Analysis Comparison of Cost and Time of Concrete and Paving Block Jobs in the Implementation of Village Road Development using Village Fund Budget

Indra Jaya[1]*, Andy Putra Rambe[1]
[1]*Department of Civil Engineering, Faculty of Engineering. Universitas Sumatera Utara, Padang Bulan, Medan 20155, Indonesia*

Keywords: Concrete, paving block, Cost, Time.

Abstract: Minister of finance regulation No.93/PMK.07/2015 concerning procedures for allocation, distribution, monitoring and evaluation of village funds regulates in more detail the use of village funds. The purpose of this research is to analyze the cost and time of alternative selection of concrete materials and paving blocks in carrying out the construction of village roads. The research used was a field study/ direct observation. Collecting secondary data such as wage and basic material standards and budget of village fund for concrete road works. Collecting primary data such as survey of paving block prices, survey of basic wage and material prices, coredrill, concrete quality testing and paving blocks, mix design paving block. In 2017, The 1 m^2 unit price of paving block work was cheaper by IDR.25472 than concrete road with the same quality. The 1 m^2 unit price of paving block work was cheaper by IDR.163588 than the existing concrete road. In 2018, The 1 m^2 unit price of paving block work was cheaper by IDR.32693 than concrete road with the same quality. The 1 m^2 unit price of paving block work was cheaper by IDR.132944 than the existing concrete road. The conclusion in this research, paving block is 2 times cheaper than concrete material, and Concrete material is 4 times faster than paving blocks.

1 INTRODUCTION

The amount of the village funds budget distributed to more than 74 thousand villages requires strict supervision, but the lack of state civil apparatus (ASN), supervision in the low field.

Until now the total circle of the Village Fund reached 62 cases, while in the process of investigation reached 48 cases (liputan6, 2018).

Village funds can be used to build village road infrastructure. Until 2017, the total funds available to finance village funds were 127.74 trillion for 74,910 villages that received assistance. The details in 2015 were IDR 20.76 trillion, 2016 IDR 49.98 trillion, and 2017 IDR 60 trillion (coverage 6, 2018)

This research is useful to provide technical justification for the Village Head as the highest official of the Village Government in implementing the construction of village roads with an alternative selection of concrete materials and paving blocks seen from the aspect of cost and time.

2 LITERATURE REVIEW

2.1 Concrete Block

In accordance with SNI 03-0691-1996, concrete brick is a composition of building materials made from a mixture of portland cement or similar hydraulic adhesives, water and aggregate with or without other additives that do not reduce the quality of the concrete brick. Concrete brick classification according to SNI 03-0691-1996, is Quality A, concrete brick is used for roads. Quality B, concrete brick is used for the parking lot. Quality C, concrete bricks are used for pedestrians. Quality D, concrete bricks are used for parks and other uses.

Table 1: Paving Specification according SNI 03-0691-1989

Quality	Compressive Strength kg/cm^2		Abrasion Resistance mm/minute		Absorption %
	Average	Lowest	Average	Lowest	

Jaya, I. and Rambe, A.
Analysis Comparison of Cost and Time of Concrete and Paving Block Jobs in the Implementation of Village Road Development using Village Fund Budget.
DOI: 10.5220/0010099403680374
In *Proceedings of the International Conference of Science, Technology, Engineering, Environmental and Ramification Researches (ICOSTEERR 2018) - Research in Industry 4.0*, pages 368-374
ISBN: 978-989-758-449-7

I	400	340	0.090	0.103	3
II	300	255	0.130	0.149	5
III	200	170	0.160	0.184	7

2.2 Paving Block for Rural Roads

Sharma, P. and Kumar, B.R. 2016, "Cement Concrete Paver Block For Rural Roads", TROI, Volume-3, Issue-2, ISSN: 2393-8374. India.

