

Analysis of The Cost Comparison of Bridge Floor Plate Formr on Toll Road Project

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Abstract

In this study, researchers wanted to discuss the installation of formisting to be installed on the floor plate structure between the girders inside the concrete bridge. In this case the authors want to know the comparison of cost analysis using conventional form form, bondek plate and deckslab. Because the Cost Budget Plan is very much related to the design and selection of materials to be used on girder bridge type I. In construction projects in Indonesia especially on the installation of formware residual material, the use of tools, the location of material procurement is very influential to the cost of construction work therefore it is necessary to be considered and taken into account carefully the selection of efficient formery so that the costs that will be incurred are not overbudget. In the research process this final task requires the foundations of the theory that support the problems that are reviewed. Through the study of literature is expected to be able to increase knowledge and study the basic theory used as a reference. At this stage the activity is a review of literature related to similar case studies from journals, literature books, and previous research reports. Cost analysis is reviewed in terms of services / labor namely, labor users for conventional systems and bondek in the same amount, while for deckslab precast less, but requires more precision. Cost analysis reviewed in terms of equipment, that is, for bondek system equipment does not require complicated equipment, unlike conventional ones that use scaffolding aids as well as deckslab precast that use heavy equipment such as crawler cranes and hyab cranes. Price analysis in terms of materials namely, materials for conventional and bondek is very easy to obtain for the price depending on the area of the project location, for deckslab precast is required special supplier because the manufacture is directly from fabrication with a higher price when compared to conventional and bondek. Price analysis of each formisting system is, the installation of conventional formisting with a price of /m² of Rp. 729,371. The total price of installing bondek form form with a price of /m² is Rp. 367.593. Total installation price of deckslab precast form work with /m² price of Rp. 803.795. From the results of the analysis, it can be concluded, that bondek form form form method is worth using for the toll bridge project because in terms of simpler methods and in terms of cost more efficient and effective.

Keywords

Comparison, Conventional, Cost, Deckslab Precast, Formse.

1. Introduction

The development of construction technology is currently progressing rapidly, which is characterized by the emergence of various types of modern materials and equipment. In ancient times with simple equipment can build monumental buildings that today still remain in use. With the development of this construction technology makes contractors consider all methods in the implementation of construction of several existing implementation methods. The way that contractors do that is by changing conventional methods to modern (Diandra, 2017).

A form of construction must qualify strength, rigidity, and stability. This requirement should be met given that formwork is repeated work on multi-storey buildings and costs a great deal to create (the American Concrete Institute). The cost for form formness ranges from 40%-60% of the cost of concrete work or about 10% of the total cost of building construction (Hidayat, Arif; Radian, 2017) Currently in Indonesia there are 3 types of formisting namely conventional form of form, semi system and system. The selection of types of form matter is an important decision on multi-storey building projects because it affects the cost, time of work and the quality of construction (Hidayat, Arif; Radian, 2017).

In construction projects in Indonesia especially on the installation of material residual formery, the use of tools, the location of material procurement is very influential to the cost of construction work therefore it is necessary to be considered and taken into account carefully the selection of efficient formery so that the costs that will be incurred are not overbudget . Easy, safe, and fast installation method is required because it has a very influential effect on baiaya that will be issued later. In this study, researchers wanted to discuss the

installation of formisting to be installed on the floor plate structure between the girders inside the concrete bridge. In this case the authors want to know the comparison of cost analysis using conventional form form, bondek plate and deckslab. Because the Budget Plan is very much related to the design and selection of materials to be used on the girder bridge type I.

2. Library Overview

According to Project Management Institute (2017) a project is a temporary effort made to create unique products, services, and results. A project can involve a single organizational unit or multiple organizational units. In the journal Henong (2016) construction projects are one form of activity that takes place in a limited time and uses resources and costs that have been taken into account, to achieve results in the form of buildings or infrastructure.

According to S AbhiyanD R PatelNeerajd SharmaBhavinkkashiyani (2013) explained that, Bekisting is a shaper or mold including all supporting structures, which are used to form and sustain concrete until it reaches enough strength to sustain its own weight. This form of formness should be able to carry all the dead loads and forced burdens in addition to the weight itself.

