

Time And Cost Comparison Of Conventional And Alternative Plate Hollow Slab, Halfslab And Metaldeck

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Abstract: With the development and fabrication of construction elements, the building owners have many choices on the material used. Particularly the structure of the floor slab of the building, in addition to ordinary reinforced concrete slab construction (conventional), there are other alternatives. The alternative construction is hollowslab, halfslab, metaldeck, palace and various other precast. From the variety of product alternatives floor slab, the author wants to compare alternatives such products with conventional floor slab. Step calculation is divided into two stages for each method, the calculation of the duration of the implementation and exercising their cost calculations. In calculating the duration of the implementation, the measure used is the volume of work items that were shared with the productivity tools or power. Arising from the duration, the cost can be calculated from the material, labor, equipment, etc. The results of the various methods of calculation, the next step is to compare the cost and time of each method. The calculations show that the least expensive method and its implementation is fast enough metaldeck method, with a duration of 107 days implementation and total cost Rp.4,687,322,686, -.

Index Terms: floor slab, method, duration, cost.

1 INTRODUCTION

Technology development and fabrication of construction elements, make the building owner has many options on the material used. In the structure of the floor slab of the building, in addition to ordinary reinforced concrete slab construction (conventional), there are other alternatives. The alternative construction is the construction of semi precast concrete where the concrete has been made in the factory / worked well in the majority, appropriate shape and then assembled according to the location identification and continued to manufacture other parts that have not been carried, for example halfslab. Construction of concrete composite are construction that consists of two different materials, forming one single element to bear the burden of the work, in this case that concrete and steel / metaldeck. From the variety of product alternatives floor plate, it will be compared to alternatives such products with conventional slab hollowslab, halfslab, metaldeck, place and various other precast. Precast concrete construction is one of the latest innovations in the world of construction, where concrete has been made in the factory / carried by the distant day, as its shape and then assembled according to the location identification, for example hollowslab.

1. Specifications conventional plate

No.	Description	Specifications
1	Materials slab	Reinforced concrete
2	Plate thickness	120mm
3	Quality of concrete	K-350
4	Quality of steel	Fy-400 Mpa
5	Diameter Steel	D10-200
6	Number of floors	7 floors
7	Area	13.857 m2

2. Specifications plate hollowslab

No.	Description	Specifications
1	Material Slab	Precast concrete
2	Tickness	120mm

3	Quality of concrete	K-450
4	Quality of Stell / wire	Fy-1670 Mpa
5	Diameter Steel / wire	ø5 & ø7
6	Number of Floors	7 floors
7	Area	13.857 m2
8	Points fabrication	Factory

3. Specifications plate halfslab

No.	Description	Specifications
1	Materials slab	Semi concrete precast
2	Precast slab thickness	60mm
3	Convection plate thickness	60mm
4	Quality of concrete	K-350
5	Quality of steel	Fy-400 Mpa
6	Diameter Steel	D10-200
7	Number of Floors	7 floors
8	Area	13.857 m2
9	Points fabrication	Factory

4. Specifications plate metaldeck

No.	Description	Specifications
1	Materials slab	Concrete composite
2	Plate thickness	120mm
3	Quality of concrete	K-350
4	Quality of metaldeck	Fy-570 Mpa
5	Thickness metaldeck	0.75mm
6	Quality of wiremesh	Fy-500 Mpa
7	Diameter Steel / wire	M8-150
8	Number of Floors	7 floors
9	Area	13.857 m2

To be able to be used as a reference in selecting alternative planning and implementation of the field. A review of each of these alternatives against time and construction costs of preparation, assembly/installation, casting, open the formwork until ready to function or the cost and time of execution in the project. In the calculation of the consideration of the beam as the foundation slab for the

symbiotic relationship between the two elements. For the price reference material and energy use of Semarang Price List 2015 by auxiliary program Ms.Office Excel and Project. The hypothesis use of plate group semi-halfslab much faster in execution in the field and cost less to conventional slab

