Analysis of The Most Affecting Factors in The Selection of Conventional and Precast Concrete Floor Slabs on Time Performance
(Case Study : IKEA Jakarta Garden City Project)

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Abstract

One of the efforts to achieve the goals of construction project in terms of cost, quality and time is to replace conventional methods with more modern ones, namely by applying precast concrete. Precast concrete products, especially for buildings, are quite varied, one of them is Hollow Core Slab (HCS). Supported by previous research which explains that precast concrete floor slabs can save processing time compared to conventional floor slabs. Therefore, it is necessary to identify factors and variables that affecting the selection of conventional and precast floor plates on time performance and how the influence of the X variable (Factors) on the Y variable (Time performance). The results showed that the most affecting factors in the selection of conventional floor slabs on time performance were manpower factor with variable number of workers (41.3%), location factor with variable distance of batching plant to project site (19.8%), and also technical factors with shop drawing revision variable (by 41.8%). As for, the most affecting factors in the selection of precast concrete floor slabs on time performance include manpower factors with worker’s expertise variable (29.7%), and technical factors with shop drawing revision variable (by 38.4%).

Keywords:
Conventional Concrete Floor Slab, Hollow Core Slab, Precast Concrete Floor Slab, Selection of Concrete Floor Slab Method, and Time Performance.

1. Introduction

With the increasing number of infrastructure and building construction in Indonesia, the development of technology and innovation in the world of construction should be growing. These innovations are expected to have a good impact in the implementation of construction. To achieve the requirements of cost, quality and time, it is necessary to carry out work efficiently and effectively. One of the efforts made is to replace conventional methods with more modern ones, namely by applying precast concrete. The consideration of the timing of the selection of the precast system has an effect on improving the performance of the implementation of building construction projects later (Rusli et al., 2018).

Hollow Core Slab is a type of precast floor slabs that is commonly used in building construction projects that have a hole in the center of the floor slab. Hollow Core Slabs made fabricated using special molds and pre-tension system, where the pre-stressed cable is pulled first before casting.

Based on research (Najoan et al., 2016) Hollow Core Slab can save 28 days beside conventional slab. Meanwhile, (Firdaus et al., 2017) showed that Hollow Core Slab is 12 days more efficient than conventional one. This becomes one of the considerations in choosing the method of concrete floor slabs on construction projects.

Therefore, it is necessary to further review the factors and variables for selecting the use of precast slabs or HCS (Hollow Core Slab) on the time performance of project implementation time compared to conventional concrete floor slabs and to determine how far these factors and variables can affect time performance.

1.1. Identification of problems

Related to the research background, it is necessary to identify the following things:

1. Factors and variables that affecting the selection of conventional precast concrete floor slabs on time performance.
2. The effect of variable X (Factors) on variable Y (Performance time).

This needs to be reviewed because there is still a lack of previous research that compares the two methods and obtains the value of contribution in the selection of a method in terms of implementation time.
1.2. Research Purpose and Objectives

The purpose of this study are:

1. To know the factors and variables that affecting the selection of conventional and precast floor slabs on time performance
2. To know how does variable X (factor) affect on variable Y (time).
3. Which is variable X is the factors that affect the selection of conventional and precast concrete floor slabs, while Variable Y is time performance.

2. Methodology

In this study, the results of the respondent's questionnaire, site observation and documentation are used as a primary data collection and for secondary data came from previous journals or literature study. This researched method uses quantitative research, which was conducted through statistical analysis testing with SPSS 26. The test instrument including normality test, validity test, reliability test, and multiple linear regression analysis including the coefficient of determination, F test and T test.

