Formosa Journal of Science and Technology (FJST)
Vol.1, No.1, 2022: no halaman disini

ANALYSIS QUALITY CONTROL IN PROJECT DEVELOPMENT WAREHOUSE PT SANTOS JAYA ABADI USING THE PROCESS DECISION PROGRAM CHART METHOD

Yohanes Usman Nandyanto[1], Michella Beatrix[2], Masca Indra Triana[3]
Teknik Sipil, Fakultas Teknik, Universitas 17 Agustus 1945 Surabaya
Corresponding Author: yohanesnandyanto@gmail.com

ARTICLE INFO

Keywords: Quality control, Analysis Risk, Process Decision Program Chart

Received : Date, Month
Revised : Date, Month
Accepted: Date, Month

ABSTRACT

Construction projects are growing wider and more complex in terms of physical and cost. In practice, a project has limited resources in people, materials, costs, or tools. Construction project must have quality control to guatantee safety worker. However, even though technical specifications have been prepared, deviations in quality during construction project implementation always occur, so that the quality of the resulting building does not comply with the quality requirements that have been set and causes the low quality of human resources in the construction world Factors causing quality control in this study can directly or indirectly affect the project. This research began with data collection through the process decision program chart method and questionnaire method, distributed to project warehouse PT Santos Jaya Abadi, with the respondents from project managers to workers. Furthermore, the collected data questionnaires were analyzed using the Process Decision Program Chart Method dan Microsoft Excel. The analysis quality control and analysis risk show that quality control have a effective and well implemented in project contruction, with the result in structure work such as beam work and column work have the same percentage of 76% and floor plate work has a percentage of 72%. While on structure work such as beam has risk level value 7.49, column structure work with a value of 7.42, floor plate structure work with a value of 6.43

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INTRODUCTION

Construction projects are growing wider and more complex in terms of physical and cost. In practice, a project has limited resources in people, materials, costs, or tools. This requires project management from the initial project stage to the project completion stage. With the increasing project complexity and increasingly scarce resources, improving a superior and integrated project management system is also necessary. (Nugroho et al., 2020).

Along with the rapid development of the construction world today, competition in the construction world is also getting tighter so that guarantees and control over quality are demanded higher. One form of realization in the face of competition and to meet these demands is to prepare a quality assurance system. Quality assurance is a systematic step needed to provide confidence that the work to be realized can meet the desired standards. Within the scope of construction projects, quality assurance in the form of technical requirements/specifications and drawings is described in a Work Plan and Requirements document prepared by the planning consultant.

However, even though technical specifications have been prepared, deviations in quality during construction project implementation always occur, so that the quality of the resulting building does not comply with the quality requirements that have been set and causes the low quality of human resources in the construction world. A news article in the Kompas Daily Newspaper at 02 November 2020 with the article title Number of Human Resources in the Construction World in Indonesia is Low, informs that the quality of construction in Indonesia is still very low. One of the factors is negligence in construction projects, namely in the planning stage, implementation stage, and supervision stage (Ahmad, 2019)

Based on the facts above, to achieve work results following the quality requirements set out in the technical specifications, quality control is needed. Quality control is an activity that includes monitoring, checking, and testing to control and ensure that the quality of materials, implementation methods, and project work results are following established technical specifications.

In the implementation of quality control, there are often several obstacles. This causes delays in the implementation of construction projects, which impact the achievement of project performance. Internal factors or external factors can cause these obstacles or constraints. In the implementation of construction projects, quality control is needed so that the projects carried out can run well according to the plan.

Implementing a construction project is a series of the activities between one job and another. The bigger the project, the greater the risk it will face. So the use of quality control in construction companies will result in a one-time job to prevent rework. If quality control is carried out properly, it will avoid quality that exceeds the specifications stated in the contract to avoid unnecessary costs (Santosa et al., 2019).

The importance of quality control in the construction project, control can be interpreted by the determination of the process that has been achieved. Improvement and evaluation of work need to be carried out so that quality

control can be used as an evaluation step for the performance that has been carried out in carrying out quality control. Quality control on projects is usually carried out with measurements made by using a tick on a certain check sheet to evaluate the quality process management step that will occur or specifications and criteria as the selected step. With this, a project that will be involved has a certain target for achieving project quality as desired by consultants, contractors, and owners.

