IMPROVEMENT MEASURES FOR QUALITY CONTROL IN STRUCTURAL WORKS ASSESSMENT BY USING BUILDING INFORMATION MODELLING

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ABSTRACT

Building Information Modelling (BIM) provides significant advantages to the construction players throughout information sharing, features and functions. In building construction should be quality-oriented in which BIM assist a lot in providing quality protection to ensure that the building construction in a good quality standard. In line with that, from the good quality standards could lead to high return on investment (ROI). This paper aims to propose the improvement measure for Quality Control by using BIM through its objectives by identify; (1) the current problems among Quality Control for Structural Works Assessment; (2) to investigate the key elements of Quality Control for Structural Works Assessment and; (3) to propose the improvement measures of Quality Control by using BIM. A literature review was put through to review the correlation between BIM and Quality Control. This study involved a qualitative approach. The data will be collected through interview sessions. The overall data will be analyzed by using a qualitative content analysis technique. Besides, reviewing the journals and handbooks also part of tools to gather data. Therefore, this study can serve as a reference in terms of improve project quality and directly shall support the Industrial Revolution 4.0 roadmap for the construction industry in 2020 and onwards. This in return, reduces the common problems experienced in construction projects that employ conventional methods, thus minimizing losses and saving time and cost.

ABSTRAK

‘Building Information Modeling’ (BIM) mempunyai banyak kelebihan kepada industri pembinaan dari segi perkongsian maklumat, ciri dan fungsi. Dalam pembinaan bangunan harus berorientasikan kualiti di mana BIM banyak membantu dalam memberikan perlindungan kualiti untuk memastikan bahawa pembinaan bangunan dalam standard kualiti yang baik. Sejajar dengan itu, dengan standard kualiti yang baik dapat meningkatkan pulangan pelaburan yang tinggi. Oleh itu, kajian ini bertujuan untuk mencadangkan langkah penambahbaikan untuk ‘Quality Control’ menggunakan BIM melalui objektifnya dengan mengenal pasti; (1) masalah ‘Quality Control’ untuk ‘Structural Works Assessment’; (2) untuk menyelidiki elemen utama ‘Quality Control’ untuk ‘Structural Works Assessment’ dan; (3) untuk mengusulkan langkah-langkah peningkatan pengendalian mutu dengan menggunakan BIM. Kajian literatur dilakukan untuk mengkaji hubungan antara BIM dan ‘Quality Control’. Kajian ini menggunakan pendekatan kualitatif. Data akan dikumpulkan melalui sesi temu ramah separa berstruktur tatap muka. Keseluruhan data akan dianalisis dengan menggunakan teknik analisis kandungan kualitatif. Selain itu, jurnal dan buku panduan juga merupakan sebahagian daripada alat untuk mengumpulkan data. Oleh itu, kajian ini dapat menjadi rujukan dalam hal meningkatkan kualiti projek dan secara langsung akan menyokong Revolusi Industri 4.0 untuk industri pembinaan pada tahun 2020 dan akan datang. Tambahan lagi dapat mengurangkan masalah yang dialami dalam projek pembinaan yang menggunakan kaedah konvensional dan seterusnya meminimumkan kerugian dan menjimatkan masa dan kos.

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BIM	-	Building Information Model
QC	-	Quality Control
ROI	-	Return on Investment
PDCA	-	Plan-Do-Check-Act
AR	-	Augmented Reality

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CHAPTER 1

INTRODUCTION

1.1 Background of Problems

Building Information Modelling (BIM) is a digital representation of the project (geometric and non-geometric information) which provides a model-based mechanism to manage all building-related data and information on a particular project through a shared repository. Besides, to increase the productivity in the construction industry will be achieve by implement BIM technology. Referring to S. Azhar *et al* (2015) mentioned that with BIM can have effective exchange of information among partners so called as collaborative environment which able to give pleasure to construction projects and all parties involved.