The research flowchart in this study is as follows:

![Flow Chart Image]
3. Result and Discussion

3.1. Factors and Variables

The factors and variables proposed for the distribution of the first expert validation questionnaire are as follows:

Table 1. Proposed Factors and Variables

<table>
<thead>
<tr>
<th>No.</th>
<th>The factors and variables that effect selection of concrete floor slab method on time performance</th>
<th>Independent Variable (X)</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Man Power Factors</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Number of workers</td>
<td>X1 (Wajskoro et al., 2018)</td>
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<tr>
<td></td>
<td>Worker’s expertise</td>
<td>X2 (Asnuddin et al., 2018)</td>
<td></td>
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<tr>
<td></td>
<td>Number of office hours</td>
<td>X3 (Najoan et al., 2016)</td>
<td></td>
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<tr>
<td></td>
<td>Worker’s discipline</td>
<td>X4 (Palusia, 2018)</td>
<td></td>
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<tr>
<td>B</td>
<td>Location Factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weather</td>
<td>X5 (Najoan et al., 2016)</td>
<td></td>
</tr>
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<td></td>
<td>Alternative road access</td>
<td>X6 (Najoan et al., 2016)</td>
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<tr>
<td></td>
<td>Stockyard</td>
<td>X7 (Najoan et al., 2016)</td>
<td></td>
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<td></td>
<td>Distance between Batching Plant to Site Project</td>
<td>X8 (Syamsuddin et al., 2019)</td>
<td></td>
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<td></td>
<td>Area clearing</td>
<td>X9</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Technical Factor</td>
<td></td>
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<tr>
<td></td>
<td>Incomplete shopdrawing</td>
<td>X10 Site Observation</td>
<td></td>
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<tr>
<td></td>
<td>Shopdrawing revision</td>
<td>X11 Site Observation</td>
<td></td>
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<td></td>
<td>Approval process of shopdrawing</td>
<td>X12 Site Observation</td>
<td></td>
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<tr>
<td></td>
<td>Additional work</td>
<td>X13 (Susilowati, 2017)</td>
<td></td>
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<tr>
<td></td>
<td>A change of completed work</td>
<td>X14 (Susilowati, 2017)</td>
<td></td>
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<td></td>
<td>A change of work’s method</td>
<td>X15 Site Observation</td>
<td></td>
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<td></td>
<td>Design error</td>
<td>X16 Site Observation</td>
<td></td>
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<tr>
<td>D</td>
<td>Equipment/Tool Factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipment capacity</td>
<td>X17 Site Observation</td>
<td></td>
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<tr>
<td></td>
<td>Equipment supply</td>
<td>X18 (Asnuddin et al., 2018)</td>
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<td></td>
<td>Broken equipment</td>
<td>X19 Site Observation</td>
<td></td>
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<td></td>
<td>Heavy equipment use</td>
<td>X20 (Najoan et al., 2016)</td>
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<td>E</td>
<td>Material Factors</td>
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<tr>
<td></td>
<td>Material supply</td>
<td>X21 (Asnuddin et al., 2018)</td>
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<td></td>
<td>Material specification error</td>
<td>X22 Site Observation</td>
<td></td>
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<td></td>
<td>Product quality</td>
<td>X23 (Asnuddin et al., 2018)</td>
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<td></td>
<td>Lack of stock</td>
<td>X24 Site Observation</td>
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<td></td>
<td>Finishing of a product</td>
<td>X25 Site Observation</td>
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<tr>
<td>F</td>
<td>Managerial Factors</td>
<td></td>
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<td></td>
<td>Coordination between stakeholders</td>
<td>X26 (Asnuddin et al., 2018)</td>
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<td></td>
<td>Supervision</td>
<td>X27 (Asnuddin et al., 2018)</td>
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<td></td>
<td>Quality Control</td>
<td>X28 (Asnuddin et al., 2018)</td>
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<td></td>
<td>Difficulty in funds</td>
<td>X29 (Asnuddin et al., 2018)</td>
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<td>G</td>
<td>Occupational Health and Safety Factor</td>
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<tr>
<td></td>
<td>Work accident</td>
<td>X30 (Susilowati, 2017)</td>
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</tbody>
</table>

3.2. The Result of First Expert Validation

After the first expert validation, it was obtained 17 variables of 30 variables that are considered affected the selection of concrete floor slabs method by the expert. So that, these variables will be proposed in the distribution of the respondent’s questionnaire.