II. THEORITICAL BASIS

Slab conventional method is a method of implementation begins from the work scaffolding, formwork beams and plates, then iron distribution beams and plates. Then proceed foundry work. All items such work is done in sequence, so that the execution time becomes longer. Hollowslab slab method is a method in which the execution of the job prior to the beam, plate elements work already carried out by way of precast shaped holes in sectionnya. Time used in the implementation be shorter. Halfslab slab method is a method of implementation of the work plate elements in which, half a slab layer has been done in advance / precast beam elements prior to execution of the work. When the beam elements and elements work halfslab completed then continued iron distribution and foundries half layer slab. For the name of the method is called halfslab / slab half. Metaldeck slab method is a method of

implementation of the work plate elements using additional elements, namely metaldeck. Metaldeck itself capable of replacing two functions simultaneously on ordinary concrete floor slabs which is a function of positive reinforcement and formwork function. In a construction project, the cost becomes very vital aspect and main. To that end, in use should be calculated, so that the project does not suffer financial losses. Broadly speaking, the construction project cost aspect is as follows.

- The main material Cost and temporaryThe cost of labor
- The cost of equipment
- The sub-contracting costs
- The cost of common projects

Labor in a project can be determined from three things: the volume of work, the planned time and productivity. Productivity is the volume of work divided by time planned. Based on the contract volume is estimated to be roughly the amount of energy that should be required if the project would like to finish by a certain time. The value of productivity itself can also be taken from the literature on the implementation of construction projects or using of assumptions.

No.	Work item	Labor		Productivity		
		Plumbers	Helper	m ² /person/day	m ³ /person/day	kg/person/day
1	Soil excavation	1			1.80	
2	land fill	1	1		1.40	
3	Fabrication iron distribution manual	1	2			80.00
4	Installation iron distribution	1	2			125.00
5	fabrication formwork	1	3	6.00		
6	installation of formwork	1	2	6.00		
7	Brick couple	1	2	8.00		
8	Plastering	1	2	10.00		

Value of labor productivity (Reference Book for Contractors, 2003)

Besides the productivity values, there are fundamental things regarding labor, the working hours. Hours of work on construction projects often occurs overtime, it is due to the scheduling of dense, so expect productivity per day of a job can be improved.

The coefficient of overtime work

No.	No. Work Period	Period Number of Working Hours	Koef. Working overtime (day)
1	08.00 - 16.00	7	1.00
2	08.00 - 18.00	9	1.29
3	08.00 - 20.00	10	1.57
4	08.00 - 21.00	11	1.86
5	08.00 - 22.00	12	2.00
6	08.00 - 24.00	14	2.50
7	08.00 - 03.00	16	3.00

The coefficient value of overtime work is a value used as a reference for the payment of labor per day. Within one calendar day, construction workers will be paid umptean thousand per day with hours 8:00 a.m. to 16:00. It would be

different if it was required to work 08:00 to 22:00, then the workers will be paid as much as 2 working days in one calendar day.

III. METHODOLOGY

1. Determine Work Items and Quantity
2. Calculating Duration Jobs

Quantity / volume of all work items that have been determined then calculated the duration and the sort order for the implementation of the conditions on the ground. Productivity data taken from the literature, the experience and existing supporting data, the duration of each item so that it can work. Then the calculation of the data inputted into the Microsoft Office Project 2007 program to determine the overall duration of the work in dependency with other work items. To determine the duration / time and cost of alternative usage of slab, which is done first is to determine all work items in detail and implementation methods eventually in the field each alternative covering material,