In line with BIM approaches, this study focuses on the improvement measure for Quality Control (QC) in structural assessment by using BIM in Klang Valley. Pertaining to Lee *et al.* (2014) stated that the QC tasks need to handling all documentation and record in the file management system together with responsible on the site tasks for attain higher quality standard.

Following with that, by implementing BIM in QC inspection may improve the quality performance efficiency. On top of that, with better quality will reduce cost and hence a better Return on Investment (ROI) for the user. Hence, the BIM's benefits and its correlation with Quality Control will be further explore in the next chapter.

1.2 Statement of Problem

There are few problems related to Quality Control (QC) inspection that could lead to poor coordination. Speaking on the coordination, it is more on the Quality Control's straightforwardness and professionalism which is marked as the key elements of Quality Control. One of the problems is some of the Quality Control shortage of skill and experience. With different expertise or experience among Quality Control could lead to weak inspection result and perhaps may elongate the assessment time. Like example in handling the dumpy level, if not familiar in the way to set up this instrument, definitely the assessment will be prolonged. Besides, the unsuitable assessment tools which are not intended for a particular assessment also will give wrong assessment.

Next, the structural tools assessment consists of spirit level, measurement tape, steel gauge, plump bob, L-square and more. When there are senior Quality Control and junior Quality Control carry out the structural assessment, there will be a slightly different in terms of judgement on defects and score. In addition, others problem that related with Quality Control is having difficulty in determining the accuracy of measurement or dimensioning while carry out the structural assessment.

Moving forward, other problems related to Quality Control is drawings. The construction drawing needs to bring along in order to check on rebar number, size, spacing, links design and more. With large size of construction drawing is such inconvenienced to bring all the way with site condition in less than 80% construction progress. Besides, with strong windy condition also may affected during structural assessment. Furthermore, the material specification needs to refer from progress report. Again, the record documentation needs to find out to check and validate the material. Like example the door frame at toilet is using Zincalumn and there is wet area at the bottom, however this wet area is haven't undergone the epoxy treatment. The epoxy treatment is characterized by solvent-resistant finish, toughness and strong adhesion.

Therefore, by using BIM may help in site coordination to solve these problems which BIM models consist of details design elements and specification information that can identify clashes or conflicts on defects during structural assessment. Moreover, instead of overlaying drawing to see if there are any conflicts, with BIM though, this process is vastly improved as BIM brings automation to clash detection.

Furthermore, with BIM also the levelling work can be less as model give accurate coordination control and exact location. Nevertheless, with BIM also will avoid double work or handling due of setting out errors. Next, referring to Namhun Lee *et al*, (2014) stated that the Quality Control having a workload ownership in taking care the complex quality practices due of limited number of Quality Control. Besides, pertaining to Autodesk (2012), with BIM implementation can achieve the results in quality improvement and reduction in cost overrun.

As nowadays, quality workmanship is important to ensure future marketability and enhances the confidence of clients. Taguchi (1986) viewed variation as a lack of consistency in the product that will give rise to poor quality. Therefore, Taguchi developed methodologies aimed at reducing two elements of variation on deviation from the target and variation with respect to others in the group.

1.3 Research Objectives

This study is aimed to propose the improvement measure for Quality Control in structural assessment by using BIM in Klang Valley. To achieve these aims, the following objectives were established:

i. To identify the current problem among Quality Control in Structural Works Assessment.
ii. To investigate the key elements of Quality Control in Structural Works Assessment.
iii. To recommend an improvement measures of Quality Control by using BIM.

1.4 Research Questions

These are the research questions that aim to be answered throughout this study:

a) What are the current problems among Quality Control in Structural Works Assessment?
b) What are the key elements of Quality Control in Structural Works Assessment?
c) How to improve the current problems among Quality Control in Structural Works Assessment?

1.5 Conceptual Framework

There is propose a conceptual framework sourced from (Ryan Jang, 2020) as shown in figure 1.1 which to define the concepts within the problem of this study. This concept should help in describes how the research problems would be explored. Thus, this conceptual framework would be using in this study to aid as logical structure in research problem.

