Analysis of the Causes of Change Order in Housing Project Implementation in Banjarmasin (Case Study on Citra Land Housing)

Hendra Prasetya¹, Irfan Prasetia² Civil Engineering Study Program, Engineering Faculty, University of Lambung Mangkurat

Abstract:- In the CitraLand Banjarmasin residential project, there are several things that arise due to change orders, such as additional costs and work completion times. In addition, there may also be disputes in the field between workers and supervisors and management. This is unavoidable as a result of the emergence of changes that make the rhythm and flow of the work process also change, such as the change in the design of the facade of the house that occurred in the middle of the construction process.

The factors that cause change orders are divided into 3 groups of variables, namely construction, administration and resources. This study aims to determine the factors that cause change orders in the implementation of the CitraLand Banjarmasin housing project. For this purpose, it is necessary to collect primary and secondary data. Primary data uses 2 types of data, namely data from interviews with questionnaires to respondents and field observations. The data from the interviews are the perception data of respondents who make an assessment of the factors causing the change order.

Then the observation data aims to obtain the actual situation and condition of contractors and service users. So that later it can be used as a reference in making strategies to avoid change orders. Analysis of the questionnaire data using the Relative Importance Index (RII) method to obtain the dominant factor causing the change order. Furthermore, the dominant factors obtained will be used for the preparation of prevention strategies based on interviews and discussions with the owner, namely PT. Cita Citra Lestari and contractors implementing the CitraLand residential housing project in Banjarmasin.

The results showed that the dominant factor causing the change order was a construction factor consisting of planning and design errors, discrepancies between drawings and field conditions. And then the resource factor, namely materials that are not available in the market. This is in line with some findings in the field, such as errors in the selection of materials used in canopy and carport work.

Keywords:- Change Order, RII, Housing Project.

I. INTRODUCTION

In the CitraLand Banjarmasin residential project, there are several things that arise due to change orders, such as additional costs and work completion times. As in the case above, changes in work or commonly referred to as change orders will often occur as a construction project progresses. So it will be difficult to find in an implementation of a construction project where there is no change in work until the project is completed (Nunnaly, 1993). Change orders themselves can occur at the beginning of project implementation, mid-project, or even at the end of the project and can also occur at all stages of construction project implementation work. So there will be many factors that cause change orders with different characteristics and will not be the same for every construction project implementation. (Gumolili and Rantung, 2012).

Change order is a proposed change in writing between the owner and contractor to change several conditions from the initial contract document, such as adding, reducing work, this change can change the specification of contract costs and payment schedules, project schedules. Change orders can be defined as modifications of the original contract (Schaufelbeger & Holm, 2002). According to Fisk (2006) a change order is a letter of agreement between the project owner and the contractor to confirm the revisions and the amount of cost compensation to the contractor that occurred during construction, after the signing of the work contract between the owner and the contractor. Meanwhile, according to Widhiawati (2016), a change order is a written agreement signed by the owner, contractor, and also the planner to modify or make changes to the work that has been regulated in the contract document where the change can be considered, resulting in an adjustment to the cost and time of the work.

The impact of change orders can affect the smooth implementation of construction work, both in terms of cost and time. In the cost aspect, the project costs can swell, while in the time aspect, the project will take longer than the initial contract. Several research examples have revealed that the costs incurred as a result of change orders are quite significant. According to Rahman (1995) said that the cost of nonconformance in a highway project he studied was 5% of the contract value. In another study on nine projects (Burati et al, 1992) it was stated that the average cost incurred to correct quality problems was 12.4% of the

ISSN No:-2456-2165

contract value. Meanwhile, according to (Barber et al, 2000) even found costs due to quality failure to reach 25% of the contract value.

According to Berrie (1992), the effect of change orders on project implementation is divided into 3 (three) categories, namely: direct costs, time extensions and impact costs. According to Hanna (2002) states that the effect of change orders on a construction project often results in productivity loss, if there is a productivity loss there will be a significant increase in project time and cost. According to Schaufelberger and Holm (2002), if there is a change order, there will be an additional workforce accompanied by the addition of project equipment.

