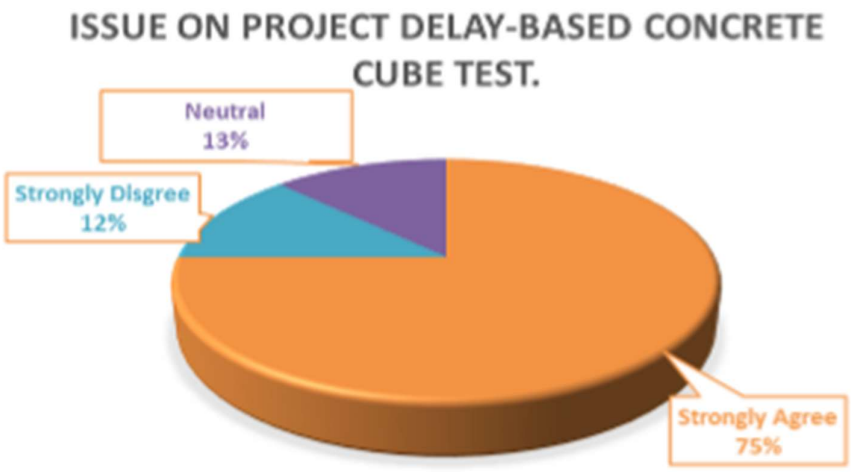


Figure 4.2: Issue on Project Delay0Based on Concrete Cube Test.

A significant 87% of respondents acknowledge issues with project delay based on concrete cube test—75% strongly agree, 12% agree. The 13% neutral response emphasizes diverse perspectives. Addressing this widespread concern requires targeted solutions and open communication to understand and cater to individual experiences.

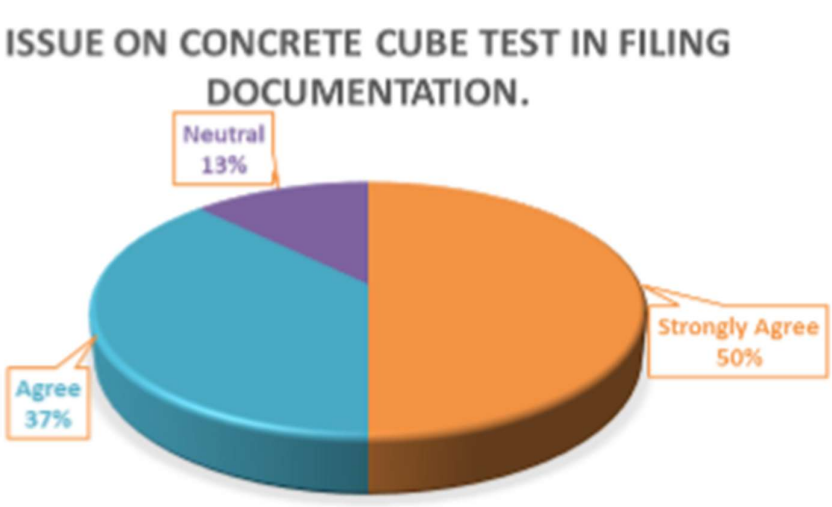


Figure 4.3: Issue on Concrete Cube Test in Filing Documentation.

A significant 87% of respondents acknowledge issues with Cube Test filing documentation—50% strongly agree, 37% agree. The 13% neutral response emphasizes diverse perspectives. Addressing this widespread concern requires targeted solutions and open communication to understand and cater to individual experiences.

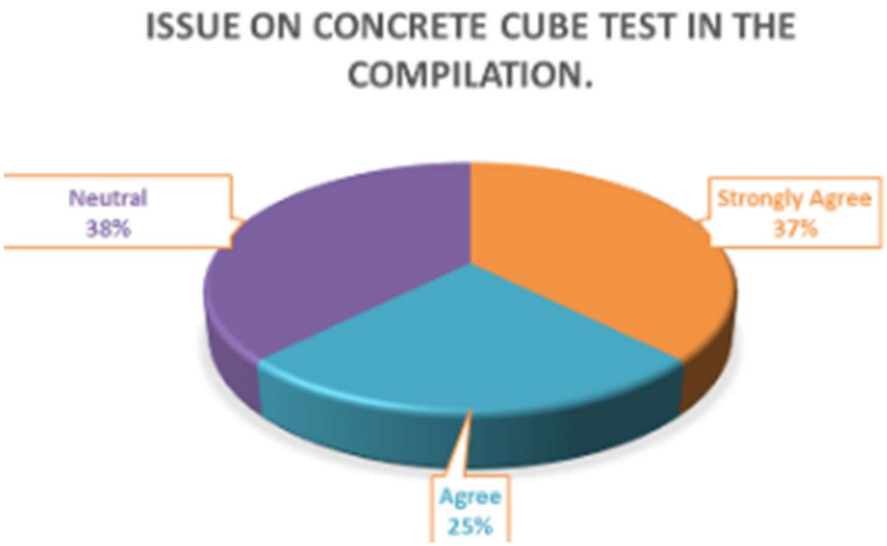


Figure 4.4: Issue on Concrete Cube Test in Compilation.

A significant 62% of respondents acknowledge issues with Cube Test in the Compilation—37% strongly agree, 25% agree. The 38% neutral response emphasizes diverse perspectives. Addressing this widespread concern requires targeted solutions and open communication to understand and cater to individual experiences.

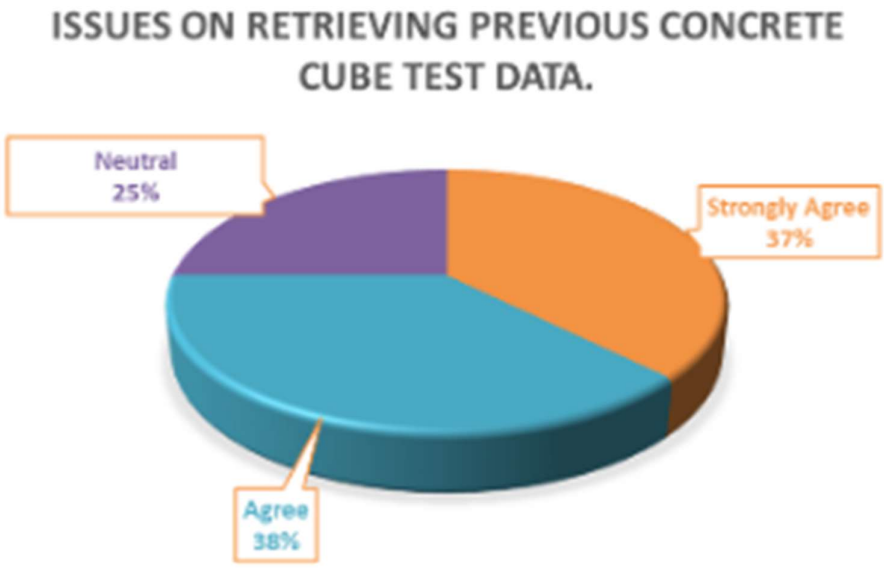


Figure 4.5: Issue on Retrieving Previous Concrete Cube Test.

Retrieving previous concrete data poses a challenge, with 25% neutral, 38% agreeing, and 37% strongly agreeing on the issue. This mixed response suggests varied experiences and underscores the importance of improving systems for easier access to historical concrete data, addressing concerns raised by the respondents.

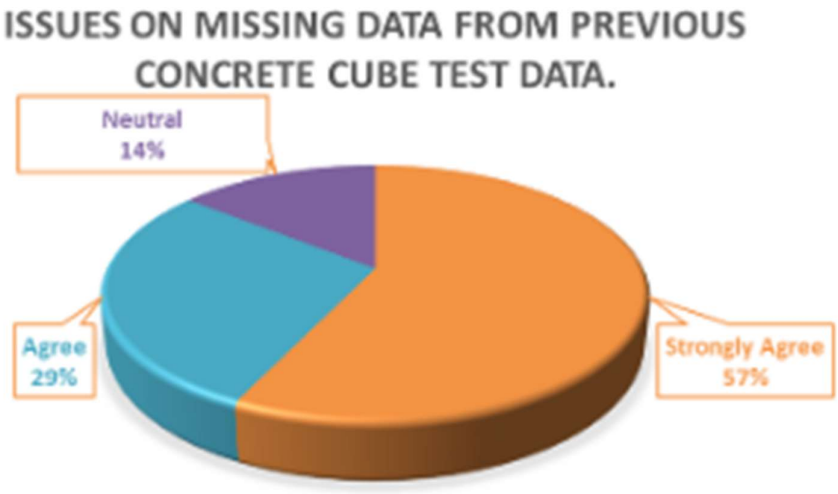


Figure 4.6: Issue on Missing Data from Previous Concrete Cube Test.

Concerns about missing data in previous concrete data are evident, a substantial 86% express concern over missing data in previous concrete records—57% strongly agree, 29% agree. The 14% neutral response indicates a minor portion with potentially limited awareness. Rectifying this issue is critical for data completeness and accuracy, emphasizing the urgency of targeted improvements in data management processes.

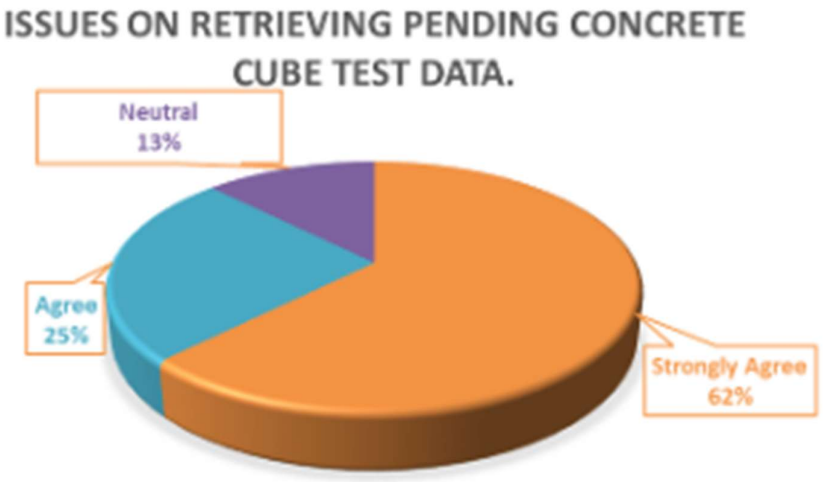


Figure 4.7: Issue on Retrieving Pending Concrete Cube Test Data.

A substantial 87% of respondents express concern about retrieving pending data in concrete records—62% strongly agree, 25% agree. The 13% neutral response suggests a smaller portion with potentially limited awareness. Addressing this issue is vital for data completeness, emphasizing the need for targeted improvements in data retrieval processes.

Figure 4.8: Issue on Time Management on Compiling Data

Significant concern over data compilation management is evident, with 63% in agreement and a notable 37% strongly agreeing. This emphasizes the critical need for improvements in data compilation practices. Addressing these concerns will likely enhance overall efficiency and data integrity in the management process.

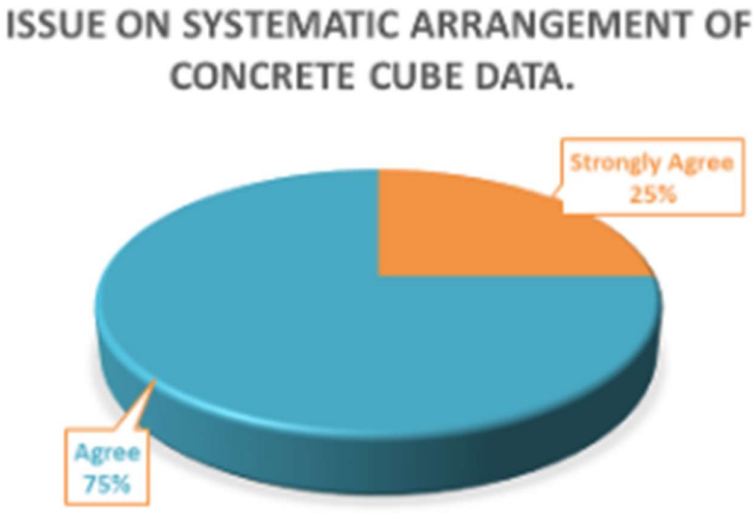


Figure 4.9: Issue on Systematic Arrangement of Concrete Cube Data

A substantial 75% agreement, with 25% strongly agreeing, indicates a consensus on the issue of systematic arrangement in concrete cube data. This emphasizes a shared recognition of the problem, necessitating focused efforts to enhance the organization and structure of concrete cube-related information for improved efficiency and clarity.