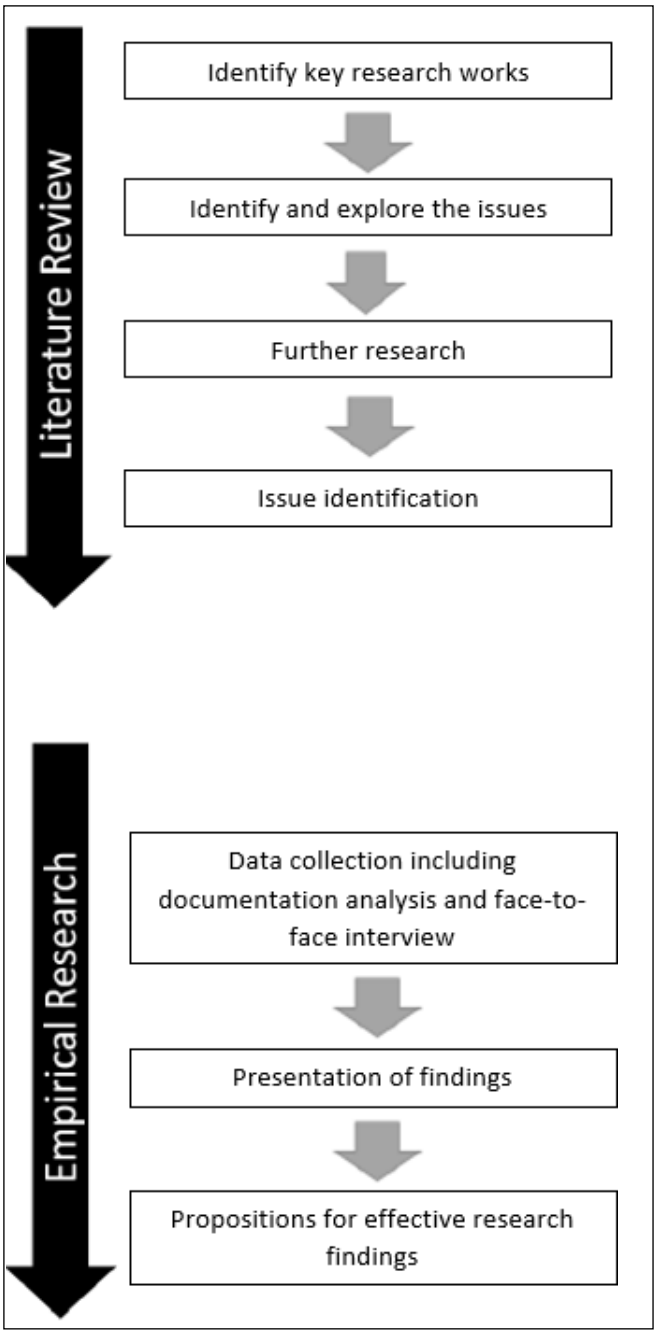

Figure 1.1 Conceptual Framework (Ryan Jang, 2020)

1.6 Significance of the Research

Further to BIM approaches, this study focuses on the improvement measure for Quality Control (QC) by using BIM in Klang Valley. The quality of certain construction projects in Malaysia does not always meet expectations and today has undergone numerous setbacks such as a decrease in standard of quality (M.A. Othuman Mydin *et al*, 2014). In line with this study, there are few problems related on Quality Control (QC) inspection that could lead to poor coordination of quality issues.

Problems related to Quality Control is drawings. The construction drawing needs to bring along in order to check on rebar number, size, spacing, links design and more. With large size of construction drawing is such inconvenienced to bring all the way with site condition in less than 80% construction progress. Besides, with strong windy condition also may affected during structural assessment. Furthermore, the material specification needs to refer from progress report. Again, the record documentation needs to find out to check and validate the material.

Besides, the other problem is some of the QC inspector shortage of skill and experience that could lead to a different inspection result. Therefore, by using BIM may help to solve these problems as BIM brings automation to clash detection and convenient to bring tablet along structural assessment rather than construction drawings.