Project development warehouse PT Santos Jaya Abadi is one of the projects currently implementing a quality control system. To find out the implementation of the quality control system at the construction development of PT Santos Jaya Abadi, an analysis of quality control was carried out and what factors were the obstacles to its implementation. Because the warehouse construction project found risk factors that cause the work achieved is not optimal, this is what underlies the author to conduct research related to quality control.

THEORETICAL REVIEW

Making Fishbone Diagram

Fishbone diagram is an approach to identify various potential causes of an effect or problem, and analyze the problem through brainstorming sessions. Problems will be broken down into a number of related categories, including people, materials, machines, procedures, policies, and so on. Each category has causes that need to be explained through a brainstorming session.

The steps taken at the fishbone diagram stage are as follows:

a. Define a problem.
b. Identify categories.
c. Finding the potential causes of each category.
d. Conduct a study of the most likely causes

Making Process Decision Program Chart

Process Decision Program Chart is a diagram to map activity plans along with situations that may occur so that Process Decision Program Chart is not only made to solve a final problem but also to cope with risk surprises that may occur. In other words, Process Decision Program Chart is used to plan scenarios. If, in a certain situation, there is a problem, we have planned how the problem is likely to be solved so that we are ready to handle it

Data Collection Technique

At this stage, the data needed for analysis and report generation for this research includes primary data and secondary data. The primary data needed in the data collection stage is the result of direct observation and questionnaires to related parties to determine the level of risk that can cause quality control in the implementation of structural work to be less than optimal.

Questionnaires are information obtained by collecting data needed in research by directly asking construction workers at the project construction

warehouse PT Santos Jaya Abadi and filling in the data through questionnaires distributed to construction workers.

Observation is the observation of a work process in a construction project, then understanding the knowledge of a phenomenon based on previously known knowledge to obtain the information needed on the project construction warehouse PT Santos Jaya Abadi.

Secondary data needed in the data collection stage is the work plan and technical terms and detail engineering design. The secondary data was obtained indirectly through the contractor PT Prambanan Dwipaka to determine the quality control and implementation of work on the construction project of PT Santos Jaya Abadi.

Analysis Level of Risk

Risk analysis is to determine the magnitude of a risk which is reflected in the likelihood and severity of it. According to AS/NZS 4360 Risk analysis is an opportunity for an event to have an effect on an object. Risk assessment is intended to determine the magnitude of a risk probability of occurrence likehood, severity or consequences.

Probability	Consequence				
	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Figure 3. Risk Rating

A simple way is to create a risk rating like the example above where the likelihood and severity rating is given a value between 1-5. The risk value can be obtained by switching between probability and severity, which is between 1-25. From the picture above, a risk rating can be made, for example:

Data processing was carried out using tables obtained from distributing questionnaires to research needs. While data were analyzed based on Risk Ratings. To determine risk assessment by first estimating the value of consequences and opportunities. The risk value can be calculated manually, based on the formula Impact x Probability to get score for assement analysis risk.

Analysis Performance Quality Control

Risk management from AS/NZS 4360 have standard has been utilized before to give an overview of specific risk management methods for concurrent engineering projects. Besides that we have the freedom to use which rules are used to determine the risk category of a construction project

According to Nurrohmah (2020), the score interpretation criteria based on respondents' answers can be determined as follows: the maximum score for each questionnaire is 5 and the minimum score is 1, or ranges from 1% to 100%. Then the range between scores is 19%. So that the following criteria are obtained.

Table 1. Interpretation Score

Scale	Category
1% - 20%	Not Effective
21% - 40%	Less Effective
41% - 60%	Moderately Effective
61% - 80%	Effective
81% - 100%	Highly Effective

The interpretation of this score is obtained by comparing the impact item score obtained based on the respondent's answer divided by the maximum score of the answer then multiplied by 100%