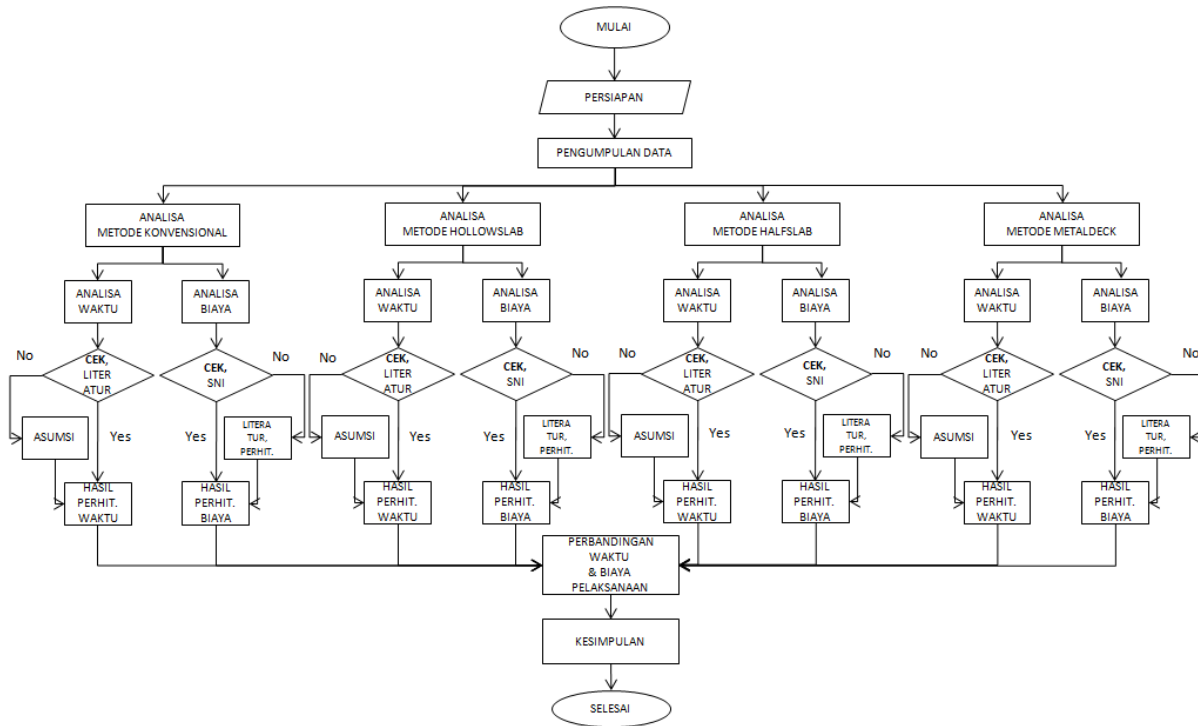
preparation, assembly / installation, casting, delivery, open formwork and forth until ready to function. Based on the calculated image work items that have been determined or can be taken the data from the project document.

1. Cost Analysis

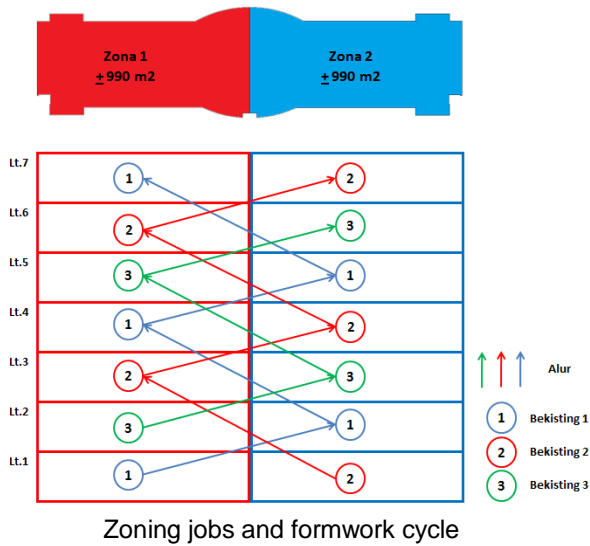
Of the volume, calculated costs arising both the material, equipment, subcontractors (if any), labor and indirect costs from the analysis of SNI and the reference to a variety of existing literature, in order to get the total cost of the final.