Referring to Junying Lou *et al* (2016) which stated that BIM is such information sharing, features and functions that providing a lot of help to improve project quality and efficiency.

1.7 Scope and Limitation of Research

This study is focusing on Quality Control (QC) which involves operational techniques and activities that are used to fulfil requirements for quality. On the other words, QC is more on product oriented and focuses on defect identification. Moving forward, this study undertaken using the following methodology which involves literature review and formal qualitative interviews with a group of Quality Control.

Besides, the limitations from this study covers on structural works assessment for the building inspection and QC in Klang Valley in the same company. Structural work assessment is carried out during construction of the building project. The assessment also covers performance testing. The structural integrity of the building is of paramount importance as the cost of failure and repairs are very significant.

Moreover, the assessment of structure works consists of firstly is site inspection of reinforced concrete, structural steel and prestressed concrete structures during construction. Secondly is test results of compressive strength of concrete and tensile strength of steel reinforcement. Thirdly is non-destructive testing of the uniformity and cover of hardened concrete. For the literature review, it is to understand the current problems come up from QC during carry out the building inspection and BIM is proposed to solve the gaps.

Subsequently, part of the theoretical view is carried out to construct questions that fit the purposive research objective. Besides, reviewing the past researches is purposely to gather the possible interactions and connections in current construction practices.

1.8 Research Methodology

Further to the following methodology that involved literature review and questionnaire survey from the focus group interview from Quality Control (QC) with variety level of experience in Klang Valley.

Inside literature review would be discuss on the role of QC, the gaps happen along assessment and the beneficial of Building Information Modelling as the improvement measure.

Moving forward, pertaining to the semi-findings from literature review, the interview will be conducted to the focus group of Quality Control.

1.9 Structure of Study

Chapter 1 is about the introduction of the study which consist of background of the study, research objectives, conceptual framework, scope and limitation that will be walk through in this chapter as intention or idea of this study.

While chapter 2 is the literature review part which review from the past study as a collective data and guideline to strengthen more on this study. Besides, from this chapter Quality Control and Building Information Modelling will be depth elaborate along this chapter.

Moving forward, chapter 3 will be discussing on the methodology of data collection and a qualitative content analysis technique applied in this study. This chapter is the main skeleton in order to proof and strengthening the research objectives.

Next, chapter 4 is the data analysis and findings. After collect data via interview, the result will be appeared and the analysis will be based on the objectives and aim of this study.

Nevertheless, chapter 5 is the last part which is act as a wrap up for the entire chapters so called as conclusion and recommendation. This chapter shall be using for others relevant parties or body for their additional knowledge.

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APPENDICES

Appendix A Questionnaire Survey

IMPROVEMENT MEASURES FOR QUALITY CONTROL IN STRUCTURAL WORKS ASSESSMENT BY USING BIM IN KLANG VALLEY: A QUALITATIVE APPROACH

The main objective of this research is to propose the improvement measure for Quality Control in structural assessment by using BIM in Klang Valley. This survey is divided into four sections as follows:

SECTION A	:	Demographic Profile (6 questions);
SECTION B	:	The current problems among Quality Control for Structural Works Assessment in Klang Valley.(6 questions);
SECTION C	:	The key elements of Quality Control for Structural Works Assessment in Klang Valley (4 questions);
SECTION D	:	Improvement measures for Quality Control in Structural Assessment by using BIM in Klang Valley (3 questions);

(The interview session should only take approximately 10 to 15 minutes and the answers will be kept in strictest confidentiality).

SECTION A: DEMOGRAPHIC PROFILE

The personal information of the interviewee.

All information, including all results and personal information from the interviewee will be kept strictly confidential and be used for research purposes by Universiti Teknologi Malaysia (UTM) only.