METHODOLOGY

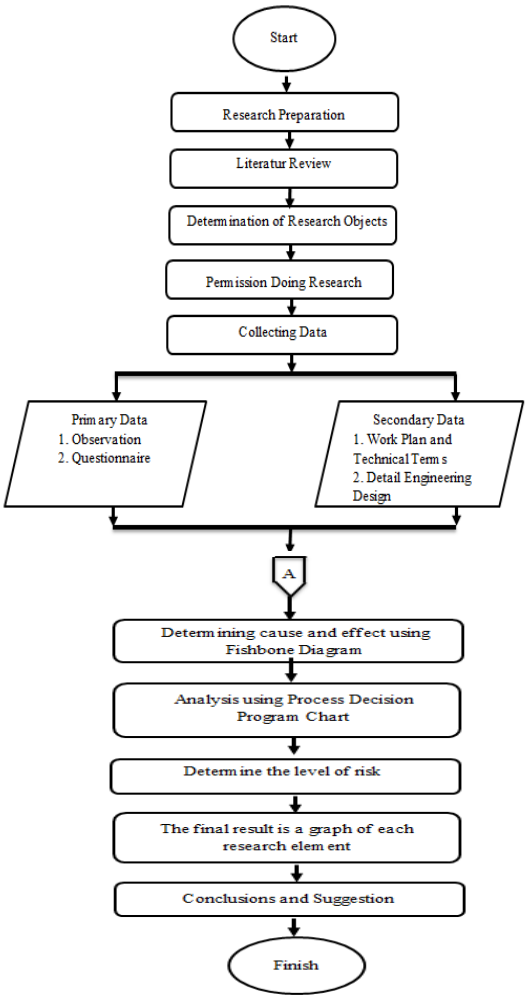

Figure 1 Flowchart

The stages in data analysis are a sequence of research steps carried out systematically and logically so that the right analysis can be obtained to achieve the author's goals. The following are the stages of the sequence of analysis in this study.

1. Research Preparation Stage: The preparation stage is carried out by collecting source materials and regulations related to the preparation of research reports.
2. Literature Review Stage: Literature study is a stage to find references or theories that are relevant to the problems or cases found in doing the final project. The literature study was carried out comprehensively using sources from previous journals and other references related to the topic taken.
3. Determination of Research Objects: Research at this stage, the following things are carried.
4. Permission Doing Research Stage: At this stage, administrative licensing is carried out to conduct research and obtain data from the construction service provider.
5. Collecting Data Stage: At this stage, the data needed for analysis and report generation for this research includes primary data and secondary data. Primary data is a source of research data obtained directly from the source. Secondary data is a source of research data obtained by researchers indirectly through intermediary media.
6. Analysis Stage: At this stage the data obtained will be analyzed using the Process Decision Program Chart method. The steps taken at this stage are as follows.
7. Conclusion and Suggestion Stage: The data that has been analyzed will make a conclusion that is in accordance with the objectives of this study so that it can provide suggestions to related parties to maximize the quality of implementation of the project to get the desired quality. For more details, the research stages can be seen in the research flow chart

RESULTS

Fishbone Diagram

Fishbone diagrams or cause and effect diagrams show the relationship between the problem at hand and its possible causes and influencing factors. Identification of risks that may occur in a construction project activity is vital in quality control of construction projects. Techniques used in risk identification include discussions, observations, interviews, historical information, and others.

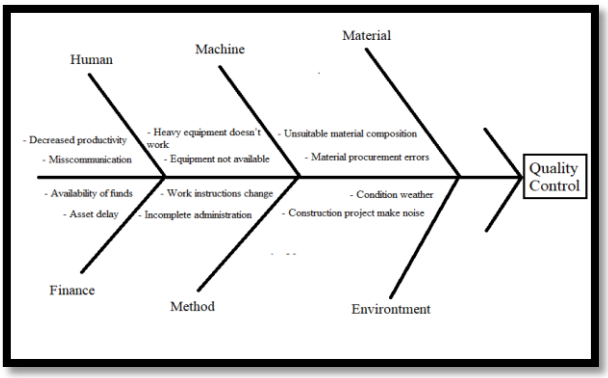

Figure 4. Fishbone Diagram

After knowing the types of problems that occur, it is necessary to take corrective measures to prevent the emergence of similar problems or work accidents. The important thing to do and explore is to find the cause of the defect. As a tool to find the cause of the defect, a cause and effect diagram is used or called a fishbone diagram

Process Decision Program Chart

The process decision programm chart in this research is integrated with the stage of the fishbone diagram. Process decision programm chart helps companies to avoid unexpected factors and identify whether the solutions that have been formulated to be applied in the company. The process decision programme chart was obtained by conducting interviews and brainstorming with the quality control manager of the PT Santos Jaya Abadi warehouse construction project. They are six factor researcher found from fishbone diagram, and then to solve problem that found use process decision programm chart. The sic factors are material, machine, human, environment, method, and finance.