Based on previous research by Gumolil (2012), where the magnitude of the factors that cause change orders to the performance of the construction project implementation time is 88.4% and the dominant factor is the discrepancy between the image and the field conditions. While the remaining 11.6% is a factor or variable that is not examined. The second study by Zentenno (2021), where the factors that cause CCO to cost performance on national strategic project (PSN) toll road works are 80.9% with the dominant factor being the factor during the construction period. While the remaining 19.1% was obtained from outside the variable model, in the analyzed regression. Subsequent research by Muluk (2018), where the dominant factor causing change orders on road construction projects in Sumatra that was obtained was a mismatch between drawings and field conditions with a presentation value of 88%. Then other factors are the occurrence of landslides. the acceleration of the execution time of the work due to the owner's request to finish quickly, and the problem of land acquisition.

The impact of the change order on the CitraLand Banjarmasin residential project also caused disputes in the field between workers and supervisors and management. This is unavoidable as a result of the emergence of changes that make the rhythm and flow of the work process also change, such as the change in the design of the facade of the house that occurs in the middle of the construction process. Then there are several clusters that have housing units larger than the standard, namely the corner/hook type. And then in the initial tender, all housing units are calculated with the same area. So this also gives rise to a change order for the job. As a result of all that, it will make a loss for all parties involved.

The character of this project is very different from other building projects in general. In the CitraLand Banjarmasin residential building project, there are 2 types of contracts given to implementing contractors, namely several housing units in 1 cluster that can be given in 1 unit of Work Order (SPK) and some are in the form of SPK per house unit. However, in general, 1 SPK given is the construction of several housing units in 1 cluster. However, the last cluster with housing units with a building area of more than 200 m2 to 300 m2 has 1 SPK for each house. Then, there may be a design change after the work begins due to the request of the owner of the housing unit or a design change that is directly requested by the owner to the implementing contractor. In addition, the payment contract system for this project is in the form of terms based on field progress. Where there is a down payment (DP) given to the contractor after the SPK is signed by both parties and there is a maintenance period which is worth 5% of the value of the work contract.

II. METHOD

A. Primary Data Collection

The primary data used in this study used 2 types of data, namely data from interviews with questionnaires to respondents and field observations. The data from the interviews are the perception data of respondents who make an assessment of the influence of factors on the occurrence of change orders. While the observations to be made aim to obtain the actual situation and condition of the contractors and service users. So that later it can be used as a reference in making strategies to avoid change orders.

B. Secondary Data Collection

Secondary data used in this study are letters and reports consisting of Work Orders (SPK), Budget Plans (RAB), and Time Schedules. This data is used to confirm that there has been a negative impact on the project due to change orders such as additional costs, delayed completion time, disputes in the field, etc.

C. Dominant Factor Analysis

The data that has been presented in the frequency distribution table is then analyzed using the Relative Importance Index (RII) method to determine the level of importance for each factor causing the change order and then compiled in a ranking system. The highest RII value is given the first rank, which means that this factor is the most important factor in causing change orders and vice versa.

D. Prevention Strategy

After obtaining the dominant factors that influence the change order from the results of questionnaire data processing using the Relative Importance Index (RII) analysis, field observations were then carried out to see the correlation of the dominant factors to the actual condition. This will help in formulating prevention strategies based on the results of interviews and discussions with the owner and implementing contractors.

III. RESULTS AND DISCUSSION

A. Validity dan Reability Test

a) Validity Test

Before conducting the validity test, the respondent first conducted a recapitulation of the results of filling out the questionnaire. Then the results of the validation of the variables can be tested by comparing the correlation coefficient of Spearman's rank with the critical value in question. The critical value referred to α 0.05 is 0.334 obtained from the results of the first validity test of 35 respondents as

shown in Table IV.6. The results of the first Validity Test on the factors causing the change order. It is known that the value of the Spearman Rank correlation coefficient (*R*) is greater than the critical value ($R_{0.05} = 0.334$) so it can be concluded that there are 2 question items declared invalid.

Questions that are declared invalid will be deleted and a validity test will be carried out again as shown in Table 1 Results of the second Validity Test on the factors causing the change order.