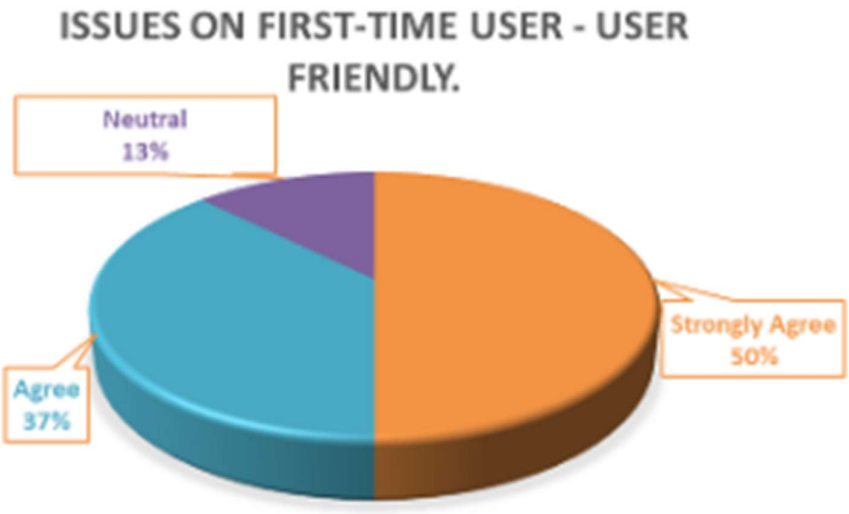


Figure 4.10: Issue on First-Time User- User Friendly

Finally, A consensus emerges on the user-friendliness of the system, with 50% strongly agreeing, 37% agreeing, and 13% neutral. While the majority recognizes a positive experience, addressing neutral responses is crucial for a universally user-friendly platform. Striving for continuous improvements based on user feedback is essential for enhanced user satisfaction.

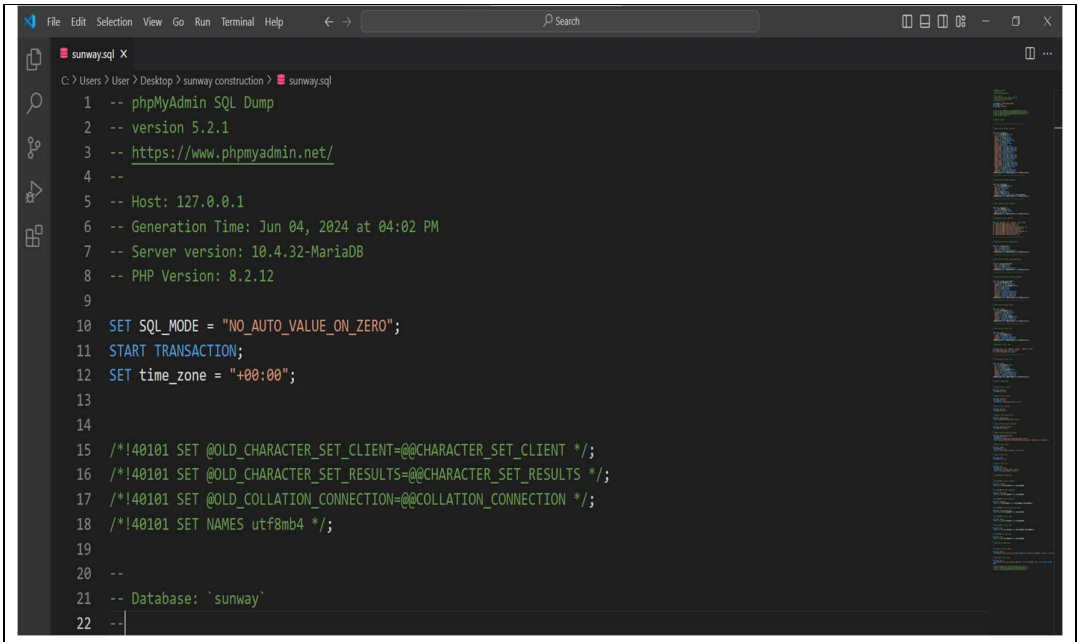
4.3 OUTCOME OF PLATFORM DESIGN

The CCT Data Management System prototype stage in the design thinking process marks the transformation of conceptual ideas into tangible representations. Designers and developers build a scaled-down version of the system during this critical stage, incorporating key features identified in the Ideate stage. The prototype is a visual and functional model that provides stakeholders with hands-on experience with the envisioned CCT Data Management

System.

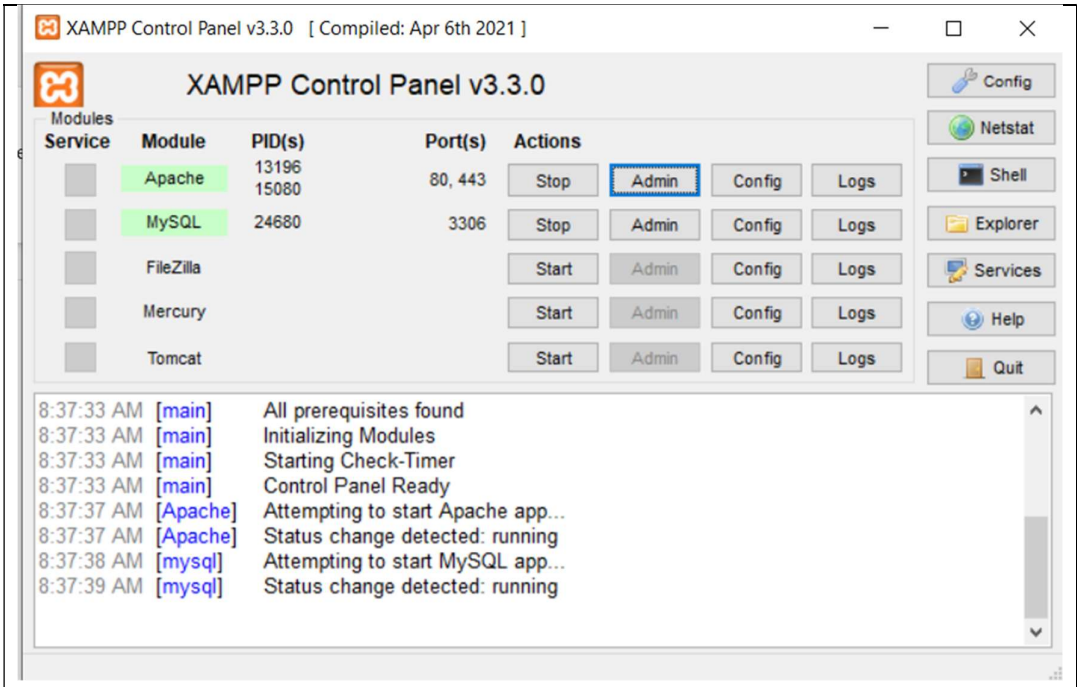
This iterative process allows for rapid testing and refinement, as well as valuable feedback from end-users and industry professionals. Interacting with the prototype allows stakeholders to assess the system's usability, identify potential issues, and suggest improvements. This stage not only refines the user interface but also ensures that the CCT Data Management System integrates seamlessly with the workflow of construction professionals. The prototype stage is critical in mitigating risks, validating design choices, and shaping the final product before full-scale development, ensuring the ultimate success and adoption of the CCT Data Management System in the construction industry.

Table 4.2: Prototype of CCT-Data System

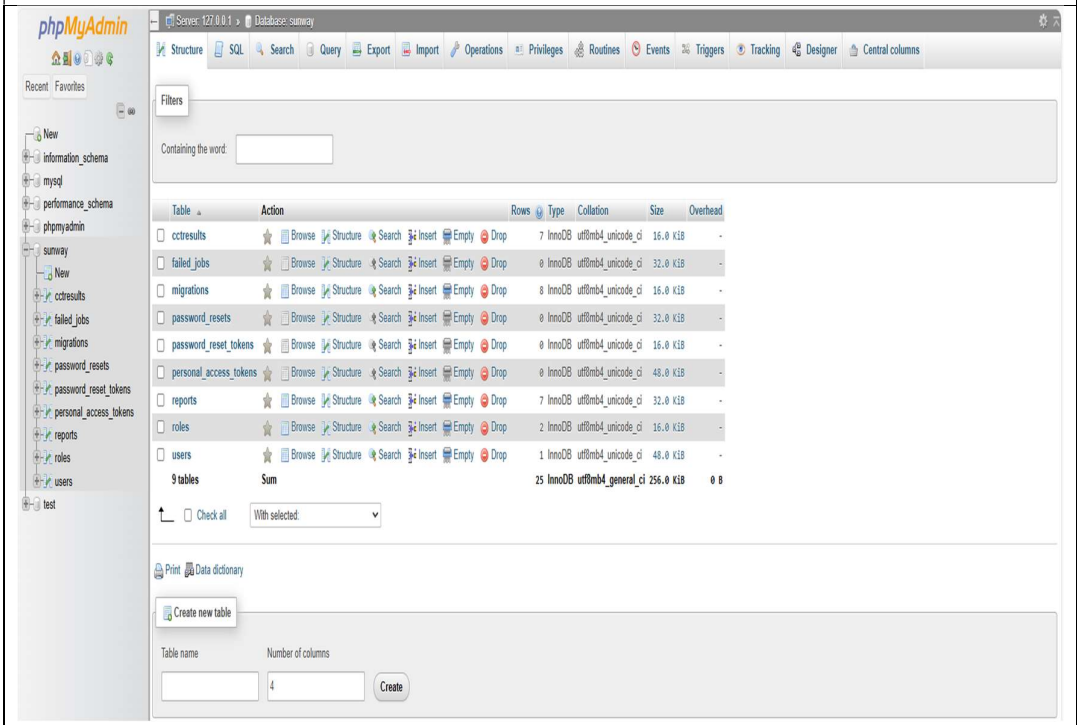


Step 1: Open to Create Database at Visual Studio Code. Start the PHP SQL server by running the command.

Table 4.2: Prototype of CCT-Data System (Continued…)



Step 2: To run by using localhost in website platform.



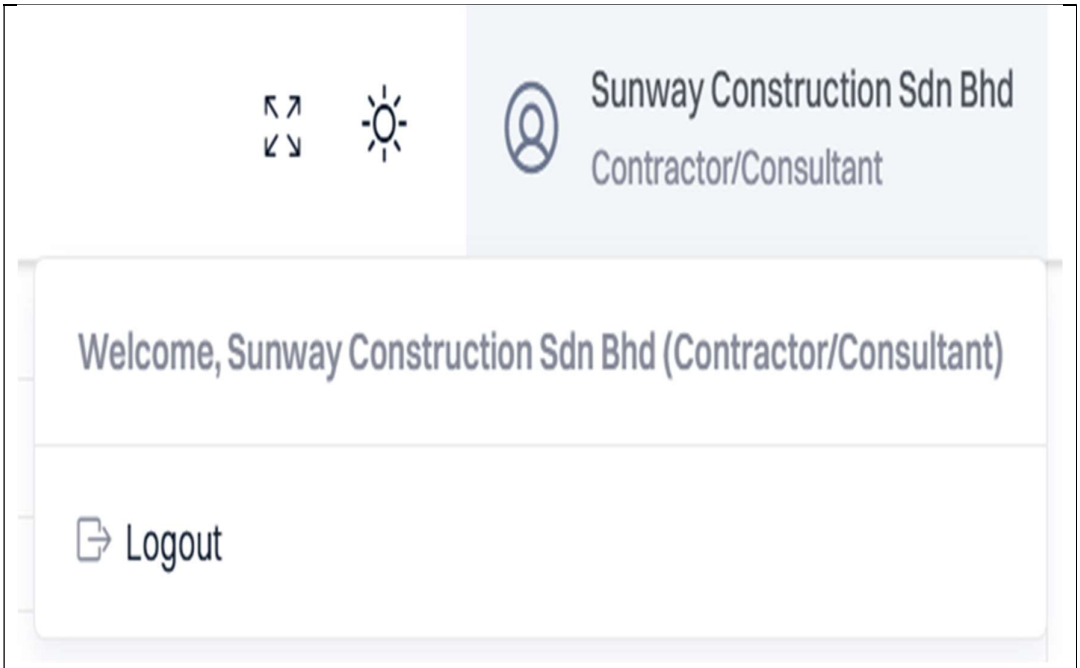
Step 3: Open PHPMyAdmin to Run the system on Localhost to access the CCT Data Management Platform.