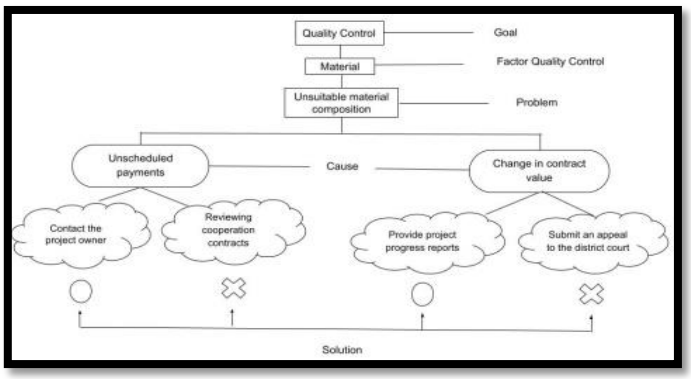

Figure 5. Process Decision Program Chart Material

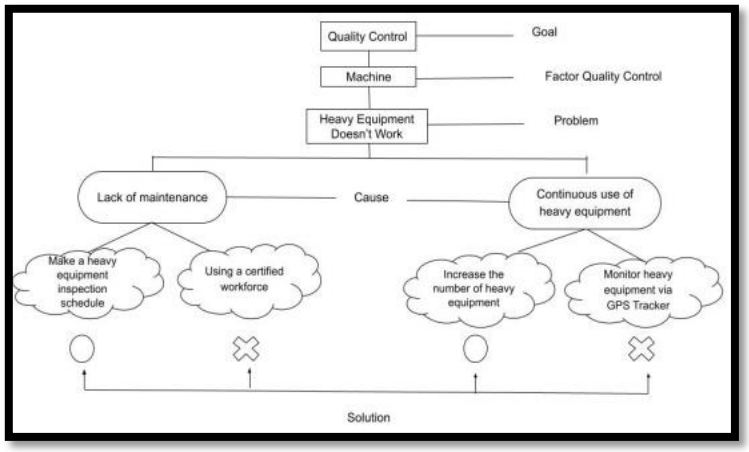

Figure 5. Process Decision Program Chart Machine

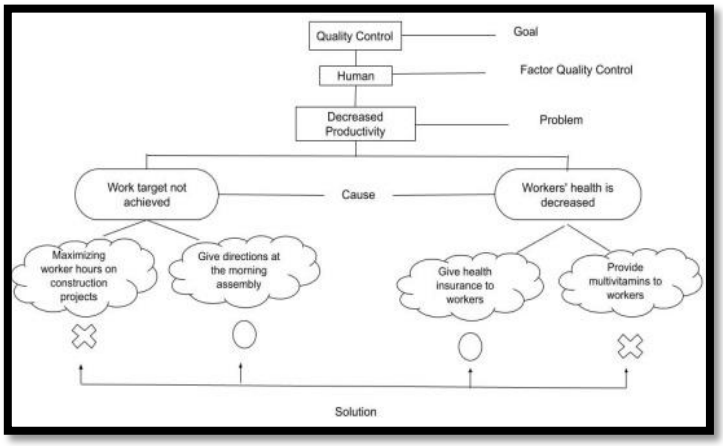

Figure 6. Process Decision Program Chart Human

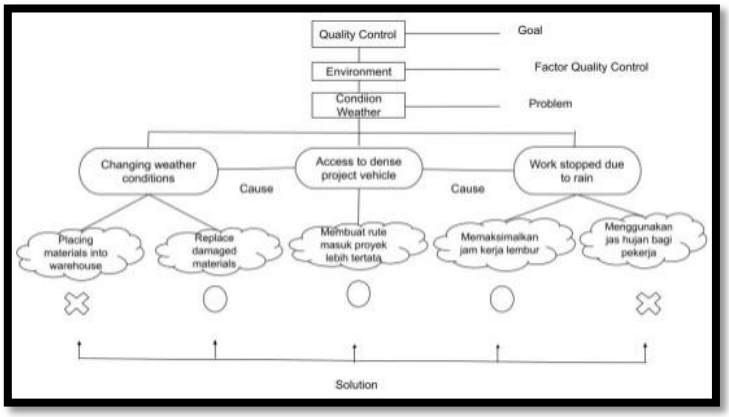

Figure 7. Process Decision Program Chart Environment

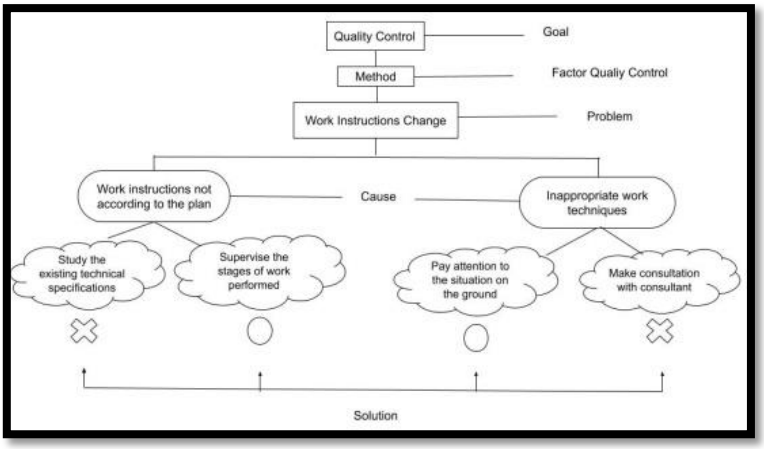

Figure 8. Process Decision Program Chart Method

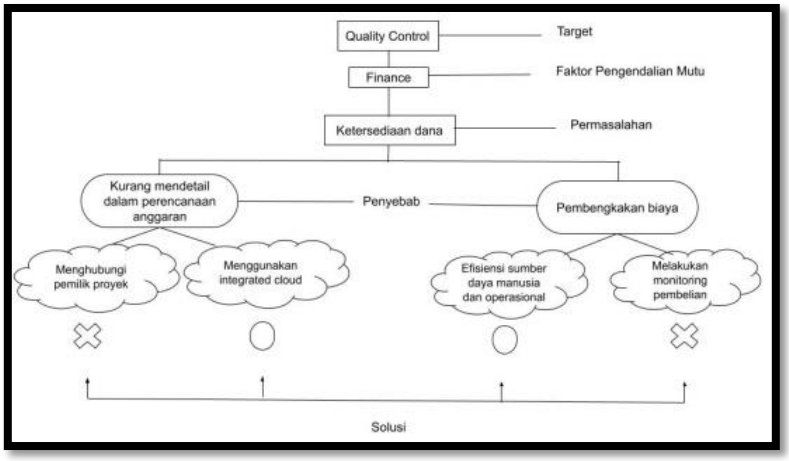

Figure 9. Process Decision Program Chart Finance

The result of the analysis is the risk level value obtained from the questionnaire that has been obtained in the PT Sanros Jaya Abadi warehouse construction project area, with the assessment results obtained will be used to determine the level of risk of work on the structure under review. The results of the recapitulation of the questionnaire assessment of each work item that has been obtained are as follows:

Analysis Risk

The risk assessment came from a questionnaire that had been distributed to workers on the construction project. The structural works carried out were concreting, fixings, and casting. The risk level is derived from the likelihood assessment multiplied by the likelihood of impact. The risk level obtained will be used for the risk category for each job.