The floor yard is a thin structure made of reinforced concrete with horizontal direction and load that works perpendicularly on the field of the structure so that in the building this court building serves as a diaphragm or horizontal edict element that is very useful to support the kink of the portal beam. In the planning, the floor plate must be made flat, rigid and straight so that the user of the building can steadily massage his feet. Things that are taken into account include a fixed load that works for a long time. Other things like unexpected loads of earthquakes, winds, tremors, etc. are not taken into account (Harya Wisanggeni, 2017).

2.1. Conventional Formery Reasoning Method

The wooden method used is the structure of the floor plate that is done in a direct casting site that covers the whole by using plywood as a formwork and scaffolding as scaffolding. This method is quite ancient and most widely used but can take a long time and cost.

2.2. Deckslab Installation Method

The floor structure of the deckslab method is a reinforced concrete floor plate work in a half precast way and the other half is made on site. The reason is only made half precast because adjusting the maximum load that is still safely lifted by the crane, if the project location is available machine that is able to lift the entire thickness of the plate then it would be better if using a single precast system intact, this can happen on a floor with a small span.

2.3. Bondek Installation Method

Bondek method is a substitute for wood formwork that is permanently installed on the plate, by replacing the lower bone into a bondek plate in hopes of saving the iron of the bone and the formwork of the bottom. Upper bones can be made in the form of bars or can also be replaced with wiremesh iron or threaded iron to be faster in installation. As well as the method of installation is considered easier than using wood formwork. The use of bondek is expected to speed up the time of making floor plates when compared by wood.

3. Research Methods

Research flow chart in figure 1. This research method uses two ways of data retrieval techniques, namely primary data and secondary data.

The sequence of stages used for research is as follows:

1. Data Collection Literature Study: Calculation of conversion of Form form of structure, floor plate. regulations or SNI related to bekisting work, implementation method, project unit price.
2. Calculation of conventional method materials, Deck slab and Bondek methods.
3. Calculation of the cost of work analyzed from BoQ Project, Project Unit Price Analysis.
4. Calculation of time and number of workers based on labor coefficient (Badan Standardisasi Nasional, 2008)