Table 4.2: Prototype of CCT-Data System (Continued…)

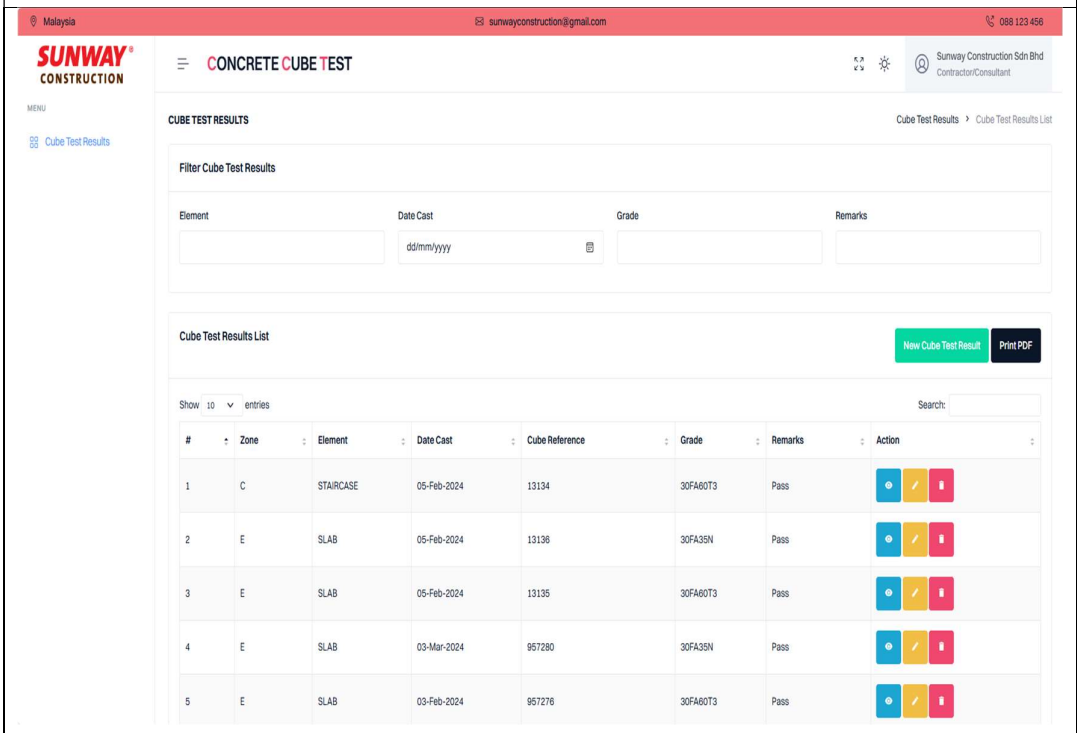
Step 4: Create a Project: Open a terminal or command prompt and navigate to the PHP installation directory.

Step 5: Design the page layout of the CCT Data Management System for system login.

Table 4.2: Prototype of CCT-Data System (Continued…)

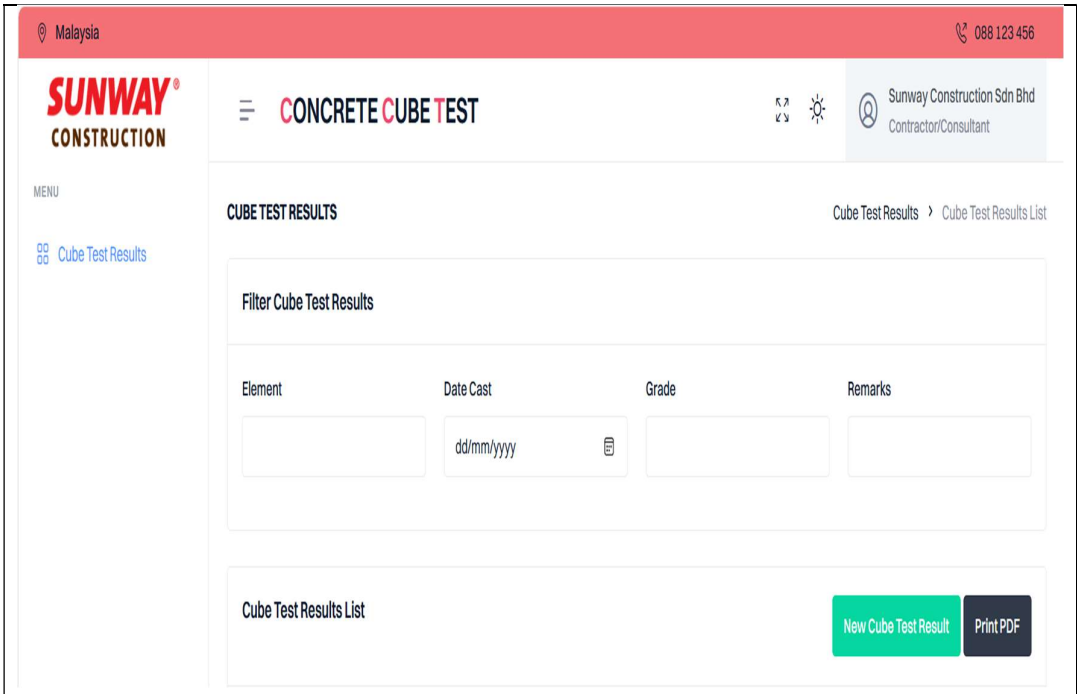


Step 6: This is the feature for Contractor and Consultant user. From Login, Logout button also provided to user after complete using the platform.

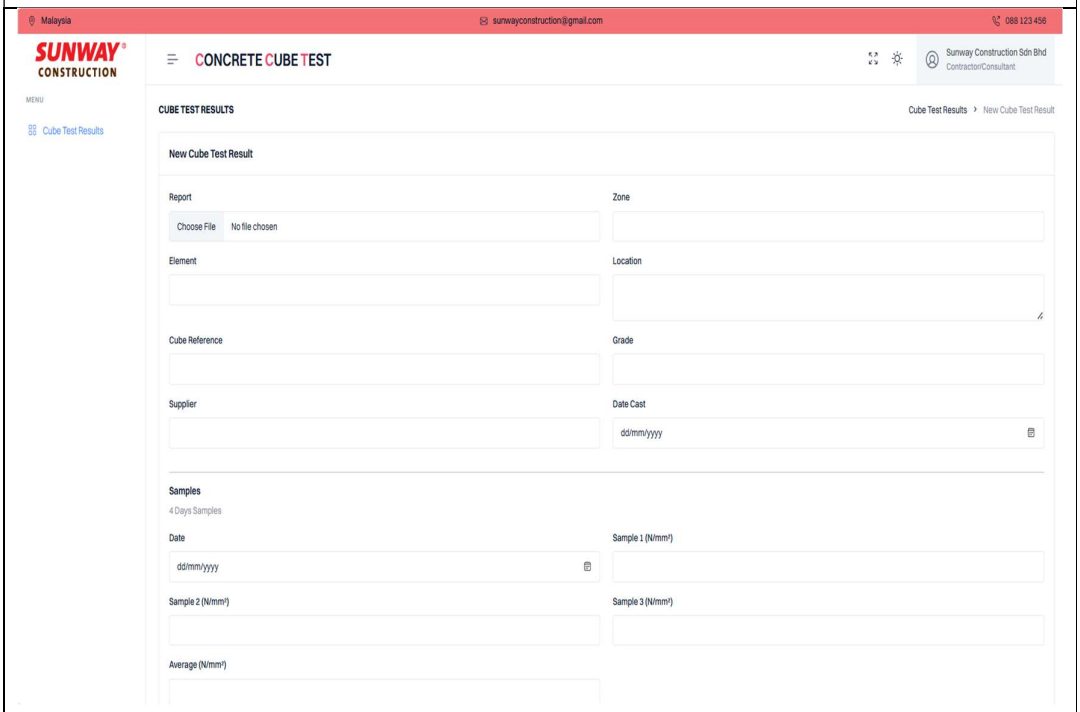


Step 7: Design the page layout of the CCT Data Management System for the system to differentiate the contractor and consultant use.

Table 4.2: Prototype of CCT-Data System (Continued…)

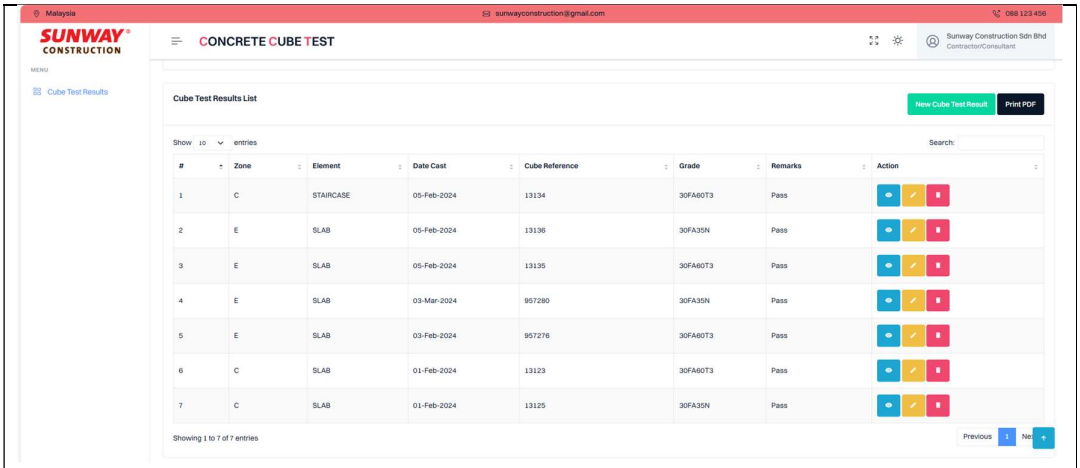


Step 8: User can add new cube test by clicking the green button of "New Cube Test Result" and generate PDF by clicking "Print PDF"

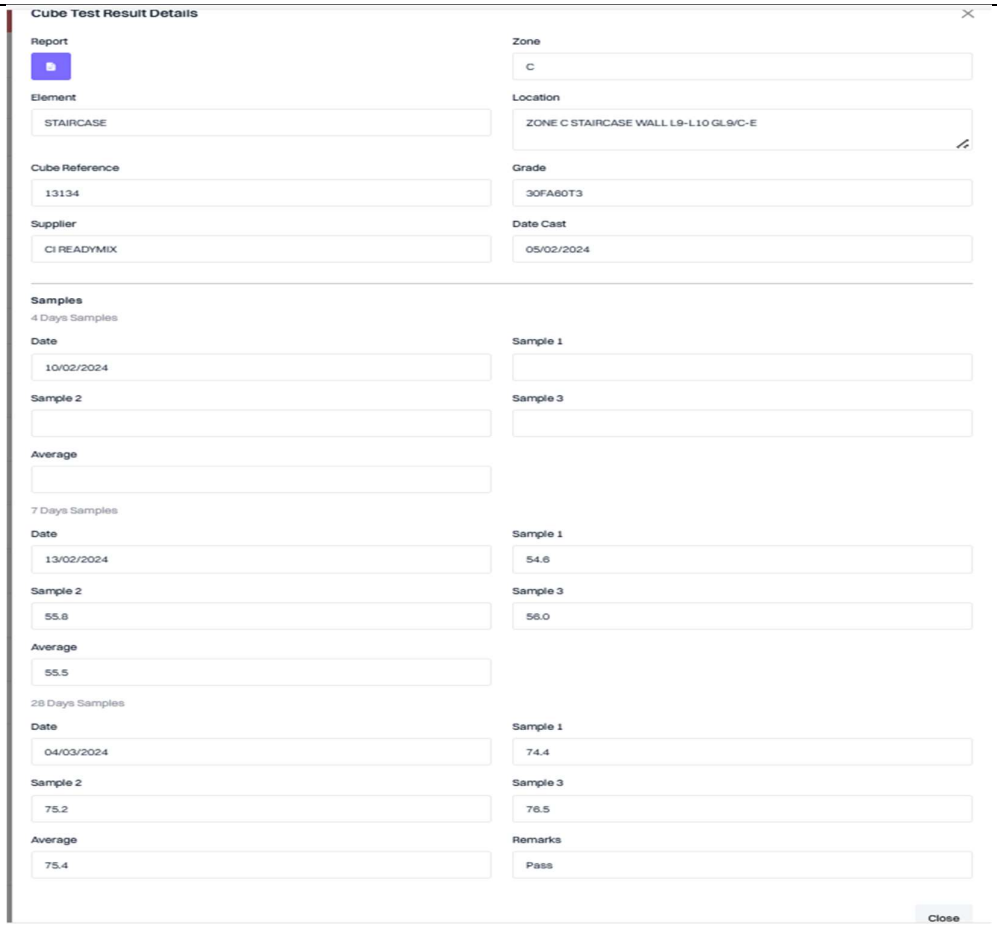


Step 8: Design the page layout of the CCT Data Management System for the page for key-in data for the cube test result, laboratory official report PDF, and Summary.