1 Gender:

( ) Male

( ) Female

2 Age:

( ) 21 – 30 years old

( ) 31 – 40 years old

( ) 41 – 50 years old

( ) 51 – 60 years old

( ) More than 61 years old

3 Race:

( ) Malay

( ) Chinese

( ) Indian

( ) Others

4 Highest education level:

( ) Masters

( ) Bachelor

( ) Diploma

( ) SPM

5 Position grade:

( ) Head of Department

( ) Manager

( ) Senior Quality Control

( ) Quality Control

6 Years of experience in construction projects:

( ) 1 – 3 years

( ) 4 – 6 years

( ) 7 – 9 years

( ) More than 10 years

SECTION B: THE CURRENT PROBLEMS AMONG QUALITY CONTROL FOR STRUCTURAL WORKS ASSESSMENT IN KLANG VALLEY

1) What is the main current problem while carry out the structural assessment? How do you mitigate it?

2) What is the common mistake among Quality Control while carry out the structural assessment?

3) Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?

4) The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?

5) While carry out the structural assessment, which element of structural assessment take some time?

6) What are the most common defects found after assessment? Could you please explain further?

SECTION C: ELEMENTS OF QUALITY CONTROL FOR STRUCTURAL WORKS ASSESSMENT IN KLANG VALLEY

7) What is the main ownership of Quality Control to ensure the structural assessment carry out successfully?

8) Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?

9) How do you decide the final decision among Quality Control team when there are different findings?

10) What are the average days to complete the structural assessment?

SECTION D: IMPROVEMENT MEASURES FOR QUALITY CONTROL IN STRUCTURAL ASSESSMENT BY USING BIM IN KLANG VALLEY

11) The implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. What is your thought on the BIM usage along structural assessment?

12) Besides, integrated with BIM technology will be more convenient as it may save more assessment duration and improve the work efficiency. What is your opinion on the proposed recommendation?

13) In line with management and business direction towards digitization and way forward, what is your suggestion to all Quality Control team in engaged with the high-technology platform?

Appendix B Transcript (Respondents)

Transcript of interview (R1)

Interviewer	:	Good morning, first of all sorry for taking your time at this moment. I would like to interview you regarding on my research which is the improvement measures for Quality Control in structural works assessment by using BIM
R1	:	Good morning, sounds nice!
Interviewer	:	Without further due, shall we start?
R1	:	Sure, please.
Interviewer	:	What is the main current problem while carry out the structural assessment? How do you mitigate it?
R1	:	The main current problem is the competency in carry out assessment. Level of understanding on the technical part also different. Thus, training for technical in structural assessment will be suggested
Interviewer	:	What is the common mistake among Quality Control while carry out the structural assessment?
R1	:	Ok, common mistake shall be on judge of the technical and specification of the elements such as the lippage between 2 tiles should not be more than 1 mm and so on.
Interviewer	:	Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?
R1	:	Yes definitely, the more experience work force you have, will have a better workmanship, quality controls and works are more efficient and works can be completed faster.
Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R1	:	Surely the wrong tools being used can have a negative results, wrong message will be sent to the management.
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R1	:	Well, it would be all parts, the biggest area, the more need to be assessed.
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?

R1	:	It's depends. Some project has different contractor, might encounter different issue of defects.
Interviewer	:	What is the main ownership of Quality Control to ensure the structural assessment carry out successfully?
R1	:	QC must be firm in judging the defects. With skillful and more experiences will a bonus.
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?
R1	:	Other than that should be confidence. Confident in making decision
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?
R1	:	We would take the most precise decision and mostly came from the most experience QC.
Interviewer	:	What are the average days to complete the structural assessment?
R1	:	Mostly 1-2 workings day
Interviewer	:	Ok, now we're at the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought on the BIM usage along structural assessment?
R1	:	It's a good movement since our management direction is towards digital transformation of business processes and to adopt ways moving forward
Interviewer	:	Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is your opinion on the proposed recommendation?
R1	:	Yes BIM will definitely help to superimpose structural, architectural & M&E drawings in order to check for any clashes or any detailing need to be further improved.
Interviewer	:	Last question, what is your suggestion to all Quality Control team in engaged with the high-technology platform?
R1	:	Yes since all of us did use CDE, EMP, Field View, therefore no issue on this.