2. Summary of Results Calculation

The duration of the work and the cost of each use of the method are summarized in the table slab reinforced with the chart comparison and analysis results for each slab method.



Flow Diagram



IV. RESULTS AND ANALYSIS

From all the results of calculations the duration of the floor slab either conventional methods, hollowslab, halfslab and metaldeck, the comparable time of the construction, in order to get the fastest method and brief. Here are the results of the calculation of the overall duration of the floor plate method.

Table comparing the duration of each job to the 1st floor

No.	Item Pekerjaan	M. Konvensional	M. Hollow slab	M. Halfslab	M. Metaldeck
A	Pekerjaan Lantai - 1	40	30	32	31
A1	Balok				
1	Pengecoran				
	- Zone 1	1	1	1	1
	- Zone 2	1	1	1	1
2	Fabrikasi pembersian	10	10	10	10
3	Instal besi polos & besi ulir				
	- Zone 1	3	3	3	3
	- Zone 2	3	3	3	3
4	Fabrikasi bekisting				
	- Zone 1	8	8	8	8
	- Zone 2	8	8	8	8
5	Instal bekisting				
	- Zone 1	5	5	5	5
	- Zone 2	5	5	5	5
6	Bongkar bekisting				
	- Zone 1	3	3	3	3
	- Zone 2	3	3	3	3

No.	Item Pekerjaan	M. Konvensional	M. Hollow slab	M. Halfslab	M. Metaldeck
A	Pekerjaan Lantai - 1	40	30	32	31
A2	Pelat Lantai				
1	Pengecoran				
	- Zone 1	1		1	1
	- Zone 2	1		1	1
2	Grouting sambungan				
	- Zone 1		2		
	- Zone 2		2		
3	Fabrikasi pembersian	5	3	3	
4	Instal pembersian/wiremesh				
	- Zone 1	2	2	2	2
	- Zone 2	2	2	2	2
5	Fabrikasi bekisting/metaldeck				
	- Zone 1	11			5
	- Zone 2	11			5
6	Instal bekisting/metaldeck				
	- Zone 1	6			3
	- Zone 2	6			3

No.	Item Pekerjaan	M. Konvensional	M. Hollow slab	M. Halfslab	M. Metaldeck
A	Pekerjaan Lantai - 1	40	30	32	31
7	Instal precast				
	- Zone 1		4	3	
	- Zone 2		4	3	
8	Instal support precast				
	- Zone 1		2	2	2
	- Zone 2		2	2	2
9	Bongkar bekisting/support				
	- Zone 1	4	1	1	1
	- Zone 2	4	1	1	1