No	Indicator	Variable	R	Conclusion
Α.	Construction Factor			
1	Planning and design mistakes	X1	0,427	Valid
2	Change of work method	X3	0,797	Valid
3	The discrepancy between the picture and the field conditions	X5	0,529	Valid
4	Unclear details	X6	0,401	Valid
5	Incomplete field investigation	X7	0,719	Valid
6	Additional requirements of dungeon repair	X8	0,789	Valid
7	Improved dungeon investigation	X9	0,780	Valid
8	Different underground conditions	X10	0,690	Valid
9	Security Considerations		0,872	Valid
10	Landslide	X12	0,587	Valid
11	Flood	X13	0,788	Valid
12	Land Subsidence	X14	0,767	Valid
В.	Administration Factor			
13	Improvements to urban planning regulations	X15	0,762	Valid
14	Political considerations	X16	0,596	Valid
15	Dominate superior authority	X17	0,482	Valid
16	Adding facilities for the neighborhood	X18	0,628	Valid
17	Special request from city council	X19	0,739	Valid
18	Contract conflicts and disputes	X20	0,556	Valid
19	Lack of team work	X21	0,734	Valid
20	Lack of information about the state of the field	X22	0,713	Valid
21	Lack of anticipation of sudden situations	X23	0,614	Valid
22	Late delivery of materials	X24	0,523	Valid
23	Late in approving pictures	X25	0,756	Valid
24	Contractor's schedule is late	X26	0,852	Valid
25	Subcontractor's schedule is late	X27	0,822	Valid
26	Another unexpected factor	X28	0,711	Valid
С.	Resource Factor		-	
27	Work not according to procedure	X29	0,807	Valid
28	Wrong judgment in the field	X30	0,869	Valid
29	Low skill of workers	X31	0,892	Valid
30	Poor contractor performance	X32	0,874	Valid
31	Poor subcontractor performance	X33	0,843	Valid
32	Materials not available in the market	X34	0,507	Valid
33	Labor dispute	X35	0,772	Valid
34	Errors in the execution of work	X36	0.813	Valid

Table 1: Results of the second Validity Test on the factors causing the change order

b) Reliability Test

The reliability test was carried out by comparing Cronbach's alpha (α) with the minimum value of reliability. If the value of $\alpha > 0.600$ (Table of Reliability) is declared reliable. The reliability test was carried out with the data from the validity test results with the results stating that all question items were declared valid, namely in Table 1. The results of reliability testing can be seen in Table 2.

No	Indicator	Variable	R	Conclusion			
A.	Construction Factor						
1	Planning and design mistakes	X1	0,973	Reliable			
2	Change of work method	X3	0,971	Reliable			
3	The discrepancy between the picture and the field conditions	X5	0,972	Reliable			
4	Unclear details	X6	0,973	Reliable			
5	Incomplete field investigation	X7	0,971	Reliable			
6	Additional requirements of dungeon repair	X8	0,971	Reliable			
7	Improved dungeon investigation	X9	0,971	Reliable			
8	Different underground conditions	X10	0,971	Reliable			
9	Security Considerations	X11	0,971	Reliable			
10	Landslide	X12	0,972	Reliable			
11	Flood	X13	0,971	Reliable			
12	Land Subsidence	X14	0,971	Reliable			
В.	Administration Factor						
13	Improvements to urban planning regulations	X15	0,971	Reliable			
14	Political considerations	X16	0,972	Reliable			
15	Dominate superior authority	X17	0,972	Reliable			
16	Adding facilities for the neighborhood	X18	0,972	Reliable			
17	Special request from city council	X19	0,971	Reliable			
18	Contract conflicts and disputes	X20	0,972	Reliable			
19	Lack of team work	X21	0,972	Reliable			
20	Lack of information about the state of the field	X22	0,972	Reliable			
21	Lack of anticipation of sudden situations	X23	0,972	Reliable			
22	Late delivery of materials	X24	0,973	Reliable			
23	Late in approving pictures	X25	0,971	Reliable			
24	Contractor's schedule is late	X26	0,971	Reliable			
25	Subcontractor's schedule is late	X27	0,971	Reliable			
26	Another unexpected factor	X28	0,972	Reliable			
С.	Resource Factor						
27	Work not according to procedure	X29	0,971	Reliable			
28	Wrong judgment in the field	X30	0,971	Reliable			
29	Low skill of workers	X31	0,970	Reliable			
30	Poor contractor performance	X32	0,971	Reliable			
31	Poor subcontractor performance	X33	0,971	Reliable			
32	Materials not available in the market	X34	0,972	Reliable			
33	Labor dispute	X35	0,971	Reliable			
34	Errors in the execution of work	X36	0,971	Reliable			