Table 2: Dimensions and tolerance recommended for paving blocks

.No	Dimensions	Recomended values	Tolerance limit	
			Thickness <100 mm	Thickness >100 mm
1	Width, W	To be specified by manufacturer	±2mm	±3mm
2	Length, L	To be specified by manufacturer	±2mm	±3mm
3	Thickness, T	50 to 120 mm	±3mm	±4mm
4	Aspect ratio (L/T)	Maximum 4.0	+0.2	+0.2
5	Arris/Chamfer	Minimum:5mm Maximum:7mm	±1mm	±1mm
6	Thickness of wearing layer	Minimum:6mm	+2mm	+2mm
7	Plan Area, Ast	Maximum:0.03mm^2	+0.001 m^2	+0.001 m^2
8	Wearing face area,	Minimum 75% of plan area	-1%	-1%
9	Squareness	Nil	±2mm	±3mm

Table 3: Value of paving blocks for traffic category

Grade Designation of Paver Blocks	Specified Compressive Strength of Paver Blocks at 28 Days N/mm^2	Traffic Category	Recommended Minimum Paver Block Thickness in mm	Traffic Examples Application
M-30	30	Non Traffic	50	Building premises, monument premises, landscapes, public, garden/parks, domestic drivers, paths and patios, embankment slopes, and stabilization area etc.
M-35	35	Light Traffic	60	Pedestrian plazas, shopping complex ramps, car parks, office driveways, housi

				ng colonies, office complexes, rural roads with low volume traffic, farm houses, beach sites, tourist resort local authority foot ways, residential

3 RESEARCH METHODOLOGY

3.1 Direct Observation

The research used was a field study/ direct observation.

3.2 Collecting Secondary Data

Collecting secondary data such as wage and basic material standards and budget of village fund for concrete road works, in year 2017 and 2018.

3.3 Collecting Primary Data

Collecting primary data such as survey of paving block prices, survey of basic wage and material prices, coredrill work, concrete quality testing and paving blocks, mix design paving block of K-350.

4 RESULT AND DISCUSSION

4.1 Material and Wage Standard Unit Price

Table 4: Material and wage standard unit price

Description	Unit	2018	2017
Portland cement	kg	1485	1438
Sand	m^3	63525	53763
Fine aggregate	kg	42	33
Split size 2-3cm	m^3	490875	390500
Gravel (Max .30mm)	kg	320	255
Split size 0,5-1cm	m^3	508200	390500
Paving Blok thickness 6 cm	pcs	1600	1500
Worker	man day	90000	862500
Bricklayer	man day	120000	1150000
Head	man day	130000	1265000
Foreman	man day	135000	1322250

Price of paving block with thickness 6 cm was IDR.1600 in 2018.

4.2 Budget of Village Fund Concrete Road Works

Table 5: In Year 2017

Location	Length (m)	Wide (m)	Thickness (cm)	Budget (Rp)	Cost /m^2 (Rp)
I	160	2.3	15	95492000	259489

II	105	2.3	15	64723000	268004
III	100	2.0	15	67300000	336500
IV	100	2.0	15	67300000	336500
V	150	1.0	15	54016000	360107

Cost average /m2 for five location was IDR.312120 in 2017.

Table 6: In Year 2018

Location	Length (m)	Wide (m)	Thickness (cm)	Budget (Rp)	Cost /m^2 (Rp)
I	175	2.0	15	97431500	278376
II	425	2.0	15	253664000	298428
III	50	2.0	15	29783000	297830
IV	215	2.0	15	130722000	304005
V	100	1.5	15	40513000	270087

Cost average /m2 for five location was IDR.289745 in 2018.

4.3 Direct Survey in the Field

Based on direct surveys in the field in 2018, the price of 1 block paving with a size of 21x10.5x6cm in 3 locations in a row is in IDR.1200; IDR.1400; IDR1500, and Wage of worker was IDR.90000/day, Sand was IDR.50000/m^3, Portland cement was IDR.52000/zak 40 kg, Split size 0,5-1cm was IDR.280/kg.

4.4 Unit Price of Work Refers SNI 2013

Table 7: Unit Price of Concrete Work K-350

Description	Unit	Coefficient
Worker	man day	2.100
Bricklayer	man day	0.350
Head	man day	0.035
Foreman	man day	0.105
Portland cement	kg	448.0
Fine aggregate	kg	667.0
Gravel (Max .30mm)	kg	1000.0
Water	liter	215.0

Table 8: Unit Price of Paving Block Work Size of 21x10,5x6cm

Description	Unit	Coefficient
Bricklayer	man day	0.250
Head	man day	0.025
Worker	man day	0.500
Foreman	man day	0.025
Paving block	Pcs	45.00
Sand	m^3	0.050

4.5 Unit Price in 1 m^2 of Work

Table 9: Unit price of 1 m^2 Concrete K-350 with thickness 15 cm, In 2017

Description	Unit	Coefficient	Basic price	Amount
Worker	man day	2.1	86250	181125
Bricklayer	man day	0.35	115000	40250
Head	man day	0.035	126500	4428
Foreman	man day	0.105	132250	13886
Portland cement	kg	448	1438	644000
Fine aggregate	kg	667	33	21713
Gravel (Max .30mm)	kg	1000	255	254620