Table 4.2: Prototype of CCT-Data System (Continued…)

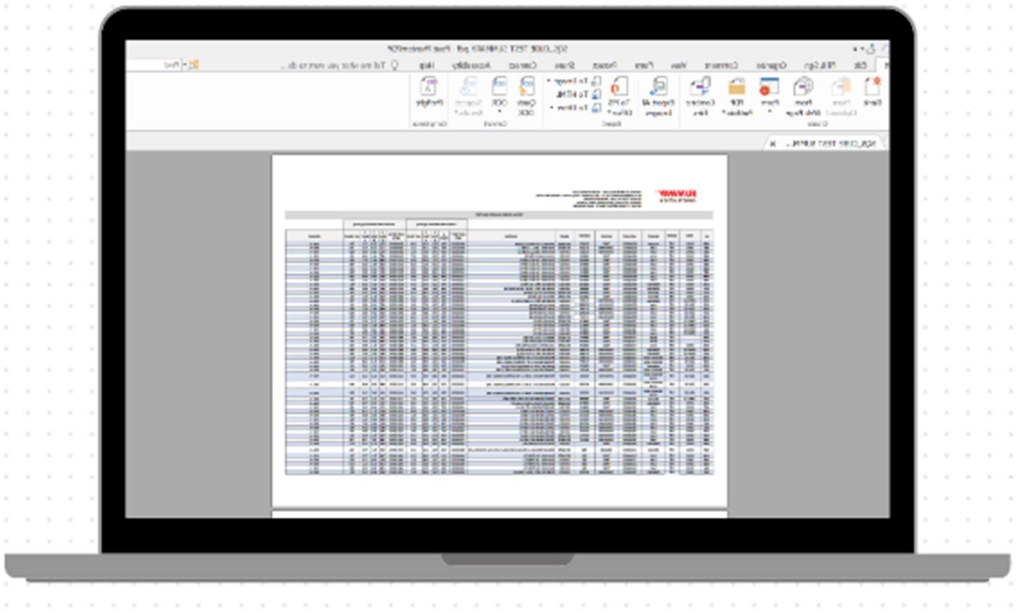


Step 9: Design the element needed for compiling data for cube test results according to the data sheets such as location, concrete grade, results for 7 days and 28 days, and reference number.

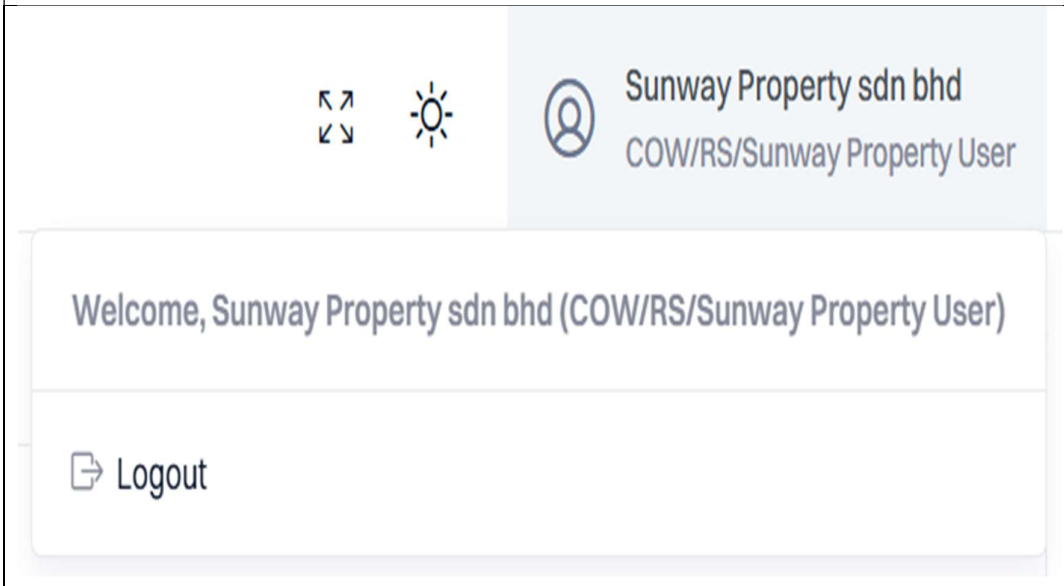


Step 10: This is the data collecting system that has been used on collecting cube test data.

Table 4.2: Prototype of CCT-Data System (Continued…)

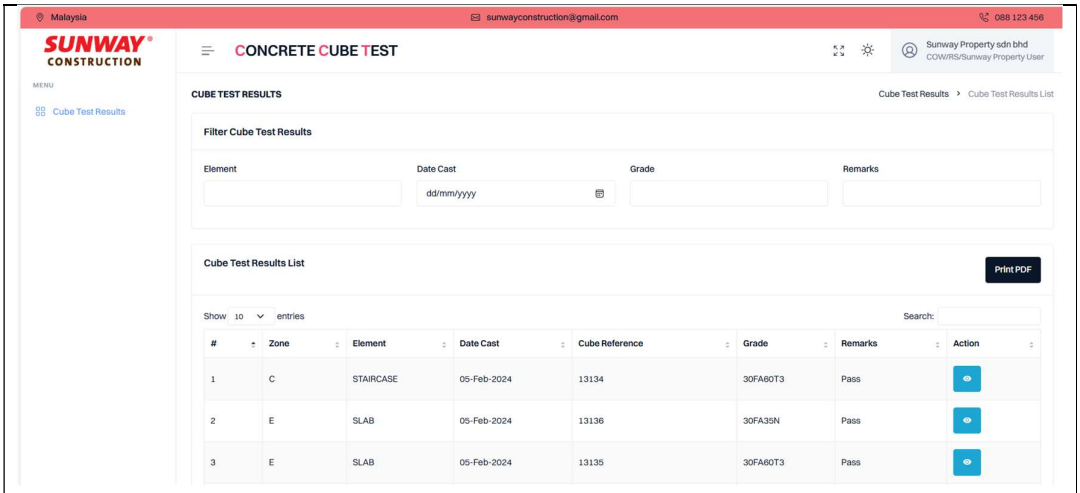


Step 11: Design the page layout of the CCT Data Management System for the PDF section of the cube test data result and official lab reports

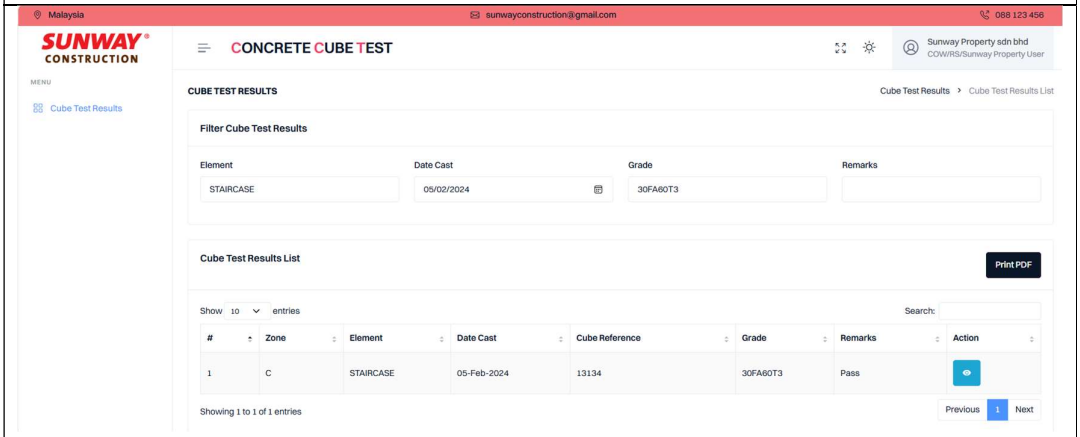


Step 12: This is the feature for COW/RS/Sunway Property user. From Login, Logout button also provided to user after complete using the platform.

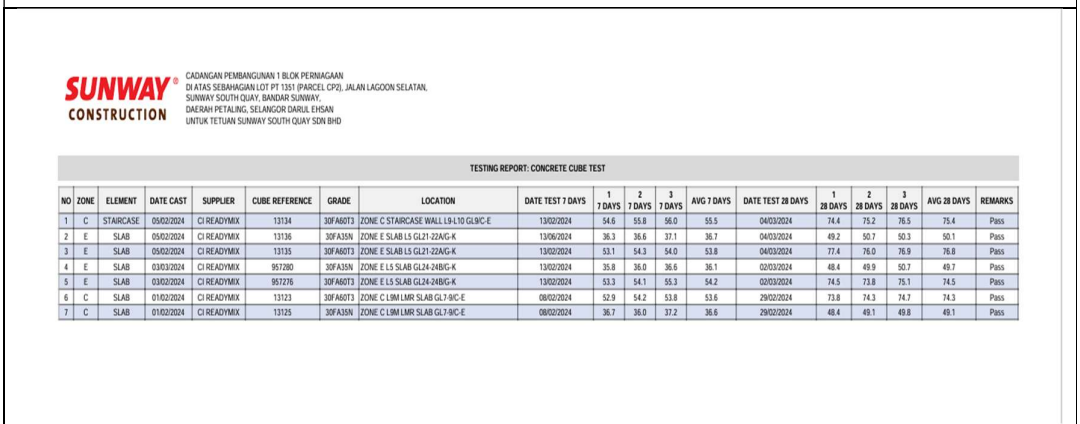
Table 4.2: Prototype of CCT-Data System (Continued…)



Step 13: In this feature COW/RS/Sunway Property user only can access the result data to view and aprint PDF.



Step 14: From Filter Cube Test Results can be filtered from Element, Date Cast, Grade and Remarks.



SUNWAY CONSTRUCTION

CADANGAN PEMBANGUNAN 1 BLOK PERNIAGAAN
DI ATAS SEBAHAGIAN LOT PT 1351 (PARCEL CP2), JALAN LAGOON SELATAN,
SUNWAY SOUTH QUAY, BANDAR SUNWAY,
DAERAH PETALING, SELANGOR DARUL EHSAN
UNTUK TETUAN SUNWAY SOUTH QUAY SDN BHD

TESTING REPORT: CONCRETE CUBE TEST

NO	ZONE	ELEMENT	DATE CAST	SUPPLIER	CUBE REFERENCE	GRADE	LOCATION	DATE TEST 7 DAYS	1 7 DAYS	2 7 DAYS	3 7 DAYS	AVG 7 DAYS	DATE TEST 28 DAYS	1 28 DAYS	2 28 DAYS	3 28 DAYS	AVG 28 DAYS	REMARKS
1	C	STAIRCASE	05/02/2024	CI READYMIX	13134	30FA60T3	ZONE C STAIRCASE WALL L9-L10 GL9/C-E	13/02/2024	54.6	55.8	56.0	55.5	04/03/2024	74.4	75.2	76.5	75.4	Pass
2	E	SLAB	05/02/2024	CI READYMIX	13136	30FA35N	ZONE E SLAB L5 GL21-22A/G-K	13/06/2024	36.3	36.6	37.1	36.7	04/03/2024	49.2	50.7	50.3	50.1	Pass
3	E	SLAB	05/02/2024	CI READYMIX	13135	30FA60T3	ZONE E SLAB L5 GL21-22A/G-K	13/02/2024	53.1	54.3	54.0	53.8	04/03/2024	77.4	76.0	76.9	76.8	Pass
4	E	SLAB	03/03/2024	CI READYMIX	957280	30FA35N	ZONE E L5 SLAB GL24-24B/G-K	13/02/2024	35.8	36.0	36.6	36.1	02/03/2024	48.4	49.9	50.7	49.7	Pass
5	E	SLAB	03/02/2024	CI READYMIX	957276	30FA60T3	ZONE E L5 SLAB GL24-24B/G-K	13/02/2024	53.3	54.1	55.3	54.2	02/03/2024	74.5	73.8	75.1	74.5	Pass
6	C	SLAB	01/02/2024	CI READYMIX	13123	30FA60T3	ZONE C L9M LMR SLAB GL7-9/C-E	08/02/2024	52.9	54.2	53.8	53.6	29/02/2024	73.8	74.3	74.7	74.3	Pass
7	C	SLAB	01/02/2024	CI READYMIX	13125	30FA35N	ZONE C L9M LMR SLAB GL7-9/C-E	08/02/2024	36.7	36.0	37.2	36.6	29/02/2024	48.4	49.1	49.8	49.1	Pass

Step 15: After button Print PDF clicked, the full summary will appear as a PDF and can be downloaded through the web.