Table 2. Assesment of Risk Levels Work

No	Item Structure Work	Level Risk
1	Reinforcing Column	6,91
2	Formwork Column	6,82
3	Casting Column	8,54
4	Reinforcing Beam	7,13
5	Formwork Beam	7,72
6	Casting Beam	7,62
7	Reinforcing Floor Plate	5,93
8	Formwork Floor Plate	4,88
9	Casting Floor Plate	8,49

In determining the risk analysis. the highest assessment is the column casting work with a risk level of 8.54 and is a moderate risk category. then for the floor plate pembekestingan has the lowest risk level of 4.88 with a low risk category

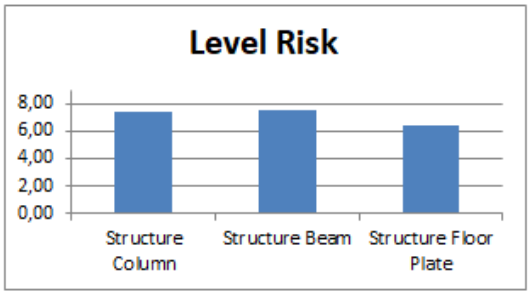

Figure 10. Bar Chart Risk Level

From Figure 10, it can be explained that the implementation of existing work on the PT Santos Jaya Abadi warehouse construction project shows that floor plate work has the lowest risk level with 6,43, floor plate work implements quality management properly and in accordance with specifications and work plans so that the effect of failure and deviation of quality control can be avoided. The results for columns and beams are in the medium risk category, although having a higher from floor plate risk category does not mean stating the results of the implementation of the work are not good but it will be even better so that its implementation can minimise the risk of failure or deviation in quality control. The value for column 7,42 and for beam 7,49.