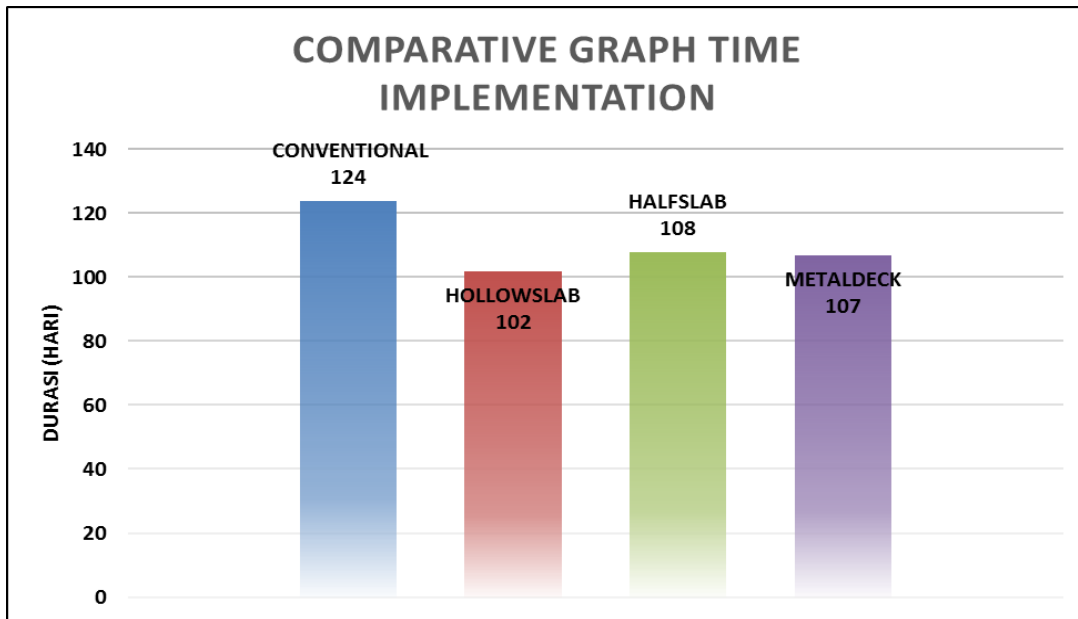
No.	Item Pekerjaan	M. Konvensional	M. Hollowslab	M. Halfslab	M. Metaldeck
A	Pekerjaan Lantai - 1 (Satu)	1.327.13.851	1.039.796.732	907.374.371	879.325.074
A2	Pelat Lantai				
1	Pengecoran Beton K 350				
	- Zone 1	126.208.509		62.860.432	125.710.865
	- Zone 2	126.208.509		62.860.432	125.710.865
2	Grouting sambungan				
	- Zone 1		22.742.032		
	- Zone 2		22.742.032		
3	Fabrikasi pembersian	309.431.077	71.159.294	154.408.039	
4	Instal				
	- Zone 1	17.189.346	3.765.831	5.914.673	60.729.946
	- Zone 2	17.189.346	3.765.831	5.914.673	60.729.946
5	Fabrikasi				
	- Zone 1	295.910.948			126.353.160
	- Zone 2	295.910.948			126.353.160
6	Instal bekisting/metaldeck				
	- Zone 1	60.102.926			6.780.000
	- Zone 2	60.102.926			6.780.000
7	Instal precast				
	- Zone 1		337.722.290	187.619.495	
	- Zone 2		337.722.290	187.619.495	
8	Instal support precast				
	- Zone 1		118.428.566	118.428.566	118.428.566
	- Zone 2		118.428.566	118.428.566	118.428.566
9	Bongkar bekisting/support				
	- Zone 1	9.379.658	1.660.000	1.660.000	1.660.000
	- Zone 2	9.379.658	1.660.000	1.660.000	1.660.000