Table 2 Reliability Test Results on the factors that cause change orders

ISSN No:-2456-2165

B. Interest Level Analysis Using the Relative Importance Index (RII) Method

No	Indicator	Variable Respondent's Answer					er	Total	рп	Conductor
INO	Indicator	variable	ТВ	KB	CB	B	SB	Total	KII	Conclusion
A.	Construction Factor	•								
1	Planning and design mistakes	X1	2	1	4	7	21	35	0.8514	Very important
2	Change of work method	X3	9	0	10	6	10	35	0.6457	Quite important
3	The discrepancy between the picture and the field conditions	X5	0	2	4	4	25	35	0.8971	Very important
4	Unclear details	X6	3	3	4	6	19	35	0.8000	Important
5	Incomplete field investigation	X7	5	1	7	10	12	35	0.7314	Important
6	Additional requirements of dungeon repair	X8	7	1	6	13	8	35	0.6800	Important
7	Improved dungeon investigation	X9	7	2	5	8	13	35	0.7029	Important
8	Different underground conditions	X10	6	2	3	9	15	35	0.7429	Important
9	Security Considerations	X11	6	2	5	5	17	35	0.7429	Important
10	Landslide	X12	10	3	2	2	18	35	0.6857	Important
11	Flood	X13	11	3	2	4	15	35	0.6514	Important
12	Land Subsidence	X14	7	3	4	2	19	35	0.7314	Important
B.	Administration Factor									
13	Improvements to urban planning regulations	X15	10	3	5	6	11	35	0.6286	Quite important
14	Political considerations	X16	16	3	8	6	2	35	0.4571	Quite important
15	Dominate superior authority	X17	5	3	4	9	14	35	0.7371	Important
16	Adding facilities for the neighborhood	X18	10	3	7	6	9	35	0.6057	Quite important
17	Special request from city council	X19	14	3	7	4	7	35	0.5257	Quite important
18	Contract conflicts and disputes	X20	5	2	5	11	12	35	0.7314	Important
19	Lack of team work	X21	6	3	9	5	12	35	0.6800	Important
20	Lack of information about the state of the field	X22	4	1	8	5	17	35	0.7714	Important
21	Lack of anticipation of sudden situations	X23	5	2	14	4	10	35	0.6686	Important
22	Late delivery of materials	X24	8	4	6	1	16	35	0.6743	Important
23	Late in approving pictures	X25	8	1	8	6	12	35	0.6743	Important
24	Contractor's schedule is late	X26	8	2	8	2	15	35	0.6800	Important
25	Subcontractor's schedule is late	X27	9	2	8	2	14	35	0.6571	Important
26	Another unexpected factor	X28	3	3	12	5	12	35	0.7143	Important
B.	Resource Factor									
27	Work not according to procedure	X29	8	1	7	6	13	35	0.6857	Important
28	Wrong judgment in the field	X30	7	1	7	6	14	35	0.7086	Important
29	Low skill of workers	X31	7	3	8	2	15	35	0.6857	Important
30	Poor contractor performance	X32	7	2	11	2	13	35	0.6686	Important
31	Poor subcontractor performance	X33	8	3	9	2	13	35	0.6514	Important

Continuation of Table 3

No	Indicator	Variable	Respondent's Answer					Total	RII	Conclusion
110			TB	KB	CB	В	SB	Total		Conclusion
32	Materials not available in the market	X34	3	1	2	11	18	35	0.8286	Very important
33	Labor dispute	X35	16	3	8	5	3	35	0.4629	Quite important
34	Errors in the execution of work	X36	8	3	7	5	12	35	0.6571	Important

Table 3: Results of the analysis using RII Method of the factors causing change orders

Based on the results of the analysis using the Relative Importance Index (RII) method, this study will use measurement criteria with a value range of 0.8001 to 1.0000 which is declared very important. This is because the factors obtained in that range have an influence on other factors with the value of the range below it. So that it can be seen that the dominant factor causing change orders in the CitraLand Banjarmasin residential development project is the construction factor which consists of planning and design error variables (X_I) , discrepancies between drawings and field conditions (X_5) , and resource factors consisting of of material variables that are not available in the market (X_{34}) . After getting the results from the analysis and observations, it is possible to make strategies to avoid the occurrence of change orders in the future on similar projects.