3.1. Diagram Alir Penelitian

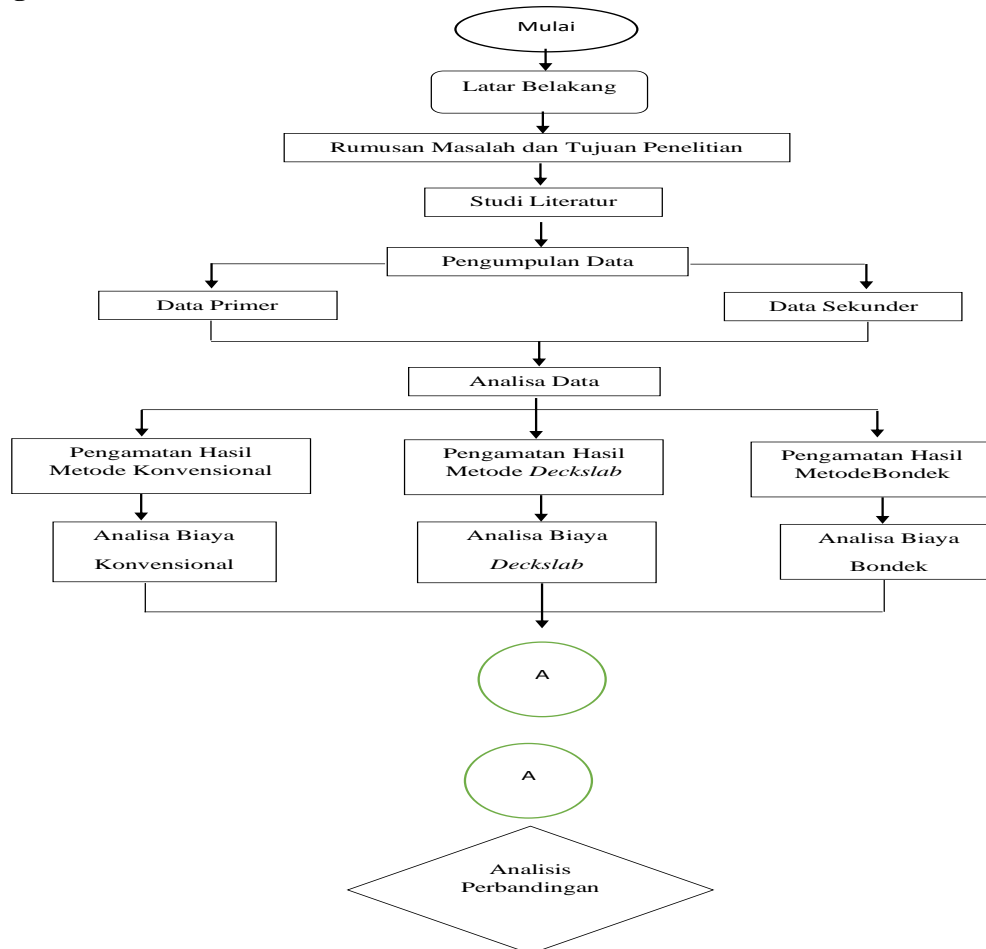


Figure 1 Flowchart
 Source: Research Data

3.2. Research Place and Time

Place : This research was conducted in Project xyz. This project is a bridge project (Toll Road).

Time: The time of this study lasts about 1 month, which is divided into two stages. The first stage is to conduct observations and interviews located at the XYZ project site. The second phase is the implementation phase which includes data processing.

4. Discussion

4.1. Conventional Methods

Tabel 1 Conventional Material Price List

Berdasarkan Pekerjaan m ²				
No	Deskripsi	Satuan	Harga (Rp)	Keterangan
1	Material			
	Multiplex 12mm	lembar	175.400	
	Besi Hollow	lembar	96.000	
	Minyak bekisting	lembar	7.100	
	Paku	lembar	16.700	

Tabel 2 Conventional Labor Price List

Berdasarkan Pekerjaan m ²				
No	Deskripsi	Satuan	Harga (Rp)	Keterangan
2	Tenaga Kerja			
	Tukang	OH	150.000	
	Mandor	OH	198.000	

Source: SNI (2018)

Tabel 3 Conventional Equipment Price List

Berdasarkan Pekerjaan m				
No	Deskripsi	Satuan	Harga (Rp)	Keterangan
3	Peralatan			
	Scaffolding	Set		
	Main Frame 180	unit	10.000	
	Cat walk	unit	40.000	
	Joint Pin	unit	3.500	
	Balok kayu	Batang	28.000	
	Jack base	unit	9.000	
	U-head 60cm	unit	10.000	
	Cross brace	unit	8.000	

Tabel 4 Conventional Bekisting Price Analysis

No	Item Pekerjaan	Volume	Satuan	Harga Satuan	Harga Pekerjaan	
A Pekerjaan plat Lantai Sistem konvensional per m²						
1	material					Rp 325.573
	Multiplex 12mm	0,0875	lbr	175.400	15.350	
	Besi Hollow	0,2002	btg	96.000	19.223	
	balok kayu	2,00	btg	140.000	280.000	
	Paku	0,64	kg	16.700	11.000	
2	man power					Rp 122.500
	tukang	0,7424	OH	150.000	111.364	
	mandor	0,0562	OH	198.000	11.136	
3	machine					Rp 279.026
	frame 180	4	bh	10.000	40.000	
	Cat walk	1	bh	40.000	40.000	
	pin	8	bh	3.500	28.000	
	cross brace	16	bh	8.000	128.000	
	U-head	2	bh	10.000	20.000	
	base jack	2	bh	9.000	18.000	
	alat kerja	1	lot	5.000	5.000	
	gerinda	0,0096	jam	2.720	26	
4	consumable					Rp 2.272
	minyak bekisting	0,3200	ltr	7.100	2.272	
					TOTAL	Rp 729.371

4.2. Bondek Method

Tabel 5 Material Bondek Price List

No	Deskripsi	Satuan	Harga (Rp)	Keterangan
1	Material			
	Semen	Sak	65.000	50 kg
	Besi Beton	Kg	9.000	SNI bjt d 40
	Pasir	M	243.000	
	Bondek	M	106.700	

Source: Penawaran Harga Supplier (2018)

Tabel 6 Bondek Labour Price List

Berdasarkan Pekerjaan m2

No	Deskripsi	Satuan	Harga (Rp)	Keterangan
2	Tenaga kerja			
	Tukang	OH	150.000	
	Mandor	OH	198.000	

