Comparison Calculation Thick Pavement Rigid (Rigid Pavement) Between Method Manual Design Pavement Road (Revision 2017) With Method Build Clan Pd-T-14-2003, on Ruas Road Shell Until Limit City Land Gr

by Muhammad Gunawan Prime

Submission date: 15-Jul-2024 01:35PM (UTC+0700)
Submission ID: 2417104130
File name: IJMICIE_VOL_JULI_2024_HAL_123-137.pdf (697.22K)
Word count: 3062
Character count: 16553

International Journal of Mechanical, Electrical and Civil Engineering
Volume.1 No.3 July 2024
e-ISSN: 3047-4531; p-ISSN: 3047-4523, Page: 123-137
DOI: https://doi.org/10.61132/ijmecie.v1i3.32
Available online at: https://international.aritekin.or.id/index.php/IJMECIE

Comparison Calculation Thick Pavement Rigid (Rigid Pavement) Between Method Manual Design Pavement Road (Revision 2017) With Method Build Clan Pd-T-14-2003, on Ruas RoadShell Until Limit City Land Grogot East Kalimantan

Muhammad Gunawan Prime
Faculty of Engineering, Islamic University of Kalimantan Muhammad Arsyad Al Banjari Banjarmasin, Indonesia

Address: Jalan Adhyaksa, No. 2 Banjarmasin Tangi Wood, Indonesia
Email: gunawan_perdana@yahoo.co.id

Abstract Roads are a means of transportation for supports various development sector and is a means of regional development of areas along the road the. By Because That, system transportation road kingdom is activity mover economy Which important beside Also become means activity resident Which involve problems economy, social And culture. Development road intended For make it easier connection from something regions to other regions, as well as to develop the economic potential that exists in area the. Objective from study this is For Plan Thick Construction Pavement Rigid With Manual Methods of Pavement Design Road 2017 and Methods Pd T- 14-2003 and compare both methods the. The thickness of the concrete slab obtained from the 2017 Road Pavement Manual method is of 28.5 cm with a thin concrete layer of 10 cm and a drainage layer with a thickness of 15 cm. The thickness of the concrete slab obtained from the Pd T-14-2003 method which is 18 cm. Based on the reinforcement calculation As Min > As Required then obtained reinforcement Which efficient For thick plate concrete 180 mmm is reinforcement 10 mm in diameter with a distance of 300 transverse and longitudinal reinforcement mm, transverse connection (Dowel) is required Ø 28 mm, with a length (L) of 450 mm and the distance (s) between dowels is 300 mm, while the longitudinal connection (Tie Bar)that is with Ø 16 mmm with long 700 mmm And distance 60 mmm. As well as Based on the calculation of reinforcement As Min > As Required, the reinforcement obtained is efficient for a concrete plate thickness of 265 mm is reinforcement with a diameter of 12 mm with distance between transverse reinforcement and longitudinal reinforcement 300 mm, transverse connection (Dowel) required Ø 32 mm, with a length (L) of 450 mm and a distance (s) between dowel 300 mmm, while the longitudinal connection (Tie Bar) is with Ø 16 mm with a length of 700 mm and a distance of 60 mm. Based on the comparison description calculation of rigid pavement thickness using the Manual Design Method Pavement Road (Revision 2017) with thick pavement rigid (rigid pavement)with Method Build Clan Pd T-14-2003 For use method MDPJ2017 show will more thick compared to method PD Q 14 Year 2003.

Key words: Fly Ash, Sand and AC – WC

1. BACKGROUND

Road is means transportation For support various sectors development And is means in development region from area along that road. System transportation the highway is an important economic driving activity as well as being a means activity resident Which involve problems economy, social And culture. Development road intended For make it easier connectionfrom something area to Other region.

Procurement road can works complex depends objective Which want to achieve, but roads are the main means of land connection as a link between one region and another. Apart from that, development This road is one of the national developments being carried out by

Received May 10th, 2024; Received June 18th, 2024; Accepted July 09nd, 2024; Published July 15th, 2024
* Muhammad Gunawan Prime, gunawan_perdana@yahoo.co.id

government For well-being public user road.