Transcript of interview (R2)

Interviewer	:	Good afternoon, first of all sorry for taking your time at this moment. I would like to interview you regarding on my research study which is the improvement measures for Quality Control in structural works assessment by using BIM.
R2	:	Yes, good afternoon, sure can.
Interviewer	:	Ok, what is the main current problem while carry out the structural assessment? How do you mitigate it?
R2	:	I would say lack of skill shall be the main current problem. Perhaps it's too subjective, I would suggest to attend the training.
Interviewer	:	What is the common mistake among Quality Control while carry out the structural assessment?
R2	:	I would say level of judging the defects.
Interviewer	:	Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?
R2	:	Of course, the more experiences the more we know what to do and decide.
Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R2	:	Definitely. When the score is wrong, it will definitely affect the integrity of the assessment.
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R2	:	I would say all elements because different elements have different specification or measurement.
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?
R2	:	For me it might be floor, because there will be contractor in and out to do rectification.
Interviewer	:	Ok next, what is the main ownership of Quality Control to ensure the structural assessment carry out successfully?
R2	:	I would say no bias in generate the result.
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?
R2	:	Punctuality.
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?

R2	:	The most experience and skillful may take in charge in decision.
Interviewer	:	What are the average days to complete the structural assessment?
R2	:	Depends on the size of sample. Average 1 to 2 workings day.
Interviewer	:	Ok, now we're heading to the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought on the BIM usage along structural assessment?
R2	:	Good! BIM is such efficient system and may improve the communications regarding quality information.
Interviewer	:	Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is your opinion on the proposed recommendation?
R2	:	Definitely. With both integrations shall improve the work efficiency.
Interviewer	:	Last but not least, what is your suggestion to all Quality Control team in engaged with the high-technology platform?
R2	:	Yes, this is a good initiative in our company towards digitization

Transcript of interview (R3)

Interviewer	:	Good morning, first of all sorry for taking your time at this moment. I would like to interview you regarding on my research study which is the improvement measures for Quality Control in structural works assessment by using BIM.
R3	:	Yes can
Interviewer	:	Ok, what is the main current problem while carry out the structural assessment? How do you mitigate it?
R3	:	Level of knowledge and different perceptions among QC. The way to mitigate shall be by frequent practice and to ensure the competency
Interviewer	:	What is the common mistake among Quality Control while carry out the structural assessment?
R3	:	Ok, for common mistake i would say more to inefficient skill in manage assessment tools.
Interviewer	:	Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?

R3	:	Yes. Experiences are required and important in determining, identifying and judging level and categories of defects.
Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R3	:	Yes. Also, with the usage of Tablet for data key in might affect the result whenever there is an error during data key in process
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R3	:	It may all elements in structural assessment
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?
R3	:	It's depends to the project phases. Because there are different consultants in taking care design and contractor in construct the building.
Interviewer	:	What is the main ownership of Quality Control to ensure the structural assessment carry out successfully?
R3	:	Always alert in surrounding and well prepare for any argument from contractor.
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?
R3	:	Teamwork and cooperation.
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?
R3	:	Will refer back to QLASSIC requirement if got discrepancy regarding on technical part.
Interviewer	:	What are the average days to complete the structural assessment?
R3	:	Average 1-2 workings day.
Interviewer	:	Ok, now we're at the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought on the BIM usage along structural assessment?
R3	:	Definitely good!
Interviewer	:	Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is your opinion on the proposed recommendation?
R3	:	Agree on this proposal as it BIM such a good collaboration and communication.