Analysis Quality Control Successes

Table 3 Assesment Quality Control Successes

No	Indicator	Value	Caption
1	Reinforcing Work	79%	Effective
	Fixing Work	69%	Effective
	Casting Work	79%	Effective
2	Reinforcing Work	80%	Effective
	Fixing Work	76%	Effective
	Casting Work	72%	Effective
3	Reinforcing Work	67%	Effective
	Fixing Work	63%	Effective
	Casting Work	85%	Very Effective
Average		74%	Effective

In determining whether the quality control carried out is successful or not based on the impact assessment. The floor plate casting work has the best percentage with a value of 85%, while the floor plate decking work has the lowest percentage of 63%.

DISCUSSION

Based on the results of the assessment through questionnaires that have been carried out on the PT Santos Jaya Abadi Surabaya warehouse construction project, the results of the analysis are obtained using the AS/NZS 4360 measurement scale. Overall the research results obtained from the analysis are as follows:

Table 4 Risk Level of Structural Work

No	Item Structure Work	Level Risk
1	Structure Column	7,42
2	Structure Beam	7,49
3	Structure Floor Plate	6,43

Based on table 4.49, the implementation of column work has a risk level of 7.42 with a moderate category risk level. Then the implementation of the beam work is 7.49 with a medium category risk level. And the implementation of the Floor Plate work is 6.43 with a medium category risk level.

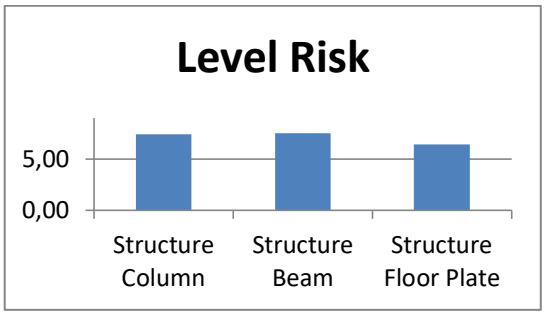

Figure 4.16 Bar Chart Risk Level of Structural Work
(Source: Processed by Researchers, 2023)

From the figure 4.16, it can be explained that the implementation of existing work on the PT Santos Jaya Abadi warehouse construction project shows that floor plate work has the lowest risk level with the data in table 4.28. With the smallest value, floor plate work implements quality management properly and in accordance with specifications and work plans so that the influence of failures and deviations in quality control can be avoided. Similarly, column and beam work are in table 4.26 and table 4.27. The results of table 4.26 and table 4.27 are in the medium risk category, although having a higher risk category compared to table 4.28 does not mean stating the results of the implementation of the work are not good but it would be better so that the implementation can minimise the risk of failure or deviation in quality control. If the implementation method used is not appropriate, it will affect the quality of work where the results of the work carried out must meet the specifications and criteria to be achieved. However, when making observations in the field, there are workers who underestimate the quality when doing casting work which results in reduced concrete strength.

Table 5 Value Impact Structure Work

No	Indicator	Value Impact
1	Reinforcing Work	3,93
	Fixing Work	3,47
	Casting Work	3,93
2	Reinforcing Work	4
	Fixing Work	3,8
	Casting Work	3,6
3	Reinforcing Work	3,33
	Fixing Work	3,13
	Casting Work	4,27

Table 6 Recapitulation of Quality Control Successes

No	Item Structure Work	Indicator	Value		Explanation
			Scale	%	
1	Structure Column	Reinforcing Work	3,93	79	Effective
		Fixing Work	3,47	69	Effective
		Casting Work	3,93	79	Effective
2	Structure Beam	Reinforcing Work	4,00	80	Effective
		Fixing Work	3,80	76	Effective
		Casting Work	3,60	72	Effective
3	Structure Floor Plate	Reinforcing Work	3,33	67	Effective
		Fixing Work	3,13	63	Effective
		Casting Work	4,27	85	Very Effective