Road pavement calculations generally include pavement thickness. Calculation thick layer pavement can differentiated become pavementrigid (*rigid pavement*) And pavement flexible (*flexible pavement*). Thick The pavement layer can be calculated in various ways (Sukirman, 1999), among others:

- Planning Pavement Rigid Method Build Clan Pd T-14-2003, Indonesia.
- Method Manuals Design Pavement Go on, Directorate General Build Clan.
- Method other.

Because there are many methods available, researchers are trying to create one something comparison calculation thick layer pavement with use two method, that is Method Build Clan Pd T-14-2003, AndMethod Manuals Design Pavement Road (Revision 2017) on Section Road Shells to Tanah Grogot City Limits, East Kalimantan STA 1+020 – 4+200.

2. THEORETICAL STUDY

Pavement is a structure consisting of many layers made to increase the bearing capacity of the soil so that it can withstand repeated loads cross so that the ground does not experience significant deformation. Pavement or structure pavement defined as structure Which consists from One or more layer pavement Which made from materialwhich has quality Which Good .

Pavement road is layers material Which installed on subgrade to receive traffic loads, so that traffic loads and heavy pavement That Alone can carried by land base.

Election type pavement will varies based on volumeThen cross, age plan, And condition foundation road. Limits no absolute, planner must consider cost Lowestduring age plan, limitations And practicality implementation. Election alternative design based on manually This must basedon discounted lifecycle lowest cost.

Rigid pavement procedures follow the provisions of Pd T-14-2003 Cement Concrete Pavement Thickness Planning. With notes that traffic load spectrum must follow the provisions Which set based on burden actual. Burden axis based on spectrum burden according to Pd T-142003 is Forcondition burden under control. Planner must apply group axis vehicle commerce with actual load. Load chart in Pd T-14-2003 should not be used for pavement design because it is based on provision heavy group vehicle Which No realistic with condition Indonesia. Surface foundation (land base) form land grainy fine(classification AASHTO A4 – A6) must be stabilized cement thick 150 mmm.

The estimated plate thickness is selected and the total fatigue and erosion damage calculated based on the composition of traffic during the life of the plan. If fatigue damage or erosion of more than 100%, the estimated thickness is increased and process planning repeated. Thick plan is thick estimate Which most small Which has a smaller total fatigue and/or total erosion damage or The same with 100%.

Thickness minimum all type pavement stiff ones will passed vehicle commerce, No can not enough from 150 mmm except pavement continued No bony without trellis (dowel), thick minimum must be 200 mm. This minimum thickness also applies to pavement rigid with layer surface asphalt with ignore thick layer surface asphalt Which There is.

Calculation thick plate can done with start – start try to choose a certain plate thickness then calculate the *total tired* " based on configuration And burden axis during age plan. If the total *fatigue* is more than 100%, then the plate thickness is taken Which more big And inspection total *fatigue* repeated return. The design thickness is the thickness that provides approximate total *fatigue* or The same with 100%.

3. RESEARCH METHODS

To support the achievement of the objectives in preparing this final assignment, then the theoretical basis used in thickness calculations will be explained pavement road with Method Build Clan Pd T-14-2003, And MethodManuals Design Pavement Road (Revision 2017) on Section Road Shell to the Tanah Grogot City Limit, East Kalimantan.

4. RESULTS AND DISCUSSION

1. ROAD PAVEMENT DESIGN MANUAL METHOD (2017 REVISION)

Procedure from planning Method Manuals Design Pavement Road (Revision 2017) is as following:

1. Data Which in get
   - Strong pull flexible (fcf) : 4.5 Mpa
   - Material Foundation lower : Stabilization
   - Quality steel reinforcement : BJTU 24 (f y2: voltage melt = 2400 kg/cm2) ForBBDT.
   - Growth traffic (i) : 3.5 % per year (Table 2.3)
   - Age plan (UR) : 40 year
   - CBR land base : 4.6 % (Attachment 4)
   - Shoulder road : Yes (concrete).