![The Value of First Expert Validation](image-url)
3.3. The Result of Factor Analysis of Conventional Concrete Floor Slab Selection on Time Performance

1. Normality Test

Normality test is a test to see the distribution of research data is normal/not. The data can be said to be normally distributed if the result of the significance value is greater than the probability value of 5% or 0.05. The results showed that all variables have a significance level of 0.200, where the value is greater than 0.05, so that the data distribution can be said to be normally distributed.

![Figure 3. Result of Normality Test in Conventional Concrete Floor Slab Method](image)

2. Validity Test

Validity test is carried out to see the validity of a proposed variable. The validity of variable is seen from the comparison of the calculated r value and r table. With number of respondents is 33, so the value of r table is 0.344. The result showed that the variables (X13 and X28) have a value of calculated r < r table. So, it can be said that the variable X13 and X28 are invalid and it can be eliminated for the next test stage.

3. Reliability Test

Reliability test is used to determine whether the measuring instrument is reliable and remains consistent for repeated measurements. The reliability of variables is seen from Cronbach's Alpha value. From the result, it showed that Cronbach's Alpha value is 0.887. This value shows the "Good" category with a range of Cronbach's Alpha values of 0.7 < a < 0.9 based on Internal Consistency Table in (Riadi, 2016). So it can be said that all data is said to be reliable.

4. Multiple Linear Regression
a. Coefficient of determination

The value of the coefficient of determination explains how big the ability of the variable X in explaining the variable Y. The value of the coefficient of determination ranges from 0 to 1. From the result, it showed that the value of Adjusted R Square is 0.836 or 83.6%. So, it can be said that the ability of variable X in explaining variable Y is 83.6%. While 16.4% is explained by other variables outside of this study.

![Figure 4. Result of Coefficient of Determination in Conventional Concrete Floor Slab Method](image)

b. F Test

The F test aims to determine whether the independent variables affect the dependent variable simultaneously (together). The results of the F test can be determined by comparing the calculated F value and F table and comparing the significance values.

The F table value obtained is 2.270. This shows that the calculated F value > F table (11.868 > 2.270). In addition, the significance value is also smaller than 0.05, which has a significant effect. So it can be concluded that the independent variables simultaneously affect the dependent variable.
c. T Test

The T test aims to determine whether the independent variables affect the dependent variable partially. The results of the T test can be determined by comparing the calculated t value and t table and comparing the significance values.

The t table value obtained is 2.110. This shows that the value of t count for X1, X8 and X11 is greater than t table. In addition, the significance value is also smaller than 0.05, which has a significant effect. So it can be concluded that the independent variables X1, X8 and X11 partially affect the dependent variable.

3.4. The Result of Factor Analysis of Precast Concrete Floor Slab Selection on Time Performance

1. Normality Test

Normality test is a test to see the distribution of research data is normal / not. The data can be said to be normally distributed if the result of the significance value is greater than the probability value of 5% or 0.05. The results showed that all variables have a significance level of 0.200, where the value is greater than 0.05, so that the data distribution can be said to be normally distributed.
2. **Validity Test**

Validity test is carried out to see the validity of a proposed variable. The validity of a variable is seen from the comparison of the calculated r value and r table. With the number of respondents is 33, so the value of r table is 0.344. The result showed that the variables (X13 and X28) have a value of calculated r < r table. So, it can be said that the variable X13 is invalid and it can be eliminated for the next test stage.

3. **Reliability Test**

Reliability test is used to determine whether the measuring instrument is reliable and remains consistent for repeated measurements. The reliability of variables is seen from Cronbach’s Alpha value. From the result, it showed that Cronbach's Alpha value is 0.914. This value shows the “Excellent” category with a range of Cronbach's Alpha values of a ≥ 0.9 based on Internal Consistency Table in (Riadi, 2016). So it can be said that all data is said to be reliable.