Table comparing the cost of each job to the 1st floor

NO	JENIS METODE	DURASI	M M M M M M M M M M M M M M M M M M M M M M																					KET.	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
A	METODE KONVENSIONAL	124,00	hr	1 Jan 2015																			25 Mei 2015		
-	Pekerjaan Lantai - 1	40,00	hr	1 Jan 2015																					
-	Pekerjaan Lantai - 2	42,00	hr																						
-	Pekerjaan Lantai - 3	49,00	hr																						
-	Pekerjaan Lantai - 4	64,00	hr																						
-	Pekerjaan Lantai - 5	70,00	hr																						
-	Pekerjaan Lantai - 6	74,00	hr																						
-	Pekerjaan Lantai - 7	91,00	hr																						
B	METODE HOLLOWSLAB	102,00	hr	1 Jan 2015																				29 Apr 2015	
-	Pekerjaan Lantai - 1	30,00	hr	1 Jan																					
-	Pekerjaan Lantai - 2	35,00	hr																						
-	Pekerjaan Lantai - 3	39,00	hr																						
-	Pekerjaan Lantai - 4	54,00	hr																						
-	Pekerjaan Lantai - 5	62,00	hr																						
-	Pekerjaan Lantai - 6	66,00	hr																						
-	Pekerjaan Lantai - 7	81,00	hr																						
C	METODE HALFSLAB	108,00	hr	1 Jan 2015																				06 Mei 2015	
-	Pekerjaan Lantai - 1	32,00	hr	1 Jan																					
-	Pekerjaan Lantai - 2	37,00	hr																						
-	Pekerjaan Lantai - 3	45,00	hr																						
-	Pekerjaan Lantai - 4	60,00	hr																						
-	Pekerjaan Lantai - 5	68,00	hr																						
-	Pekerjaan Lantai - 6	74,00	hr																						
-	Pekerjaan Lantai - 7	87,00	hr																						
D	METODE METALDECK	107,00	hr	1 Jan 2015																				5 Mei 2015	
-	Pekerjaan Lantai - 1	31,00	hr	1 Jan																					
-	Pekerjaan Lantai - 2	34,00	hr																						
-	Pekerjaan Lantai - 3	36,00	hr																						
-	Pekerjaan Lantai - 4	39,00	hr																						
-	Pekerjaan Lantai - 5	40,00	hr																						
-	Pekerjaan Lantai - 6	40,00	hr																						
-	Pekerjaan Lantai - 7	47,00	hr																						

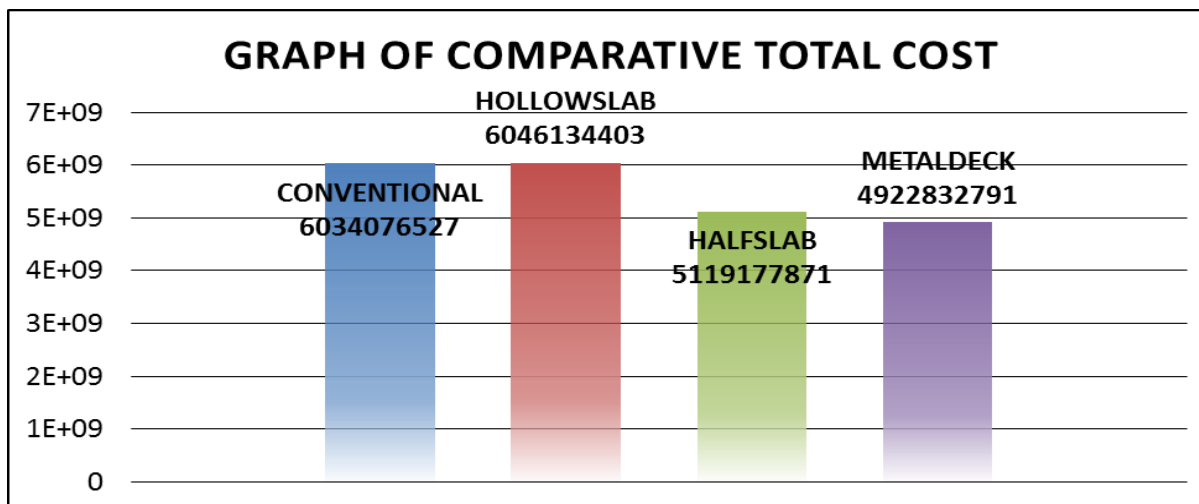
Note: M in the table is the unit for a week (6 days).

Table comparing time overall floor plate method



From the table above it can be seen that for the quickest method to be used as alternatives to the conventional method is hollowslab, then the second is a method metaldeck and the last is a method halfslab. Hollowslab be fastest method that is 102 days, it is because the plate elements made of precast whole so that on the field there are no jobs iron distribution, foundry work, formwork and slab. As described above, it was found hollowslab to be an alternative to the cost of the most expensive even more expensive than the conventional method itself, although most fast execution time. When viewed in section 4.2 discussion about methods hollowslab percentage reaches 90% of material costs, it is because the material used is high quality material and production through precast concrete factories that the market price per m2 is already quite high. And for implementation in the field of precast construction is rarely done.