Tabel 7 Bondek Equipment Price List

	Harga (Rp)	Ket.	Harga satuan (Rp)	Ket.	Total harga
Biaya Gerinda					2.720
Alat gerinda	850.000	1 bln	1.250	jam	
Cutting disk	50.000	week	70	jam	
Listrik	1.000.000	bln	1.400	jam	

Tabel 8 Bondek Bekisting Price Analysis

No.	Item Perkerjaan	Volume	Satuan	Harga Satuan	Harga Pekerjaan	
B	Pekerjaan plat Lantai Sistem Bondek per m2					
1	material					Rp 240.067
	Portland cement	0,0450	sak	65.000	2.925	
	Besi D22	5,96	kg	10.900	64.964	
	pasir beton	0,0060	m3	243.000	1.458	
	plat bondek	1,600	m2	106.700	170.720	
2	man power					Rp 122.500
	tukang	0,7424	OH	150.000	111.364	
	mandor	0,0562	OH	198.000	11.136	
3	machine					Rp 5.026
	Gerinda	0,0096	jam	2.720	26	
	Alat kerja	1	lot	5.000	5.000	
				TOTAL		Rp 367.593

Tabel 13 Recapitulation of Floor Plate Form forming Costs

Perbandingan Biaya Bekisting Lantai Jembatan Proyek Tol Bocimi			
No.	1	2	3
Metode yang digunakan	Konvensional	Bondek	Decks slab Precast
Keterangan	Bekisting multiplek dengan bantuan besi hollow	Bekisting baja yang bentuknya bergelombang	Bekisting <i>precast</i> berbentuk segiempat
Luas plat lantai seluruhnya (m ²)	2.925	2.925	2.925
Biaya /m ² (Rp)	<u>Rp 729.371</u>	<u>Rp 367.593</u>	<u>Rp 803.795</u>

Tabel 14 Labor Productivity

Uraian	Konvensional	Bondek	Decks slab
Luas area (m ²) (a)	2.925	2.925	2.925
Pekerja (b)	2	2	1
Tukang (c)	8	8	4
Mandor (d)	1	1	1
Rigger (d')	-	-	2
Operator Crane	-	-	1
Hari kerja (hari) (e)	7	7	7
Total man days (f = (b + c + d + d') x e)	77	77	63
Produktivitas (g)	Luas area/ mandays (g = a/f)	Luas area/ mandays (g = a/f)	Luas area/ mandays (g = a/f)
(m ² /orang/hari)	37,98	37,98	46,42

5. Results and Conclusions

From the analysis of conventional methods and deck slab and bondek methods above, it can be concluded that from the three methods of implementation each can be compared:

1. The results of the comparison of implementation methods between conventional form form work, bondek and decks slab precast are more effective and feasible to be used on the floor plate of toll road bridge X,Y,Z i.e. as follows:

- Analytically, the advantages of bondek formage and decks slab precast can be used forever, but not for conventional formage that only has a lifespan of 4x usage and causes waste material.
- Conventional formwork methods require tools such as scaffolding as scaffolding on bridges, and for decks slab precast methods require the help of heavy equipment such as cranes for heavy precast erection and unable to use the power of workers.
- Bondek formwork installation method is easier and simpler, because it does not require difficult enough equipment and the working process does not require such amperial space.

2. Based on the results of the cost analysis that has been done, it can be noted that the large cost incurred on the bridge floor plate work using conventional form form form system, bondek system and decks slab precast is for

conventional form work cost of Rp 729,371, for bondek form form of Rp 367,593, and for precast deckslab of Rp 803,795. Thus it can be concluded that the most cost incurred is bondek system.

5.1. Advice

From the analysis of the method of form form of the floor plate of the bridge, the advice that can be conveyed is as follows:

1. When wanting to do cost analysis on each method of floor plate form work should be done survey to the supplier because the costs incurred affect the area of the job site.
2. Be more careful in understanding each method of project work in order to make the Budget Plan (RAB) easier and more precise.
3. Further research is needed for each method of form a form of bridge floor plate, if you want to be used as a reference for further research.
4. More in the science of cost analysis from previous studies as well as by reading literature on the cost analysis of floor plate form form.

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