4.4 DEVELOPMENT OF THE APPLICATION

The development of the CCT Data Management System involved a systematic approach aimed at addressing the unique data management challenges prevalent in the construction industry. Beginning with comprehensive research and analysis, the development team identified key requirements and user needs to inform the platform's design. Leveraging cutting-edge technologies and best practices, the development process encompassed backend infrastructure setup, frontend interface design, and integration with existing construction workflows. Agile methodologies were employed to iteratively build and refine the application, allowing for flexibility and responsiveness to evolving requirements. Rigorous testing procedures were implemented to ensure reliability, security, and performance. Throughout the development phase, close collaboration with industry stakeholders facilitated continuous feedback and validation, guiding the refinement of features and functionalities. The result is a robust and user-friendly application that streamlines data management processes, enhances collaboration, and drives efficiency within the construction industry.

4.5 TEST RUN

The Test stage in the design thinking process for the Concrete Cube Test Data Management System (CCT Data Management System) is a collaborative effort involving key experts in the construction industry. Engineers, quality assurance professionals, subcontractors, and laboratory experts play a crucial role in rigorously evaluating the prototype. During this stage, the focus is on conducting thorough tests to ensure the CCT Data Management System meets industry standards, adheres to quality control requirements, and seamlessly integrates into existing workflows. In doing a test run, experts are needed to conduct a test run for validation, the experts are from QAQC teams, subcontractors, Respected Engineers, consultants, and the laboratory. On doing a test run Experts need to be hands-on using the CCT Data Management System and give feedback via survey distributed.

Engineers assess the system's structural integrity and compatibility with

diverse construction environments. Quality assurance specialists scrutinize the data accuracy and reliability, emphasizing the system's ability to enhance concrete cube testing outcomes. Subcontractors evaluate the practicality and user-friendliness of the CCT Data Management System within their project contexts, while laboratory experts validate the scientific aspects of data collection and analysis.

Through collaborative testing, this stage provides invaluable insights into the system's real-world functionality, allowing for fine-tuning based on expert feedback. The involvement of diverse industry experts ensures the CCT Data Management System is robust, effective, and aligned with the nuanced requirements of construction professionals.

4.6 OUTCOME OF EXPERT VALIDATION

Table 4.3 shows the respondent demographic from a questionnaire that has been distributed to expected users.

Table 4.3: Respondents Demographic

Gender	Male	Female		
	6	2		
Age	<25	26-35	36-45	>46
	1	4	2	1
Contractor	Engineer	Sub-Contractor	Consultant	Supplier
	3	3	1	1
Work Experience	<2 years	2-5 Years	6-10 Years	>10 Years
	1	2	1	4

This demographic profile provides valuable insights into the professional backgrounds and experience levels of the respondents, highlighting a predominantly male and highly experienced sample, primarily composed of contractors and engineers within the 26-35 age range. This sample is collected with the same respondent on the

first Pre-project survey distributed. The majority of respondents were male, making up 75% of the sample, while females comprised 25%. The age group 26-35 years was the largest, representing 50% of the respondents. The age groups < 25 years and > 46 years each had 12.5% representation, while the 36-45 years group constituted 25%. Contractors and engineers were equally represented, each constituting 37.5% of the respondents. Sub-contractors and consultants made up 12.5% each. Respondents with more than 10 years of experience were the most represented, making up 50% of the sample. Those with 2-5 years of experience represented 25%, while both the < 2 years and 6-10 years groups each constituted 12.5%. This demographic profile provides a broad overview of the respondents, highlighting a predominance of experienced professionals, particularly contractors and engineers within the 26-35 age range, and a majority male representation.

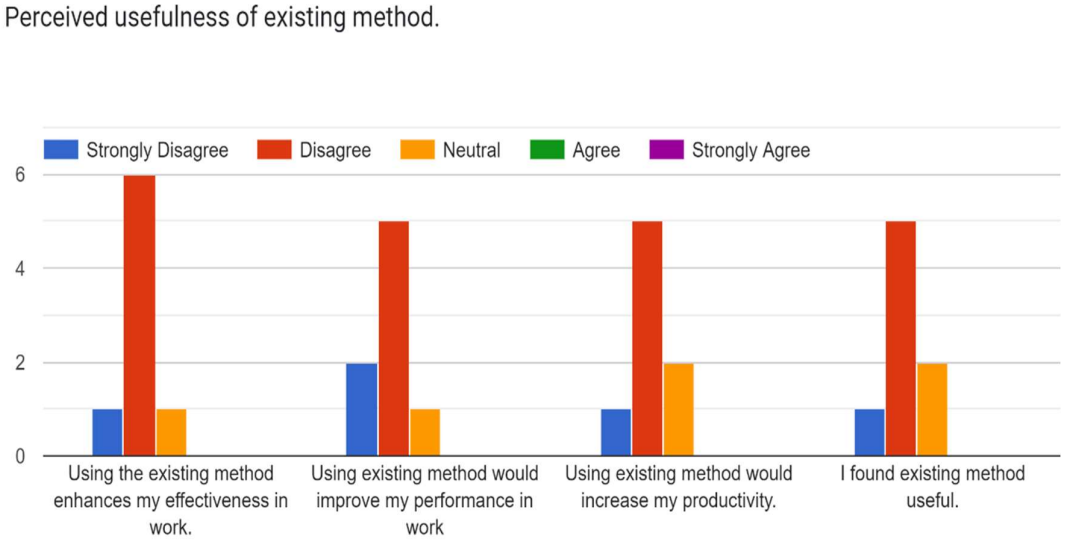


Figure 4.11: Perceived Usefulness of Existing Method.

The graph represents respondents' perceptions of the usefulness of the existing method for Concrete Cube Test (CCT) data management at the site. The responses are categorized into five levels: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. A significant majority of respondents (75%) disagreed that the existing method enhances their effectiveness in work, indicating dissatisfaction with the current system. Similarly, most respondents (62.5%) disagreed that the existing method improves their performance, suggesting a need for improvement in the data management process. The perception of productivity increase follows the same trend, with 75% of respondents disagreeing that the existing method enhances productivity. The overall usefulness of the existing method was rated poorly, with 75% of respondents disagreeing and only

12.5% remaining neutral. The overall sentiment from the respondents indicates a strong dissatisfaction with the current CCT data management system. The majority perceive the existing method as ineffective in enhancing their work effectiveness, improving performance, and increasing productivity. This feedback suggests a crucial need for the development and implementation of a more efficient data management system to address these concerns.

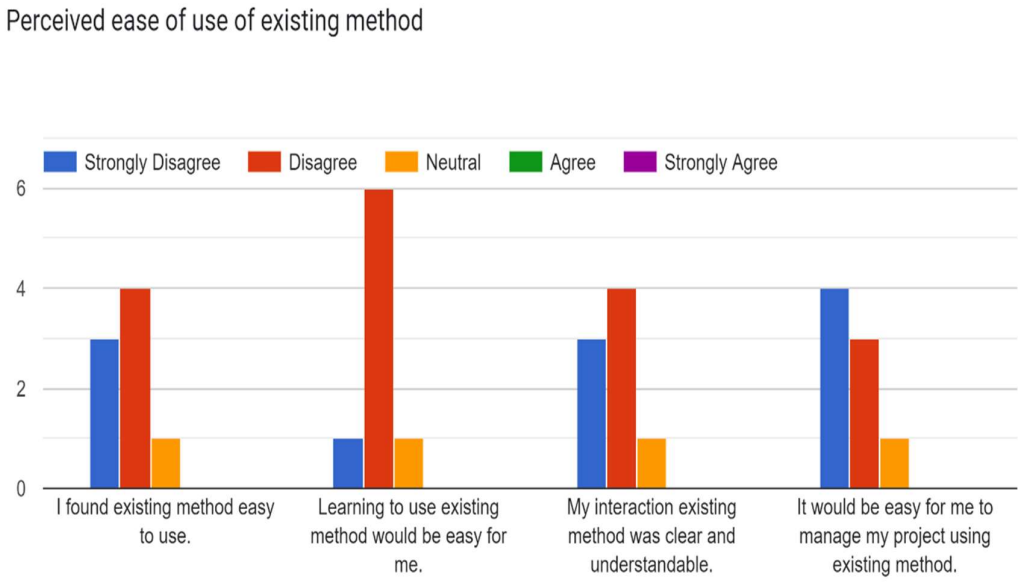


Figure 4.12: Perceived Ease of Use of Existing Method.

The graph illustrates respondents' perceptions of the ease of use of the existing method for Concrete Cube Test (CCT) data management at the site. The responses are categorized into five levels: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. A majority of respondents (50%) disagreed that they found the existing method easy to use, while 25% strongly disagreed, indicating significant challenges with the user-friendliness of the current system. Enhancing the interface to be more intuitive and user-friendly.The majority of respondents (75%) disagreed that learning to use the existing method would be easy for them, suggesting difficulties in understanding and adopting the current system. Providing comprehensive training and support to facilitate easier learning and adoption of the system. Similarly, 50% of respondents disagreed that their interaction with the existing method was clear and understandable, while 25% strongly disagreed, indicating confusion and lack of clarity in the system's interaction design. Regarding ease of managing projects using the existing method, 37.5% of respondents disagreed, and 25% strongly disagreed. However, 12.5%

strongly agreed that it would be easy for them to manage their projects using the current system, showing a slight variation in this perception. Customizing features to better meet the needs of project management, ensuring that users can efficiently manage their projects. These improvements will likely lead to increased satisfaction, productivity, and effectiveness in using the CCT data management system at the site.

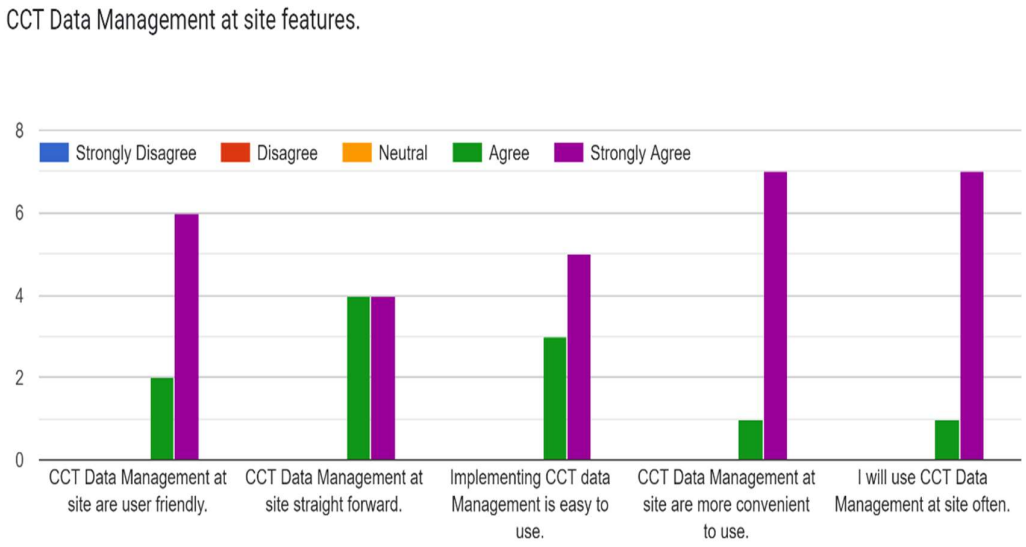


Figure 4.13: CCT Data Management at Site Features.

i. CCT Data Management at the site is user-friendly

The data portrays a highly positive consensus regarding the CCT Data Management platform's user-friendliness. The results indicate a strong consensus, with 100% of respondents either agreeing or strongly agreeing. The overwhelmingly positive feedback underscores the platform's intuitive design and ease of use. Agree: 2 participants (20%) and Strongly Agree: 6 participants (80%)

ii. CCT Data Management at the site is straightforward:

Here, Agree: 4 participants (50%) while, Strongly Agree: 4 participants (50%),.100% of participants agree or strongly agree that the platform is straightforward, indicating clear and simple functionality. The responses suggest the platform is generally seen as easy to navigate and understand.

iii. Implementing CCT Data Management is easy to use:

All respondents find the implementation easy, with 100% in agreement or strong agreement. Agree: 3 participants (30%) and Strongly Agree: 5 participants (70%) This unanimous positive response suggests that users find the initial setup and ongoing use of the platform to be straightforward and manageable, facilitating quick adoption.

iv. CCT Data Management at the site is more convenient to use:

The platform's convenience is highly rated, with 90% of participants agreeing or strongly agreeing. Agree: 1 participant (10%) and Strongly Agree: 7 participants (90%)This high percentage of positive feedback underscores the platform's efficiency and user-centered design.

v. I will use CCT Data Management at the site often:

A strong majority (100%) intend to use the platform frequently, with 90% strongly agreeing and 10% agreeing. This indicates high user satisfaction and commitment to integrating the platform into their regular workflow. The 10% who disagree reflect a minor hesitation or alternative preferences.