Table comparing the overall cost of slab method



V. CONCLUSION

From the overall discussion above on a comparative study of conventional slab with a variety of alternatives, can be summarized as follows.

- In terms of the time of construction, the fastest implementation method is a method hollowslab 102 days. That's because the plate elements made of precast whole so that on the field there are no jobs iron distribution, foundry work, formwork and slab.
- The conventional method to be the most long despite being divided into two zones, but the complexity and volume of work items so influential that its execution time reached 124 days.
- For the method of alternative other is the method halfslab execution time of 108 days and a method metaldeck execution time of 107 days.
- In terms of cost, least expensive method of implementation is the method metaldeck total cost Rp.4,922,832,791, -with the unit price Rp.355,262, - / m².
- And the most expensive is the method hollowslab total cost Rp.6,046,134,403, - the unit price Rp.436,326, - / m². These costs are more expensive than conventional methods itself with a total cost of Rp. 6,034,076,527, - and the unit price of Rp. 435.456, - / m². The expensive cost hollowslab method for precast material price in the market is still quite expensive per meter per faceted.
- And to methods halfslab total cost reaches Rp. 5,119,177,871, - at a unit price of Rp. 369.431, - / m².
- Based on the above can be drawn on slab method using the most rapid and inexpensive method is metaldeck. With slightly longer execution time with the method hollowslab but implementation costs are relatively the least expensive of any other method.

VI. REFERENCES

- Andi Tenri Uji, "Perbandingan Biaya Pelaksanaan Pelat Beton Menggunakan Boundeck Dan Pelat Konvensional Pada Gedung Graha Suraco", Jurnal Universitas Hasanuddin
- Arief Rahman, "Tata Laksana Proyek", Jakarta, 1999
- BSN, SNI 7832:2012, "Tata Cara Perhitungan Harga Satuan Pekerjaan Beton Pracetak Untuk Konstruksi Bangunan Gedung", Jakarta, 2012
- BSN, SNI 07-2052-2002, "Baja Tulangan Beton", Jakarta, 2002
- Christanto, "Time Study Pemasangan Plat Pracetak pada Bangunan Gedung", Tesis Magister Teknik Sipil Universitas Atma Jaya Yogyakarta
- Michael Tedja Dkk, "Perbandingan Metode Konstruksi Plat Lantai Sistem Double Wire Mesh Dengan Sistem Half Slab", Jurnal Comtech Vol.4 No. 2 Desember 2013
- Naufal Aiman K, "Studi Perbandingan Penggunaan Teknologi Pelat Beton Konvensional Dan Pelat Beton Bondek Gedung Ball Room Universitas Muhammadiyah Makassar", Skripsi Universitas Hasanuddin Makassar, 2014
- Orry Giovanni, "Analisa dan Perencanaan Pelat Beton Pracetak Sistem Hollow Core Slab (HCS) untuk Pelat Satu Arah", Tugas Akhir Universitas Sumatera Utara, 2008
- PT. PP, "Buku Referensi untuk Kontraktor Bangunan Gedung dan Sipil", Jakarta, 2005
- Peraturan Walikota Semarang, "Standarisasi Harga Satuan Bangunan, Upah Dan Analisa Pekerjaan Untuk Kegiatan Pembangunan Pemerintah Kota Semarang Tahun Anggaran 2015", Semarang, 2015
- Rosyid Ambar Muhadi, "Analisis Metode Precast Half Slab Pada Proyek X", Intisari
- Soedrajat S, "Analisa (cara modern) Anggaran Biaya Pelaksanaan", Bandung, 1984
- Zainal Arifin, "Pembangunan Gedung Kanwil DJP Sumut I Dan KPP Di Medan Dengan Sistem Precast", Penghargaan Karya Konstruksi Indonesia Tahun 2013