C. Field Observation on Factors Causing Change Order

Construction Factor

- Making a canopy in front of the house which is arranged using a wooden frame along with a transparent roof covering made of polycarbonate. This results in wood that is easily porous and a transparent roof that gets dirty easily during the rainy season. So this is included in the planning error in the selection of the material used.
- The use of brushed coral on the carport floor in the front of the house. This also results in the carport floor being easily dirty and mossy during the rainy season. So this is included in the planning error in the selection of the material used.
- ➤ The sloof structure on the fence behind the house is not quite right. Where there is an increase in the load by the ornament that is installed and the height of the fence wall. This should be predictable in advance so that there is no design error in the dimensions of the sloof used.
- ➢ On wall work with a middle house type, there is no plaster work so waterproof paint finishes on the outer walls of the right and left boundaries of the house. This will cause problems with the initial planning when the housing units are not built simultaneously on the same block or lane. The condition of the inner wall will be damaged if the outer wall is not given reinforcement.

• Administrative Factor

- Late delivery of materials due to procurement from outside the island which is related to the inability of the local supply chain to meet the existing material needs and this is less anticipated by the owner and contractor.
- Lack of teamwork in seeing unexpected conditions during work execution. As happened when not all housing units were sold and there was work to add side walls.
- The owner does not give the middle type and corner type homework contract at the same time which is the authority of the leadership at that time. So that at the time of execution of the work which coincides with the calculation of the added work volume and the bargaining process where the added work value is more than 10% of the initial contract. In this case, the contractor is very disadvantaged because of the long administrative process until he gets an SPK to make a DP bill for additional work.
- Resource Factor : Change order problems occur because of the high cost of customization associated with the use of special materials or special construction products. The design is customized in such a way using special materials or special construction products that cannot be met by local supply chains or those in the surrounding area. So it must be sought or supplied from another place and results in a long time in delivery. There are several things in the field that can be found, such as:
 - Granite floor covering with the Indogress brand. In Banjarmasin itself, this granite brand is not widely

sold and even like Depo Gemilang only a few stocks are available. So that some contractors order them from suppliers in Surabaya and Jakarta.

- The roof is a concrete tile type with the Monier brand. This type of roof is still less well known compared to bitumen/asphalt based tiles from the Onduline brand. The supplier of the Monier brand itself has warehouses in Surabaya and Jakarta.
- Clean water pipe with Westpex brand. This product has the advantage of not requiring pipe glue during the connection process and also the flexible material makes this pipe able to be bent 90° so as to reduce the use of pipe fittings. However, currently these products are rarely used in Banjarmasin, so the availability of the products is not much, which makes the contractors have to order them from the factory in Jakarta.

The human resources owned by the owner and contractor are an influential factor. Where good teamwork should be able to minimize the occurrence of planning errors and anticipate unexpected circumstances during the work implementation process.

D. Strategy to Prevent Change Orders

Construction Factor

- The solution so that the incident does not repeat itself requires planning as detailed as possible and conducting a feasibility study to minimize the occurrence of design errors in the selection of materials used.
- Then when identifying the location of project activities, the Design Investigation Survey (SID) and Detail Engineering Design (DED) are expected to be carried out properly and correctly, namely by paying attention to changes and errors that can occur in the design. At CitraLand Banjarmasin the design of the house model to be worked on has been prepared and determined by the planning team from the Jakarta Head Office.
- ➤ The Marketing Team should be involved in the planning process by the Design Team. This is to anticipate changes in materials proposed by consumers, where the Marketing Team can explain in detail how the products they offer have been designed in such a way according to the needs and tastes of the market in Banjarmasin.

• Administrative Factor

In order to avoid disputes regarding incomplete or inappropriate contracts, it is better if the entire tender or procurement process by the owner and contractor is complete and thorough. If there is the same type of house but has a different area because it is in the middle of the block and at the end of the block, it is better if the several units have different contracts. If the unit is considered the same as the others and then additional work is proposed during the implementation process, this will cause problems regarding completion time and contractor performance. And it all becomes the dominance of the leadership authority to determine the contract strategy used.

- Resource Factor
 - Disclosure of information regarding the supply chain. From the beginning of the ongoing tender or procurement process, the owner should be able to assist in providing some recommendations for material suppliers that cannot be met by local supply chains. This will provide readiness to contractors to be able to make timely material procurement plans.
 - All resources are integrated. To be able to create a quality product with designs and materials that have been customized in such a way, there must be solid teamwork and an integrated system for every existing personnel. The design team, field team, marketing team and contractors must be involved in every process that occurs. Such as the incoming feedback from marketing and field personnel to the design team, and the availability of information from the owner to the contractor regarding the supply chain of the materials used.