The analysis reveals an overwhelmingly positive perception of the CCT Data Management platform's features among users. The majority find it user-friendly, straightforward, easy to implement, convenient, and plan to use it regularly. The percentages (90-100% in agreement) highlight strong approval and satisfaction. The platform is well-regarded and likely to be adopted widely, enhancing site management efficiency and effectiveness.

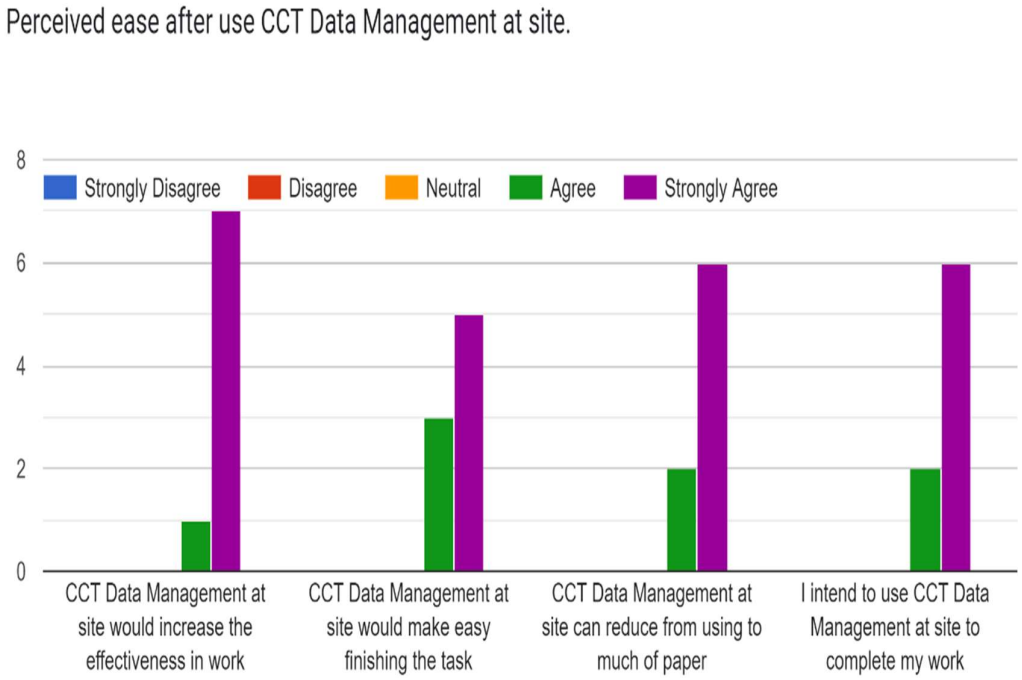


Figure 4.14: Perceived Ease After Use CCT Data Management at Site.

i. CCT Data Management at site would increase the effectiveness in work:

The majority opinion strongly favors the implementation of the CCT Data Management platform to enhance work effectiveness. Out of the responses, 7 participants strongly agree, and 1 agrees, indicating a significant confidence in the platform's ability to improve efficiency. Only one participant strongly disagrees, reflecting minimal resistance or dissatisfaction. This suggests that the platform is widely perceived as a valuable tool for increasing productivity and efficiency on-site.

ii. CCT Data Management at site would make it easy to finish tasks:

The responses to this statement are more mixed compared to the first. While 4 participants strongly agree and 3 agree that the platform facilitates easier task completion, a noticeable neutral stance is evident with 2 participants. This neutrality might indicate some uncertainty or varied experiences among users. However, the overall perception remains positive, with a majority leaning towards agreement that the CCT Data Management platform simplifies task execution.

iii. CCT Data Management at site can reduce the use of too much paper:

This statement received strong support, with 7 participants strongly agreeing and 3 agreeing that the platform reduces paper usage. This overwhelming positive response underscores the platform's effectiveness in digitizing processes, thus minimizing reliance on paper. The high agreement rate indicates a clear recognition of the platform's environmental and efficiency benefits, aligning with modern sustainable practices and reducing the administrative burden associated with physical records.

iv. I intend to use CCT Data Management at site to complete my work:

Similarly to the third statement, the intention to use the platform is strongly positive, with 7 participants strongly agreeing and 3 agreeing. This response highlights a high level of acceptance and willingness to adopt the CCT Data Management platform for routine operations. The consistency in positive responses across these statements reflects the users' confidence in the platform's utility and their readiness to integrate it into their workflows.

Overall, the analysis of the responses indicates a strong positive reception towards the CCT Data Management platform. Users predominantly believe that it enhances work effectiveness, simplifies task completion, and significantly reduces paper usage. The high intention to adopt the platform in daily operations further emphasizes its perceived value and practical benefits. While there is a small degree of neutrality and disagreement, the overarching sentiment is favorable, suggesting that the platform is well-regarded and likely to be successfully integrated into construction site operations. This positive feedback supports the platform's continued use and potential expansion to further streamline and improve data management practices in the construction industry.

4.7 OUTCOME OF IMPROVISION

The outcome of the improvisation in developing the Concrete Cube Test (CCT) Data Management platform has been truly transformative, reflecting a dedication to enhancing user experience and functionality. One of the most noticeable improvements has been the revamping of the platform's design, making it more intuitive and user-friendly. By prioritizing user feedback and streamlining the interface, navigating through the system has become a smoother and more enjoyable experience for all users involved.

Another significant enhancement lies in the flexibility of the button features. Through meticulous adjustments and refinements, the buttons now offer users a more versatile and adaptable interaction. Whether it's customizing settings or accessing specific functionalities, users can now tailor their experience to better suit their individual needs, ultimately empowering them with greater control and efficiency.

Moreover, a concerted effort has been made to reduce errors and address any lingering bugs within the platform. By conducting thorough testing and implementing rigorous quality assurance measures, the team has been successful in minimizing disruptions and ensuring a seamless user experience. As a result, users can now engage with the CCT Data Management platform with confidence, knowing that issues are promptly identified and resolved, allowing for uninterrupted workflow and data management.

Overall, the outcome of the improvisation process reflects a commitment to continuous improvement and innovation. By humanizing the development process and placing the user at the forefront of decision-making, the CCT Data Management platform has evolved into a highly functional and user-centric tool. With a more intuitive design, flexible button features, and improved error handling, the platform not only meets but exceeds user expectations, paving the way for more efficient and effective concrete cube testing and data management.

CHAPTER 5

CONCLUSION, DISCUSSION & SUGGESTION

5.1 INTRODUCTION

The study aimed to address the common issue of insufficient planning in pre-commissioning projects by developing a Concrete Cube Test (CCT) data management platform. In the development of a Concrete Cube Test (CCT) data management platform for on-site use, the conclusion, discussion, and suggestions collectively provide a comprehensive overview of the project's outcomes, the challenges encountered, and potential improvements. The conclusion underscores the platform's role in enhancing data accuracy, accessibility, and operational efficiency in managing concrete test results. The discussion delves into critical aspects such as user interface design, secure data storage, real-time analytics, and the necessity for scalability and user training. To further refine the platform, suggestions include integrating advanced analytics and machine learning for predictive insights, developing a mobile application for better accessibility, and continuously gathering user feedback for iterative enhancements. These elements together highlight the platform's current achievements and pathways for future advancements, ensuring its ongoing relevance and effectiveness in the construction industry.

5.2 DISCUSSION

In developing the CCT Data Management platform, a key focus has been on specialization for on-site data management, specifically tailored to the unique requirements of documenting concrete cube test results. This specialization ensures that the platform is equipped with features and functionalities that cater to the needs of users collecting data in real-time at construction sites. By understanding the context in which the data is collected and documenting the concrete cube test results, developers can design the platform to streamline the data management process, improving efficiency and accuracy.

One of the primary challenges addressed by the CCT Data Management Platform is the retrieval of concrete cube test results, especially in cases where data may be missing or incomplete. By incorporating advanced retrieval mechanisms, such as robust search functionalities and automated alerts for missing data points, the platform empowers users to retrieve and reconcile data efficiently. This capability not only ensures the integrity of the data but also saves valuable time and resources by simplifying the data retrieval process.

Through continuous validation and improvisation based on feedback from expected users, the CCT Data Management platform has successfully evolved into a comprehensive solution for cube test data management. By soliciting input from site engineers, project managers, and quality control professionals, developers have been able to refine the platform to meet the diverse needs and expectations of its intended users. As a result, the platform is not only specialized for concrete data documentation but also adaptable for addressing broader data management needs within the construction industry, ensuring its relevance and effectiveness across various contexts.

5.3 SUGGESTIONS AND RECOMMENDATIONS

Suggestions for Developing the CCT Data Management Platform:

1. Specialization for Site Data Management:

Given the specific nature of concrete cube testing and data collection at construction sites, it's crucial to ensure that the CCT Data Management platform is specialized for this purpose. Developers should focus on designing features and functionalities that cater specifically to the needs and requirements of site-based data management, including real-time data entry, on-site accessibility, and seamless integration with existing workflows.

2. Enhanced Data Retrieval Capabilities:

To address the challenge of missing or incomplete data, developers should prioritize the development of robust data retrieval mechanisms within the platform. This could include advanced search functionalities, data validation checks, and automated alerts for missing data points. By empowering users to retrieve and reconcile data efficiently, the platform can ensure the integrity and accuracy of the data collected.

3. Systematic Documentation of Concrete Data:

The CCT Data Management platform should offer comprehensive tools and templates for documenting concrete cube test results effectively. This includes standardized data entry forms, customizable data fields, and intuitive interfaces for inputting and organizing test data. Additionally, the platform should support the generation of detailed reports and summaries, facilitating easy communication and analysis of test results.

4. Continuous Validation and Improvement:

Throughout the development process, it's essential to prioritize validation and feedback from expected users, including site engineers, project managers, and quality control professionals. By soliciting input from these stakeholders and incorporating their suggestions into the platform's design, developers can ensure that the CCT Data Management platform meets the evolving needs and expectations of its intended users.

5. Adaptability for Diverse Data Management Needs:

While the primary focus of the CCT Data Management platform may be on concrete cube test data management, developers should also consider its potential for addressing broader data management needs within the construction industry. This could involve designing the platform with scalability and flexibility in mind, allowing it to accommodate a wide range of data types, formats, and workflows beyond concrete testing.

In summary, by developing the CCT Data Management platform with a focus on specialization, enhanced data retrieval capabilities, systematic documentation, continuous validation, and adaptability, developers can ensure that the platform effectively meets the diverse data management needs of construction sites. By leveraging feedback and input from expected users throughout the development process, the platform can evolve into a valuable tool for managing all aspects of cube test data efficiently and effectively.

5.4 CONCLUSION

In conclusion, the development of the CCT Data Management platform represents a significant milestone in streamlining and optimizing the process of managing concrete cube test data at construction sites. Designed specifically for the documentation and organization of concrete cube test results, this platform serves as a tailored solution to the unique challenges and requirements associated with data management in this context.