4. **Multiple Linear Regression**

a. **Coefficient of determination**

The value of the coefficient of determination explains how big the ability of the variable X in explaining the variable Y. The value of the coefficient of determination ranges from 0 to 1. From the result, it showed that the value of Adjusted R Square is 0.819 or 81.9%. So, it can be said that the ability of variable X in explaining variable Y is 81.9%. While 18.1% is explained by other variables outside of this study.

b. **F Test**

The F test aims to determine whether the independent variables affect the dependent variable simultaneously (together). The results of the F test can be determined by comparing the calculated F value and F table and comparing the significance values.

The F table value obtained is 2.290. This shows that the calculated F value > F table (10.041 > 2.290). In addition, the significance value is also smaller than 0.05, which has a significant effect. So it can be concluded that the independent variables simultaneously affect the dependent variable.

c. **T Test**

The T test aims to determine whether the independent variables affect the dependent variable partially. The results of the T test can be determined by comparing the calculated t value and t table and comparing the significance values.

The t table value obtained is 2.120. This shows that the value of t count for X2 and X11 is greater than t table. In addition, the significance value is also smaller than 0.05, which has a significant effect. So it can be concluded that the independent variables X2 and X11 partially affect the dependent variable.
3.5. The Result of Second Expert Validation

In second expert validation, the analyzed variables were re-validated 5 (five) experts. As for the results of second expert validation, it can be explained that the variables that most influence the selection of conventional concrete floor slabs on project time performance include:
1. Variable Number of Workers approved by 4 (four) experts;
2. Variable Distance from batching plant to project location/site approved by 4 (four) experts;
3. Variable Shopdrawing Revision approved by 3 (three) experts.

Meanwhile, the variables that most influence the selection of precast concrete floor slabs on project time performance include:
1. Manpower Expertise Variable approved by 4 (four) experts;
2. Variable Shopdrawing Revision approved by 3 (three) experts.

4. Conclusion

The following are the conclusions regarding the factors and variables that most affect the selection of conventional and precast concrete floor slabs on time performance.
1. The most affecting factors and variables in the selection of conventional concrete floor slabs on time performance include:
   a. Manpower Factor with Number of Workers Variable (X1) by 41.3%.
   b. Location Factor with Distance from Batching Plant to Project Location/Site Variable (X8) by 19.8%, and
   c. Technical Factors with Shopdrawing Revision Variable (X11) by 41.8%.

2. The most affecting factors and variables in the selection of precast concrete floor slabs on time performance include:
   a. Manpower Factor with Labor Expertise Variable (X2) by 29.7% and
   b. Technical Factors with Shopdrawing revision variable by 38.4% (X11).

References


Biographies

Fahmi was born in Jakarta, February 22, 1978. He is a lecturer in Civil Engineering, Universitas Mercubuana. He holds a bachelor's degree in Civil Engineering from the National Institut Sains dan Teknologi Nasional. Then obtained a Master's degree in Civil Engineering with a concentration in Construction Management from Universitas Pelita Harapan in 2016, with the thesis title “Analysis of Delays in Budget Hotel Construction Projects in Jakarta”. He teaches Soil Mechanics 1, Soil Mechanics 2, Prestressed Concrete Structures, Concrete Structures 2, Construction Methods and Heavy Equipment and Construction Management. And he works on construction projects since 2002 until now, as a contractor, consultant and developer.

Nadhira Nurfitriani was born in Jakarta on January 29, 1998. She completed her study at State Polytechnic of Jakarta for her Associate/Diploma Degree in 2019. She continued her study at Mercu Buana University with Civil Engineering study program in 2020-2021 for her bachelor degree. She works at Kementerian PUPR as a Civil Servant Candidates.