Table 9 shown that unit price of 1 m^2 Concrete K-350 with 15cm thickness, it was IDR.174003

Table 10: Unit price of 1 m^2 Paving block Size of 21x10,5x6cm, In 2017

Description	Unit	Coefficient	Basic price	Amount
Bricklayer	man day	0.25	115000	28750
Head	man day	0.025	126500	3163
Worker	man day	0.5	86250	43125
Foreman	man day	0.025	132250	3306

Paving block	pcs	45.0	1500	67500
Sand	m^3	0.05	53763	2688

Table 10 shown that unit price of 1 m^2 Paving block Size of 21x10,5x6cm, it was IDR. 148532

Table 11: Unit price of 1 m^2 Concrete K-350 with thickness 15 cm, In 2018

Description	Unit	Coefficient	Basic price	Amount
Worker	man day	2.1	90000	189000
Bricklayer	man day	0.35	120000	42000
Head	man day	0.035	130000	4550
Foreman	man day	0.105	135000	14175
Portland cement	Kg	448	1485	665280
Fine aggregate	Kg	667	42.0	28222
Gravel (Max .30mm)	Kg	1000	320	3200069

Table 11 shown that unit price of 1 m^2 Concrete K-350 with 15cm thickness, it was IDR. 189494

Table 12: Unit price of 1 m^2 Paving block Size of 21x10,5x6cm, In 2018

Description	Unit	Coefficient	Basic price	Amount
Bricklayer	man day	0.25	120000	30000
Head	man day	0.025	130000	3250
Worker	man day	0.5	90000	45000
Foreman	man day	0.025	135000	3375
Paving block	pcs	45.0	1600	72000
Sand	m^3	0.05	63525	3176

Table 12 shown that unit price of 1 m^2 Paving block Size of 21x10,5x6cm, it was IDR.156801

4.6 Comparison of the Unit Price of 1 M^2 Village Fund Budget for Concrete Roads with Paving Block

Table 13: Comparison of the unit price of 1 m2 Village Fund Budget for concrete roads with Paving Block

Village Fund Budget		SNI 2013 Concrete K-350		SNI 2013 Paving block	
Concrete thickness 15cm		Concrete thickness 15cm		Size of .21x10,5x6 cm	
2017	2018	2017	2018	2017	2018
312120	289745	174003	189494	148532	156801

Table 13 shown that price of paving block is 2 times cheaper than concrete material.

4.7 Quality Testing on the Road That Exists and in Paving Blocks on the Market

Table 14: Average Strength of coredrill On Existing Road

Location-1 : Length 150 m, Wide 1 m	105,58 kg/cm^2
Location-2 : Length 100 m, Wide 2 m	112,01 kg/cm^2
Location-3 : Length 100 m, Wide 2 m	109,36 kg/cm^2
Location-4 : Length 105 m, Wide 2,3 m	118,45 kg/cm^2
Location-5 : Length 160 m, Wide 2,3 m	119,58 kg/cm^2

Table 15: Average Strength of Paving Blocks On The Market

Location-1	151,0 kg/cm^2
Location-2	156,9 kg/cm^2
Location-3	153,9 kg/cm^2
Location-4	148,0 kg/cm^2
Location-5	152,9 kg/cm^2

Coredrill is carried out on a concrete road in the 2017 budget year. It aims to find out the quality installed. From the table 14 and tabel 15 shows that the quality of the concrete road is installed under the quality of

the paving block on the market. This shows that poor supervision of concrete road works.

4.8 Recommendations for Composition of Paving Block Refers to the Requirements of SNI 03-0691-1996

Paving block is used for roads in accordance with the requirements of SNI 03-0691-1996 are using K.350, Water absorption from testing on average 3 units of paving blocks should not exceed 6%.
Mix design is a way to get the composition as required by SNI 03-0691-1996.
In the table below we show the results of the paving block Mix design K-350.