By focusing on the specific needs of users involved in concrete cube testing, the CCT Data Management platform offers a specialized and intuitive system for documenting and retrieving test results. Through close collaboration and validation with expected users, the platform has undergone rigorous testing and refinement to ensure its effectiveness and usability in real-world scenarios.

One of the key strengths of the CCT Data Management platform lies in its ability to retrieve concrete cube test results efficiently, even in cases where data may be missing or incomplete. This functionality not only enhances the reliability and

accuracy of the data but also saves users valuable time and resources by simplifying the process of data retrieval and analysis.

Moreover, by incorporating user feedback and continuously improvising based on user needs, the platform has evolved into a robust and reliable tool for concrete data documentation. Whether it's documenting test results, tracking project progress, or generating reports, the CCT Data Management platform offers a comprehensive solution that meets the diverse needs of users involved in concrete cube testing.

In conclusion, the CCT Data Management platform represents a successful collaboration between developers and users to create a specialized and effective solution for managing concrete cube test data. With its user-centric design, robust functionality, and continuous refinement, this platform is poised to make a significant impact on the efficiency and accuracy of concrete testing and data management processes at construction sites.

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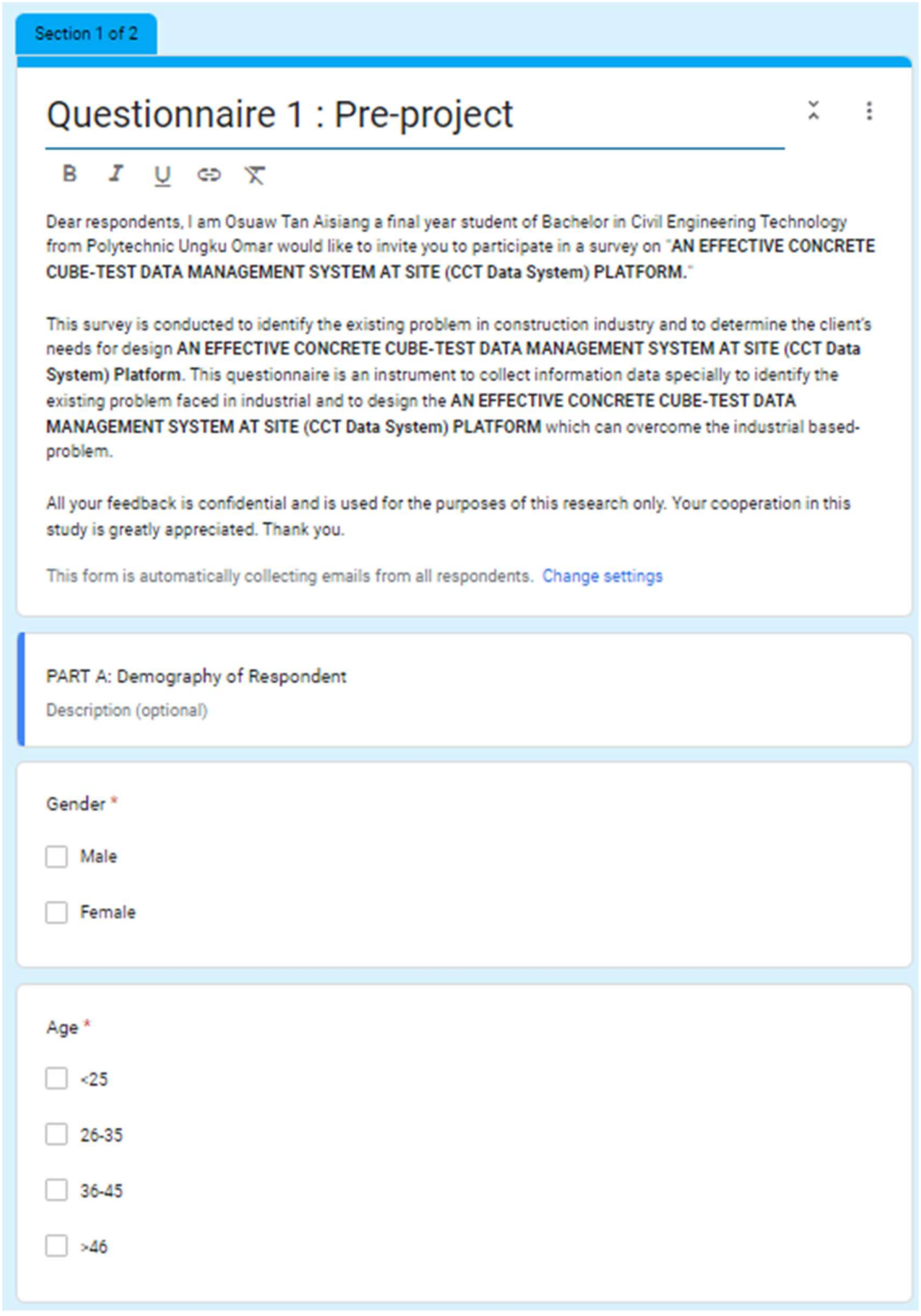
APPENDIX

APPENDIX A	**Questionnaire 1: Pre-Project**
APPENDIX B	**Questionnaire 2 : Feedback of Concrete Cube Test (CCT) Data Management at Site**
APPENDIX C	**View of Database**
APPENDIX D	**The Gantt chart of the development progress from semester 7 to semester 8**

APPENDIX A

Questionnaire 1: Pre-Project



Section 1 of 2

Questionnaire 1 : Pre-project

Dear respondents, I am Osuaw Tan Aisiang a final year student of Bachelor in Civil Engineering Technology from Polytechnic Ungku Omar would like to invite you to participate in a survey on "**AN EFFECTIVE CONCRETE CUBE-TEST DATA MANAGEMENT SYSTEM AT SITE (CCT Data System) PLATFORM.**"

This survey is conducted to identify the existing problem in construction industry and to determine the client's needs for design **AN EFFECTIVE CONCRETE CUBE-TEST DATA MANAGEMENT SYSTEM AT SITE (CCT Data System) Platform**. This questionnaire is an instrument to collect information data specially to identify the existing problem faced in industrial and to design the **AN EFFECTIVE CONCRETE CUBE-TEST DATA MANAGEMENT SYSTEM AT SITE (CCT Data System) PLATFORM** which can overcome the industrial based-problem.

All your feedback is confidential and is used for the purposes of this research only. Your cooperation in this study is greatly appreciated. Thank you.

This form is automatically collecting emails from all respondents. Change settings

PART A: Demography of Respondent

Description (optional)

Gender *

- [ ] Male
- [ ] Female

Age *

- [ ] <25
- [ ] 26-35
- [ ] 36-45
- [ ] >46

Designation *

- [ ] Engineer
- [ ] Sub-Contractor
- [ ] Consultant
- [ ] Supplier
- [ ] Other...

Work Experience *

- [ ] <2 years
- [ ] 2-5 years
- [ ] 6-10 years
- [ ] >10 years

Section 2 of 2

PART B : To identify the existing problem in industrial especially for project design phase

Description (optional)

Issue surrounding concrete cube data management at the site. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Issue on project delay-based concrete cube test. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Concrete cube test in filing documentation. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Concrete cube test in the compilation. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Issues on retrieving previous concrete cube test data. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Missing data from previous concrete cube test data. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Issues on retrieving pending concrete cube test data. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Issues on time management on compiling data. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Issue on systematic arrangement of concrete cube data. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

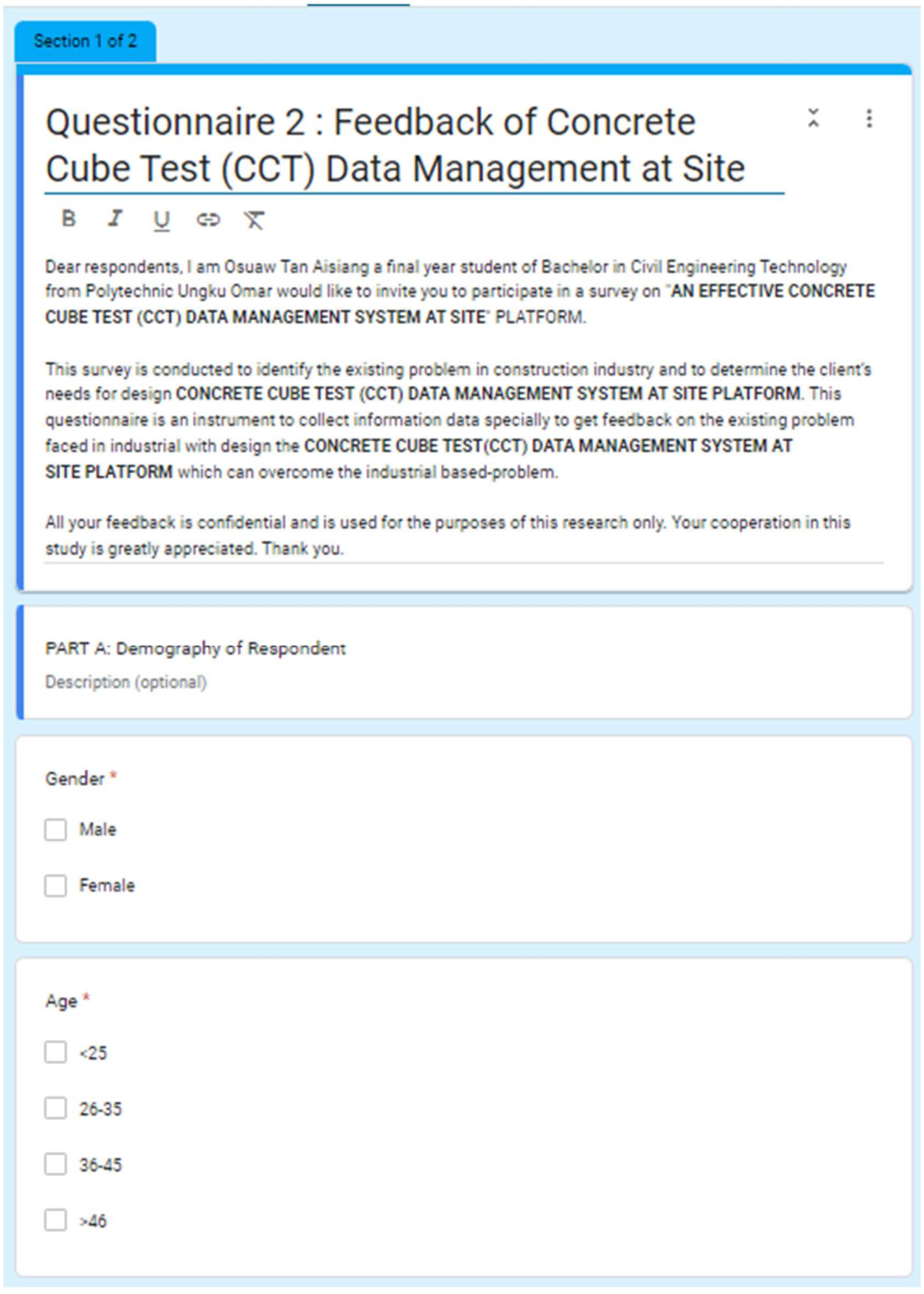
Issues on first-time user - User friendly. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Thank you.

APPENDIX B

Questionnaire 2 : Feedback of Concrete Cube Test (CCT) Data Management at Site



Section 1 of 2

Questionnaire 2 : Feedback of Concrete Cube Test (CCT) Data Management at Site

Dear respondents, I am Osuaw Tan Aisiang a final year student of Bachelor in Civil Engineering Technology from Polytechnic Ungku Omar would like to invite you to participate in a survey on "**AN EFFECTIVE CONCRETE CUBE TEST (CCT) DATA MANAGEMENT SYSTEM AT SITE**" PLATFORM.

This survey is conducted to identify the existing problem in construction industry and to determine the client's needs for design **CONCRETE CUBE TEST (CCT) DATA MANAGEMENT SYSTEM AT SITE PLATFORM**. This questionnaire is an instrument to collect information data specially to get feedback on the existing problem faced in industrial with design the **CONCRETE CUBE TEST(CCT) DATA MANAGEMENT SYSTEM AT SITE PLATFORM** which can overcome the industrial based-problem.

All your feedback is confidential and is used for the purposes of this research only. Your cooperation in this study is greatly appreciated. Thank you.