Interviewer	:	Last question, what is your suggestion to all Quality Control team in engaged with the high-technology platform?
R3	:	BIM will help a lot in term of quality delivery

Transcript of interview (R4)

Interviewer	:	Good morning, first of all thank you for your time to allow me interview you regarding on my research study which is the improvement measures for Quality Control in structural works assessment by using BIM.
R4	:	Good morning, no worries.
Interviewer	:	Without further due, shall we start?
R4	:	Yes, please.
Interviewer	:	What is the main current problem while carry out the structural assessment? How do you mitigate it?
R4	:	The main current problem is difficulty and no firm in decision.
Interviewer	:	What is the common mistake among Quality Control while carry out the structural assessment?
R4	:	Ok, I would say inconvenient in bring along large size of drawing to site.
Interviewer	:	Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?
R4	:	Yes certainly, the more experience and skill acquired, the more efficient within work.
Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R4	:	Of course, the misuse of assessment tools will make the result definitely wrong.
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R4	:	It would be set up the dumpy level and checking the beam level.
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?
R4	:	Beam crack and plastering work uneven.

Interviewer	:	What is the main ownership of Quality Control to ensure the structural assessment carry out successfully?
R4	:	Confident in making decision while to issue the Non-Conformance
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?
R4	:	Flexible and energetic
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?
R4	:	Lesson Learned Database will be one of the reference.
Interviewer	:	What are the average days to complete the structural assessment?
R4	:	Mostly 1-2 workings day
Interviewer	:	Ok, now we're at the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought on the BIM usage along structural assessment?
R4	:	Good proposal!
Interviewer	:	Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is your opinion on the proposed recommendation?
R4	:	Yes, from BIM can reduces conflicts and changes during construction.
Interviewer	:	Last question, what is your suggestion to all Quality Control team in engaged with the high-technology platform?
R4	:	Yes since all of us did use CDE, EMP, Field View, therefore no issue on this.

Transcript of interview (R5)

Interviewer	:	Good afternoon, first of all sorry for taking your time at this moment. I would like to interview you regarding on my research study which is the improvement measures for Quality Control in structural works assessment by using BIM.
R5	:	Good afternoon, should be no problem
Interviewer	:	Without further due, shall we start?
R5	:	Yes, please
Interviewer	:	What is the main current problem while carry out the structural assessment? How do you mitigate it?
R5	:	The main current problem is currently we are still using paper-based at site.
Interviewer	:	What is the common mistake among Quality Control while carry out the structural assessment?
R5	:	Somehow there will be miscommunication among QC
Interviewer	:	Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?
R5	:	Yes. Experience and skill are such valuable.
Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R5	:	Yes, will make the result unreliable and unconvincing.
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R5	:	It may in measure the dimensioning rebar, spacing etc.
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?
R5	:	Beam and column bulging
Interviewer	:	What is the main ownership of Quality Control to ensure the structural assessment carry out successfully?
R5	:	No bias in making decision
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?

R5	:	Agile and knowledgeable.
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?
R5	:	Get into discussion with QC team.
Interviewer	:	What are the average days to complete the structural assessment?
R5	:	1-2 workings day
Interviewer	:	Now we're at the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought on the BIM usage along structural assessment?
R5	:	Agree!
Interviewer	:	Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is your opinion on the proposed recommendation?
R5	:	Yes, I belief with BIM can reduce works and improve productivity.
Interviewer	:	Last question, what is your suggestion to all Quality Control team in engaged with the high-technology platform?
R5	:	Attend training to get familiar.

Transcript of interview (R6)

Interviewer	:	Good afternoon, first of all thank you for your time to allow me interview you regarding on my research study which is the improvement measures for Quality Control in structural works assessment by using BIM.
R6	:	Good afternoon, yes please.
Interviewer	:	Ok, what is the main current problem while carry out the structural assessment? How do you mitigate it?
R6	:	Shortage of experienced site supervision personnel and need to train more experienced site supervision personnel.
Interviewer	:	What is the common mistake among Quality Control while carry out the structural assessment?
R6	:	Difficulty in determining the accuracy of measurement or dimensioning while carry out structural assessment.