Table 16: Recommendations for composition of paving block

Quality	Paving Block Composition (kg/m^3)			
	Cement	Sand	Coarse Aggregate	Water
K-350	303.2	873.2	1046.5	98.9

Table 17: Strength of Paving Blocks Mix Design K-350

Sample -1	360,20 kg/cm^2
Sample -2	365,12 kg/cm^2
Sample -3	362,17 kg/cm^2
Sample -4	364,14 kg/cm^2
Sample -5	370,04 kg/cm^2

4.9 The Cost of 1 Paving Block Size of 21x10,5x6 cm Refers to the Requirements of SNI 03-0691-1996

Table 18: Cost of 1 Paving block Size of 21x10,5x6 cm K-350

Cement	303.2	g	1485	450189
Sand	873.2	g	42.06	36946
Coarse Aggregate	1046.5	g	320	334939
Water	98.9		-	-
Cost of 1 m^3				822074
Volume of 1 Paving block Size of.21x10,5x6 cm				0.00132
Number of paving blocks in 1 m^3				756
Cost of material in 1 paving block Size of.21x10,5x6 cm				1088
1 Worker in a day can produce paving block				500
Cost of worker in 1 day				90000
Cost of worker can produce 1 paving block				180
The Cost of 1 Paving block Size of 21x10,5x6 K-350				1268

The table above shows that self-produced paving blocks are cheaper than the price of paving blocks in the market.

5 CONCLUSION

1. Paving block is 2 times cheaper than concrete material.
2. Concrete material is 4 times faster than paving blocks.
3. The concrete road is suitable to be applied to road conditions with hilly geographical contour, with road slope above 10%.
4. Roads with paving blocks are suitable to be applied to road conditions with flat geographical contours, with slopes below 10%.

ACKNOWLEDGMENTS

The research is funded by the with university funding sources (USU Non-PNBP - TALENTA) in 2018.

REFERENCES

Anonim. 2003, “Perencanaan Perkerasan Jalan Beton Semen”, Pd. T-14-2003, Departemen Pemukiman dan Prasarana Wilaya, Jakarta.

Anonim, 1996, “Bata Beton (Paving Block)”, SNI 03-0691-1996, Badan Standarisasi Nasional, Jakarta

Anonim, 1995, “Petunjuk Perencanaan Teknis Jalan Desa”, No. 007/T/Bt/1995, Direktori Jendral Bina Marga, Jakarta.

Erwin, R. 2009. “Teknologi Pembuatan Paving Block Dengan Material FCA (Fine Coarse Aggregate)”, GAMMA, Volume IV. Malang.

Hulu, Y., Hamdani, H.R. dan Arif, N.M. 2018, “Pengelolaan Dana Desa dalam Pemberdayaan Masyarakat Desa”, Jurnal, Pendidikan Ilmu-Ilmu Sosial USU.

Irawan, A. 2016, “Perencanaan Infrastruktur Jalan Perdesaan Potensial Kabupaten Lebak Provinsi Banten” Universitas 17 Agustus 1945, Jakarta.

James, E. Dan Prakash, B. 2014, “Permeable Concrete Block Paving Applications In The United Arab Emirates”, International Journal Of Engineering Trends And Technology (IJETT) –Volume 16 Number 5, ISSN:2231-5381, Dubai.

Mantasa, _____, ”Evaluasi Tebal Perkerasan Beton Semen Dan Rencana Anggaran Biaya Pada Ruas Jalan KM. 38 Samboja Ke Sepaku”.

Puwarno, Dan Yulita, A.P. 2008, “Testing Of Concrete Paving Blocks The BS EN 1338:2003 British And European Standard Code”, Teknik – Vol. 29 No. 2, ISSN 0852-1697. Semarang.

Rozi, K., Hamzah, H.M. dan Saifoe, E.U. _____. ”Analisa Perbandingan Metode SNI dan Software MS. Projek Dalam Perhitungan Harga Satuan Pekerjaan Penutup Lantai Dan Dinding Serta Pemasagan Paving Block Untuk Konstruksi Bangunan”, Jurnal, Universitas Brimajaya, Malang.

Sharma, P. Dan Kumar, B.R. 2016, “Cement Concrete Paver Block For Rural Roads”, TROI, Volume-3, Issue-2, ISSN: 2393-8374. India.

Sudarsana, D.K. 2008, “Pengendalian Biaya Dan Jadual Terpadu Pada Proyek Konstruksi”, Jurnal Teknik Sipil Vol. 12, No 2, Universitas Udayana, Denpasar.

Wangsadinata, W., Indra, T.A.R., dan Najid. 2014, “Pemilihan Jenis Perkerasan Jalan Kabupaten Berdasarkan Kondisi Ekonomi Daerah”, The 17th FSTPT Internation Symposium, Jember University.