Quality control of a construction project is one of the steps that can be used to control the risk of each job. Quality control is the shared responsibility of all workers in the construction project environment, The results of data processing based on the impact assessment of each job obtained from the questionnaire. Based on the assessment carried out, the casting work on the floor plate has the highest percentage, namely 85%, which is the result of the calculation of 4.27/5 so that the implementation of quality control is very effective because it is in the range of 81%-100%. Then the floor plate decking work has the lowest percentage of 63% which is the result from a calculation of 3.13/5. However, despite having the lowest percentage, the implementation of quality control is effective because it is in the range of 61%-80%. Then in table 4.51 is the implementation of overall quality control on column, beam, and floor plate work. In table 4.51, the implementation of quality control in the PT Santos Jaya Abadi warehouse project has a percentage of 74% because it is in the range of 61%-80%, so quality control is carried out effective.

Table 7 Quality Control Results

No	Item Structure Work	Value		Explanation
		Scale	%	
1	Structure Column	3,78	76	Effective
2	Structure Beam	3,80	76	Effective
3	Structure Floor Plate	3,58	72	Effective
Average		3,72	74	Effective

In carrying out quality control, it is necessary to supervise the quality by looking at various factors in the implementation of construction projects. One of them is the materials and equipment that will be used in construction projects need to be considered and in accordance with technical specifications. Management is a factor that affects the quality in the implementation of construction projects. So in the implementation of construction projects it is necessary to have quality management in materials and equipment as well as labour control by preparing efficient plans. The quality of the work on a project is influenced by the quality of the materials used

CONCLUSIONS AND RECOMMENDATIONS

Based on research conducted on quality control in the PT Santos Jaya Abadi Warehouse Construction Project, it is concluded that the implementation of the overall structural work process has been successfully directed, implemented, and controlled the entire series of activities optimally. Based on the assessment that has been carried out on the structural work of beams, columns, and floor plates. In beam work and column work has the same percentage of 76% in the effective category because it is in the value range of 61% - 80%. The floor plate work has a percentage of 72% in the effective category because it is in the value range of 61% - 80%. And in the PT Santos Jaya Abadi warehouse construction project for the highest risk level, it is obtained that the beam structure work has the highest risk level with a value of

7.49 in the medium category because it is in the value range of 5.00 - 9.99, then the next risk level is column structure work with a value of 7.42 in the medium category because it is in the value range of 5.00 - 9.99, and the lowest risk level is floor plate structure work with a value of 6.43 in the medium category because it is in the value range of 5.00 - 9.99.

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FURTHER STUDY

In risk research on projects, there are suggestions for building and improving further research related to work risks on construction projects. The suggestions are as follows:

1. The research location can be carried out on construction projects for the construction of bridges, roads, drainage or other constructions.
2. Quality control research conducted from the beginning to the end.
3. Data processing of the study was carried out using dRofus BIM software for efficient project validation.
4. Research using other methods combined with the Process Decision Program Chart Method.

ACKNOWLEDGMENT

For the first and foremost, the writer would like to express her deepest gratitude for Almighty God, Jesus Christ for his marvelous and amazing grace, for the countless blessings and love so the writer has finally completed this thesis. This thesis is aimed to fulfill one of requirements for the bachelor of Civil Engineering Department, Faculty of Engineering, University 17 Agustus 1945 Surabaya (UNTAG). The writer is also expressing her extremely grateful to the following people:

- Faradlillah Saves, S.T., M.T. as the Head of the Civil Engineering Study Program, University of 17 Agustus 1945 Surabaya
- Michella Beatrix, S.T., M.T., Advisory Lecturer First that had given her a great guidance through her Academic years and had already motivated her to finish the Thesis by giving advices, comments, and corrections that has made her learn many new things in Academic.
- Masca Indra Triana, S.T.,M.S.M., Advisory Lecturer Second that had given her the kindness, guidance, support, comments, and information to improve her writing.
- All the Lecturers of Civil Engineering Department, Faculty of Engineering, State University 17 Agustus 1945 Surabaya, who taught and given knowledges, encouragement, and invaluable advices for her to complete this Thesis.
- All friends in BCP Civil Engineering 2019 for memorable time that had spent with laughter, love, happiness and motivation. The last but not least her special thanks for Everyone who cannot be counted and mentioned one by one for staying and coloring her life each day.

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