Interviewer	:	Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?
R6	:	Yes, more experienced site supervision personnel are more competency and skillful in structural works assessment due to understanding of sequent of structural works.
Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R6	:	Yes, the unsuitable assessment tools which are not intended for a particular assessment will give wrong assessment.
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R6	:	Setting out position for columns and the accuracy of cranking the column's rebar for lapping. This may compromise on concrete cover's requirement.
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?
R6	:	Cracks appeared on structural element i.e. concrete slabs due to improper curing time and period. Inaccuracy of setting out of structural element causing misalignment with architectural and other services.
Interviewer	:	Ok next, what is the main ownership of Quality Control to ensure the structural assessment carries out successfully?
R6	:	Coordination among quality control team.
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?
R6	:	Enthusiasm & Team Spirit.
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?
R6	:	Discuss with the quality control team to reach the final consensus.
Interviewer	:	What are the average days to complete the structural assessment?
R6	:	2-3 working days.
Interviewer	:	Now we're heading to the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought

on the BIM usage along structural assessment?

R6 : BIM can be adopted as a checking and coordination tools for quality control not only for structural but also other element's quality assessment such as architectural, mechanical and electrical.

Interviewer : Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is your opinion on the proposed recommendation?

R6 : The use of BIM is highly recommended for quality control and work efficiency for the construction industry.

Interviewer : Last but not least, what is your suggestion to all Quality Control team in engaged with the high-technology platform?

R6 : Quality control team should be trained to adopt BIM to carry out the structural assessment at site.

Transcript of interview (R7)

Interviewer : Good morning, first of all thank you for your time to allow me interview you regarding on my research study which is the improvement measures for Quality Control in structural works assessment by using BIM.

R7 : Good morning, yes you may.

Interviewer : What is the main current problem while carry out the structural assessment? How do you mitigate it?

R7 : Overlooked on trimmer bar design and calibration of equipment used.

Interviewer : What is the common mistake among Quality Control while carry out the structural assessment?

R7 : Double handling job happened due of negligence.

Interviewer : Does the competency/ skillful rely on the number of experiences? Could you please explain briefly?

R7 : Yes, agreed with this statement. With competent and skillful quality control, they can do better coordination and manage projects properly. They can foresee and better understanding on the drawings and highlight for any discrepancies. So, the mistakes and double handling job can be avoided.

Interviewer	:	The misuse of assessment tools may affect to the assessment score/ result? Could you please explain briefly?
R7	:	Yes, it will give incorrect measurement.
Interviewer	:	While carry out the structural assessment, which element of structural assessment take some time?
R7	:	Structural elements need more time for assessments are checking on rebar numbers, size, spacing and links design.
Interviewer	:	What are the most common defects found after assessment? Could you please explain further?
R7	:	Common defects after assessment is damaged of expose surface. We found many cases damage happen caused by restrike of formwork activities after concreting work done.
Interviewer	:	Ok next, what is the main ownership of Quality Control to ensure the structural assessment carries out successfully?
R7	:	Honest with the assessment and share knowledge/experience on good practice which immediately can apply without repeating same mistakes.
Interviewer	:	Besides skills and experiences, what are other criteria that need to emphasize among Quality Control team?
R7	:	Knowledge and keep update with the product quality.
Interviewer	:	How do you decide the final decision among Quality Control team when there are different findings?
R7	:	Refer to Project Quality Plan (PQP) as guidelines.
Interviewer	:	What are the average days to complete the structural assessment?
R7	:	2-3 working days.
Interviewer	:	Now we're heading to the last part which is the implementation of BIM technology has many advantages such as clash detection, reduces rework, enhancing quality and improving ROI. In your opinion, what is your thought on the BIM usage along structural assessment?
R7	:	Better understanding and visual design. It will reduce double handling works and better coordination with archi and m&e trades.
Interviewer	:	Besides, integrated with BIM technology will be more convenient as it may improve the work efficiency. What is

		your opinion on the proposed recommendation?
R7	:	High technology platform will contribute better result as long its practical and everyone fully utilized the system.
Interviewer	:	Last but not least, what is your suggestion to all Quality Control team in engaged with the high-technology platform?
R7	:	High technology platform need time and provide proper training to all respective parties in order to achieve better result.