IV. CLOSING

A. Conlution

- Based on the results of the analysis using the Relative Importance Index (RII) method in the range of values of 0.8001 to 1.0000 which is stated to be very important, it can be seen that the dominant factor in causing change orders in the CitraLand Banjarmasin residential development project is the construction factor. which consists of planning and design error variables (X_1) , discrepancies between drawings and field conditions (X_5) , and resource factors consisting of material variables that are not available in the market (X_{34}) .
- Strategies that can be taken to minimize the emergence of change orders in the CitraLand Banjarmasin residential development project are as follows:
 - A detailed planning is needed and a feasibility study is carried out to minimize the occurrence of design changes that can result in time and additional costs.
 - A study was conducted on consumer interest in the model of a dwelling they wanted, especially in South Kalimantan.
 - Identifying the location of project activities, Survey Investigation Design (SID) and Detail Engineering Design (DED) are expected to be carried out properly and correctly by paying attention to changes and errors that can occur in the design. At CitraLand Banjarmasin the design of the house model to be worked on has been prepared and determined by the planning team from the Jakarta Head Office. However, this should be reprocessed by the Engineering Team according to field conditions and consumer interest.
 - In order to avoid disputes regarding incomplete or inappropriate contracts, it is better if the entire

tender or procurement process by the owner and contractor is complete and thorough.

- Disclosure of information regarding the supply chain. From the beginning of the ongoing tender or procurement process, the owner should be able to assist in providing some recommendations for material suppliers that cannot be met by local supply chains.
- All resources are integrated. The design team, field team, marketing team and contractors must be involved in every process that occurs. Such as the incoming feedback from marketing and field personnel to the design team, and the availability of information from the owner to the contractor regarding the supply chain of the materials used.
- B. Suggestion
 - As the property industry, which spearheads the marketing team, many parties sometimes do not involve them in property development. In fact, this will actually strengthen teamwork and collaboration of all parties to realize a property that consumers want. So it would be nice if it could strengthen teamwork that could be done by CitraLand Banjarmasin for all divisions such as the Engineering Team, Marketing Team, Finance Team, and City Management Team.
 - Then the contractors can also be more active in coordinating with the owner regarding problems that arise both from internal and external factors such as those related to consumers. The medium for implementing contractors to communicate with consumers is through the Engineering Team. So this 3-way communication must run smoothly. Because every decision must be accountable by all parties.

REFERENCES

- [1.] Nurhadiyati, W. (2010). Pengendalian Change Order Terhadap Kinerja Waktu Pada Konstruksi Proyek Bangunan Bertingkat Tinggi. *Perpustakaan Universitas Indonesia*.
- [2.] Syarif, M. A. (2017). Analisis faktor-faktor penyebab change order pada pelaksanaan proyek konstruksi di lingkungan Pemerintah Kalimantan Selatan. Banjarmasin: Program Studi Magister Teknik Sipil, Universitas Lambung Mangkurat.
- [3.] Ningsih, Syahrudin, & Wardani, N. (2011). Identifikasi dan Analisis Penyebab dan Akibat Contract Change Order Terhadap Biaya dan Waktu Pada Proyek Konstruksi. *JeLAST, Vol. 2, No. 2.*
- [4.] Muluk, M., Misriani, M., Atmaja, J., Ali, S., & Monica, M. (2018). Identifikasi Faktor-Faktor Penyebab Change Order pada Proyek Konstruksi Jalan di Sumatera Barat. *JIRS Vol. XV, No. 2*, 77-87.
- [5.] Sandi A. Gumolili dan B.F. Sompie, J. R. (2012). Analisis faktor-faktor penyebab change order dan pengaruhnya terhadap konerja waktu pelaksanaan proyek konstruksi di lingkungan Pemerintah Provinsi

Sulawesi Utara. Jurnal Ilmiah Media Engineering Vol. 2, No. 4, 247-256.

- [6.] Zentenno, & Suroso, A. (2021). Analisis Faktor Penyebab CCO dan Pengaruhnya Terhadap Biaya Kontraktor Pada Proyek Jalan Tol. Jurnal Aplikasi Teknik Sipil, Vol. 19, No. 3, 335-344.
- [7.] Abdul-Rahman, H. (1995). The Cost of Nonconformance during a Highway Project: A Case Study. *Construction Management and Economics*, 23-32.
- [8.] Adianto, Y., Gunawan, D., & Linna. (2006). Studi Pemahaman dan Penerapan Constructability Kontraktor di Bandung. *Jurnal Teknik Sipil, Vol. 7(1)*, 27-39.