PART A: Demography of Respondent

Description (optional)

Gender *

- [ ] Male
- [ ] Female

Age *

- [ ] <25
- [ ] 26-35
- [ ] 36-45
- [ ] >46

Designation *

- [ ] Engineer
- [ ] Sub-Contractor
- [ ] Consultant
- [ ] Supplier
- [ ] Other...

Work Experience *

- [ ] <2 years
- [ ] 2-5 years
- [ ] 6-10 years
- [ ] >10 years

Section 2 of 2

PART B : To identify existing method before and after using CCT Data Management at site.

Description (optional)

Perceived usefulness of existing method. *

	Strongly Disagr...	Disagree	Neutral	Agree	Strongly Agree
Using the existi...	○	○	○	○	○
Using existing ...	○	○	○	○	○
Using existing ...	○	○	○	○	○
I found existing...	○	○	○	○	○

Perceived ease of use of existing method *

	Strongly Disagr...	Disagree	Neutral	Agree	Strongly Agree
I found existing...	○	○	○	○	○
Learning to use...	○	○	○	○	○
My interaction ...	○	○	○	○	○
It would be eas...	○	○	○	○	○

CCT Data Management at site features. *

	Strongly Disagr...	Disagree	Neutral	Agree	Strongly Agree
CCT Data Man...	○	○	○	○	○
CCT Data Man...	○	○	○	○	○
Implementing ...	○	○	○	○	○
CCT Data Man...	○	○	○	○	○
I will use CCT ...	○	○	○	○	○

Perceived ease after use CCT Data Management at site. *

	Strongly Disagr...	Disagree	Neutral	Agree	Strongly Agree
CCT Data Man...	○	○	○	○	○
CCT Data Man...	○	○	○	○	○
CCT Data Man...	○	○	○	○	○
I intend to use ...	○	○	○	○	○

Thank you.

APPENDIX C

View of Database

```
-- phpMyAdmin SQL Dump

-- version 5.2.1

-- https://www.phpmyadmin.net/

--

-- Host: 127.0.0.1

-- Generation Time: Jun 04, 2024 at 04:02 PM

-- Server version: 10.4.32-MariaDB

-- PHP Version: 8.2.12


SET SQL_MODE = "NO_AUTO_VALUE_ON_ZERO";

START TRANSACTION;

SET time_zone = "+00:00";


/*!40101 SET
@OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;

/*!40101 SET
@OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;

/*!40101 SET
@OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;

/*!40101 SET NAMES utf8mb4 */;

--

-- Database: `sunway`

--
```

```
-- ------------------------------------------------------

--

-- Table structure for table `cctresults`


CREATE TABLE `cctresults` (

  `id` bigint(20) UNSIGNED NOT NULL,

  `zone` varchar(255) NOT NULL,

  `element` varchar(255) NOT NULL,

  `location` varchar(255) NOT NULL,

  `cubeReference` varchar(255) NOT NULL,

  `grade` varchar(255) NOT NULL,

  `supplier` varchar(255) NOT NULL,

  `dateCast` date NOT NULL,

  `dateTest4Days` date DEFAULT NULL,

  `Sample1_4Days` decimal(10,1) DEFAULT NULL,

  `Sample2_4Days` decimal(10,1) DEFAULT NULL,

  `Sample3_4Days` decimal(10,1) DEFAULT NULL,

  `Avg4Days` decimal(10,1) DEFAULT NULL,

  `dateTest7Days` date DEFAULT NULL,

  `Sample1_7Days` decimal(10,1) DEFAULT NULL,

  `Sample2_7Days` decimal(10,1) DEFAULT NULL,

  `Sample3_7Days` decimal(10,1) DEFAULT NULL,

  `Avg7Days` decimal(10,1) DEFAULT NULL,
```

```
  `dateTest28Days` date DEFAULT NULL,
  `Sample1_28Days` decimal(10,1) DEFAULT NULL,
  `Sample2_28Days` decimal(10,1) DEFAULT NULL,
  `Sample3_28Days` decimal(10,1) DEFAULT NULL,
  `Avg28Days` decimal(10,1) DEFAULT NULL,
  `remarks` varchar(255) NOT NULL,
  `created_at` timestamp NULL DEFAULT NULL,
  `updated_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

-- ------------------------------------------------------

--

-- Table structure for table `failed_jobs`


CREATE TABLE `failed_jobs` (
  `id` bigint(20) UNSIGNED NOT NULL,
  `uuid` varchar(255) NOT NULL,
  `connection` text NOT NULL,
  `queue` text NOT NULL,
  `payload` longtext NOT NULL,
  `exception` longtext NOT NULL,
  `failed_at` timestamp NOT NULL DEFAULT current_timestamp()
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

-- ------------------------------------------------------
```

```
--

-- Table structure for table `migrations`

--

CREATE TABLE `migrations` (

  `id` int(10) UNSIGNED NOT NULL,

  `migration` varchar(255) NOT NULL,

  `batch` int(11) NOT NULL

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

--

-- Dumping data for table `migrations`

--

INSERT INTO `migrations` (`id`, `migration`, `batch`) VALUES

(1, '2014_05_10_231909_create_roles_table', 1),

(2, '2014_10_12_000000_create_users_table', 1),

(3, '2014_10_12_100000_create_password_reset_tokens_table', 1),

(4, '2014_10_12_100000_create_password_resets_table', 1),

(5, '2019_08_19_000000_create_failed_jobs_table', 1),

(6, '2019_12_14_000001_create_personal_access_tokens_table', 1),

(7, '2024_06_01_031733_create_cctresults_table', 1),

(8, '2024_06_01_033918_create_reports_table', 1);

-- --------------------------------------------------------

--

-- Table structure for table `password_resets`

--
```

```
CREATE TABLE `password_resets` (
  `email` varchar(255) NOT NULL,
  `token` varchar(255) NOT NULL,
  `created_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

-- --------------------------------------------------------

--

-- Table structure for table `password_reset_tokens`

--

CREATE TABLE `password_reset_tokens` (
  `email` varchar(255) NOT NULL,
  `token` varchar(255) NOT NULL,
  `created_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

-- --------------------------------------------------------

--

-- Table structure for table `personal_access_tokens`

--

CREATE TABLE `personal_access_tokens` (
  `id` bigint(20) UNSIGNED NOT NULL,
  `tokenable_type` varchar(255) NOT NULL,
  `tokenable_id` bigint(20) UNSIGNED NOT NULL,
```

```
  `name` varchar(255) NOT NULL,
  `token` varchar(64) NOT NULL,
  `abilities` text DEFAULT NULL,
  `last_used_at` timestamp NULL DEFAULT NULL,
  `expires_at` timestamp NULL DEFAULT NULL,
  `created_at` timestamp NULL DEFAULT NULL,
  `updated_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

-- ------------------------------------------------------

--

-- Table structure for table `reports`

--

CREATE TABLE `reports` (
  `id` bigint(20) UNSIGNED NOT NULL,
  `originalName` varchar(255) NOT NULL,
  `hashName` varchar(255) NOT NULL,
  `extension` varchar(255) NOT NULL,
  `cctresult_id` bigint(20) UNSIGNED NOT NULL,
  `created_at` timestamp NULL DEFAULT NULL,
  `updated_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

-- ------------------------------------------------------

--
```

```
-- Table structure for table `roles`

CREATE TABLE `roles` (
  `id` bigint(20) UNSIGNED NOT NULL,
  `roleName` varchar(255) NOT NULL,
  `created_at` timestamp NULL DEFAULT NULL,
  `updated_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;

--

-- Dumping data for table `roles`

--

INSERT INTO `roles` (`id`, `roleName`, `created_at`, `updated_at`) VALUES
(1, 'COW/RS/Sunway Property User', NULL, NULL),
(2, 'Contractor/Consultant', NULL, NULL);

-- --------------------------------------------------------


--

-- Table structure for table `users`

--

CREATE TABLE `users` (
  `id` bigint(20) UNSIGNED NOT NULL,
  `name` varchar(255) NOT NULL,
  `email` varchar(255) NOT NULL,
  `role_id` bigint(20) UNSIGNED NOT NULL,
  `password` varchar(255) NOT NULL,
```

```
  `remember_token` varchar(100) DEFAULT NULL,
  `created_at` timestamp NULL DEFAULT NULL,
  `updated_at` timestamp NULL DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4
COLLATE=utf8mb4_unicode_ci;


--
-- Indexes for dumped tables
--
--
-- Indexes for table `cctresults`
--
ALTER TABLE `cctresults`
  ADD PRIMARY KEY (`id`);


--
-- Indexes for table `failed_jobs`
--
ALTER TABLE `failed_jobs`
  ADD PRIMARY KEY (`id`),
  ADD UNIQUE KEY `failed_jobs_uuid_unique` (`uuid`);
--
-- Indexes for table `migrations`
--
ALTER TABLE `migrations`
```

```
 ADD PRIMARY KEY (`id`);

--

-- Indexes for table `password_resets`

--

ALTER TABLE `password_resets`

 ADD KEY `password_resets_email_index` (`email`);

--

-- Indexes for table `password_reset_tokens`

--

ALTER TABLE `password_reset_tokens`

 ADD PRIMARY KEY (`email`);

--

-- Indexes for table `personal_access_tokens`

--

ALTER TABLE `personal_access_tokens`

 ADD PRIMARY KEY (`id`),

 ADD UNIQUE KEY `personal_access_tokens_token_unique` (`token`),

 ADD KEY `personal_access_tokens_tokenable_type_tokenable_id_index`
(`tokenable_type`,`tokenable_id`);

--

-- Indexes for table `reports`

--

ALTER TABLE `reports`

 ADD PRIMARY KEY (`id`),

 ADD KEY `reports_cctresult_id_foreign` (`cctresult_id`);
```

```
--
-- Indexes for table `roles`
--
ALTER TABLE `roles`
  ADD PRIMARY KEY (`id`);


--
-- Indexes for table `users`
--
ALTER TABLE `users`
  ADD PRIMARY KEY (`id`),
  ADD UNIQUE KEY `users_email_unique` (`email`),
  ADD KEY `users_role_id_foreign` (`role_id`);
--
-- AUTO_INCREMENT for dumped tables
--
--
-- AUTO_INCREMENT for table `cctresults`
--
ALTER TABLE `cctresults`
  MODIFY `id` bigint(20) UNSIGNED NOT NULL AUTO_INCREMENT;
--
-- AUTO_INCREMENT for table `failed_jobs`
--
```

```
ALTER TABLE `failed_jobs`
  MODIFY `id` bigint(20) UNSIGNED NOT NULL AUTO_INCREMENT;
--
-- AUTO_INCREMENT for table `migrations`
--
ALTER TABLE `migrations`
  MODIFY `id` int(10) UNSIGNED NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=9;
--
-- AUTO_INCREMENT for table `personal_access_tokens`
--
ALTER TABLE `personal_access_tokens`
  MODIFY `id` bigint(20) UNSIGNED NOT NULL AUTO_INCREMENT;
--
-- AUTO_INCREMENT for table `reports`
--
ALTER TABLE `reports`
  MODIFY `id` bigint(20) UNSIGNED NOT NULL AUTO_INCREMENT;
--
-- AUTO_INCREMENT for table `roles`
--
ALTER TABLE `roles`
  MODIFY `id` bigint(20) UNSIGNED NOT NULL AUTO_INCREMENT,
AUTO_INCREMENT=3;
--
```

```
-- AUTO_INCREMENT for table `users`
--
ALTER TABLE `users`
  MODIFY `id` bigint(20) UNSIGNED NOT NULL AUTO_INCREMENT;
--
-- Constraints for dumped tables
--
-- Constraints for table `reports`
--
ALTER TABLE `reports`
  ADD CONSTRAINT `reports_cctresult_id_foreign` FOREIGN KEY (`cctresult_id`) REFERENCES `cctresults` (`id`) ON DELETE CASCADE;
--
-- Constraints for table `users`
--
ALTER TABLE `users`
  ADD CONSTRAINT `users_role_id_foreign` FOREIGN KEY (`role_id`) REFERENCES `roles` (`id`) ON DELETE CASCADE;
COMMIT;

/*!40101 SET CHARACTER_SET_CLIENT=@OLD_CHARACTER_SET_CLIENT */;
/*!40101 SET CHARACTER_SET_RESULTS=@OLD_CHARACTER_SET_RESULTS */;
/*!40101 SET COLLATION_CONNECTION=@OLD_COLLATION_CONNECTION */;
```

APPENDIX D

The Gantt chart of the development progress from semester 7 to semester 8