- Trellis (dowel) : Yes
- Planned pavement concrete cement For road 2 lane 1 direction
- Planning Pavement concrete continued with reinforcement (BBDT)
- Data traffic daily average :

Table 4.1 Data So Cross

Jenis Kendaraan	LHR 2013 (kendaraan/Hari/2arah)	
Spd. Motor, Scroter Dan Kend. Roda 3	2930	Kendaraan
Sedan, Jeep, Station Wagon	1109	Kendaraan
Truk 2 Sumbu 4 Roda	13	Kendaraan
Truk 2 Sumbu 6 Roda	552	Kendaraan
Truk 3 Sumbu	11	Kendaraan
Total	18.189	Kendaraan

Sumber : Perhitungan Sendiri

2. Calculation So Cross

Determine mark CESA And CESA5 done stepsfollowing :

Table 4.2 Calculation So Cross

JENIS KENDARAAN	JUMLAH KELOMPOK SUMBU	LHR 2021	KELOMPOK SUMBU 2021	JUMLAH KELOMPOK SUMBU 2021 - 2060
(1)	(2)	(3)	(4)	(5)
5B	2	0	0	0,00E+00
6A	2	13	26	4,01E+05
6B	2	552	1104	1,70E+07
7A1	2	11	22	3,39E+05
7A2	2	0	0	0,00E+00
7C1	2	0	0	0,00E+00
7C2A	3	0	0	0,00E+00
7C2B	3	0	0	0,00E+00
7C3	3	0	0	0,00E+00
Kumulatif kelompok sumbu kendaraan berat 2021 - 2060				1,78E+07

Sumber : Perhitungan Sendiri

Information formula table in on :

(4) = (2) x (3)

(5) = (4) x 365 x 0.5 x 1 x R_{40}

$R_{40} = (1 + 0.01 \times 3.5) \wedge 40 - 1 / (0.01 \times 3.5)$

3. Calculation Thick Pavement

For know thick work use table following :

Table 4.3 Pavement Rigid For Road with Burden So Cross Heavy

Struktur Perkerasan	R1	R2	R3	R4	R5
Kelompok sumbu kendaraan berat (overloaded)	< 4,3	< 8,6	< 25,8	< 43	< 86
Dowel dan bahu beton	Ya				
STRUKTUR PERKERASAN (mm)					
Tebal pelat beton	265	275	285	295	305
Lapis Fondasi LMC			100		
Lapis Drainase (dapat mengalir dengan baik)			150		

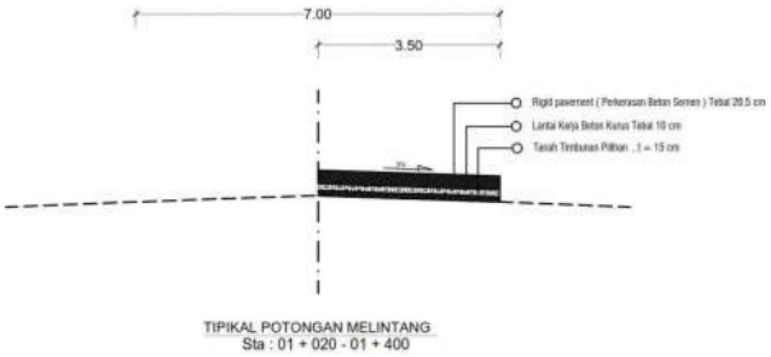
Sumber : MDPJ 2017

Based on the results of traffic calculations, the R1 pavement table is obtained Referring to the table above, the R1 Pavement Structure is used:

Plate Concrete: 26.5 cm

LMC Foundation Layer: 10 cm

Layer Drainage : 15 cm

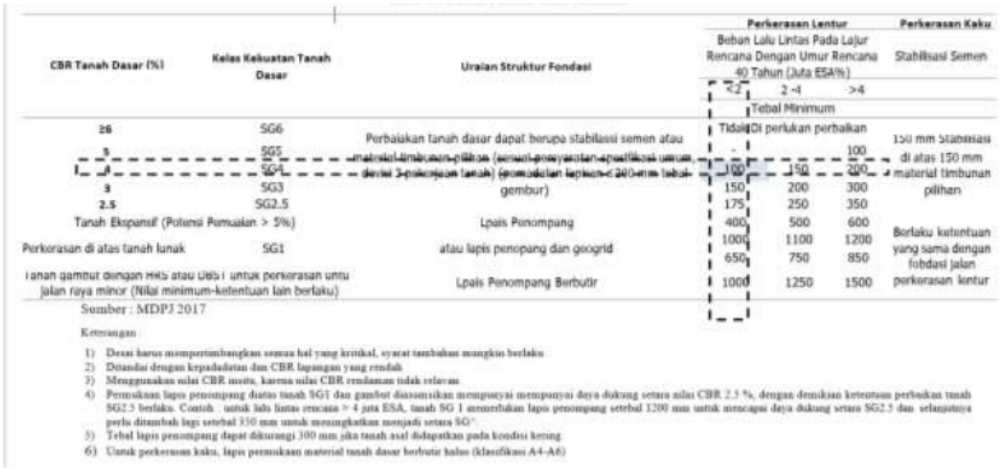


Picture 4.1 Thick Pavement Rigid Pavement According to Method Manuals DesignPavement Road (Revision 2017)

4. Calculation Thick Foundation Road Minimum

Fromresults CBR land base as big as 4.6 % And burden Then cross 1.78E+07.

Table 4.4 Design Foundation Road Minimum



CBR Tanah Dasar (%)	Kelas Kekuatan Tanah Dasar	Uraian Struktur Fondasi	Perkerasan Lentur: Beban Lalu Lintas Pada Lajur Rencana Dengan Umur Rencana 40 Tahun (Juta ESA5) <2	2-4	>4	Perkerasan Kaku: Stabilisasi Semen
			Tebal Minimum			
≥6	SG6	Perbaikan tanah dasar dapat berupa stabilisasi semen atau material timbunan pilihan (sesuai spesifikasi umum devisi 3 pekerjaan tanah) ketebalan lapisan > 200 mm lebih	Tidak di perlukan perbaikan			
5	SG5		-		100	150 mm stabilisasi di atas 150 mm material timbunan pilihan
4	SG4		100	150	200	
3	SG3	gembur)	150	200	300	
2.5	SG2.5		175	250	350	
Tanah Ekspansif (Potensi Pemuaian > 5%)		Lpais Penompang	400	500	600	
Perkerasan di atas tanah lunak	SG1	atau lapis penopang dan geogrid	1000	1100	1200	Berlaku ketentuan yang sama dengan fobdasi jalan perkerasan lentur
Tanah gambut dengan HRS atau DBST untuk perkerasan untu jalan raya minor (Nilai minimum-ketentuan lain berlaku)		Lpais Penompang Berbutir	650	750	850	
			1000	1250	1500	

Sumber : MDPJ 2017

Keterangan

1) Desai harus mempertimbangkan semua hal yang kritikal, syarat tambahan mungkin berlaku
2) Ditandai dengan kepadatatan dan CBR lapangan yang rendah
3) Menggunakan nilai CBR mesin, karena nilai CBR rendaman tidak relevan
4) Permukaan lapis penompang diatas tanah SG1 dan gambut diasumsikan mempunyai mempunyai daya dukung setara nilai CBR 2.5 %, dengan demikian ketentuan perbaikan tanah SG2.5 berlaku. Contoh : untuk lalu lintas rencana > 4 juta ESA, tanah SG 1 memerlukan lapis penompang setebal 1200 mm untuk mencapai daya dukung setara SG2.5 dan selanjutnya perlu ditambah lagi setebal 350 mm untuk meningkatkan menjadi setara SG3
5) Tebal lapis penompang dapat dikurangi 300 mm jika tanah asal didapatkan pada kondisi kering
6) Untuk perkerasan kaku, lapis permukaan material tanah dasar berbutir halus (klasifikasi A-4-A6)

2. Binamarga Method Pd T-14-2003

Procedure planning pavement rigid according to method Pd T-14-2003is as following:

1. Data

- Strong pull flexible (fcf) : 4.5 Mpa
- Material Foundation lower : Stabilization
- Quality steel reinforcement : BJTU 24 (f y2: voltage melt = 2400 kg/cm2) ForBBDT,
- Coefficient swipe between plate concrete with Foundation (μ) : 1.5(Table 2.12)
- Growth traffic (i) : 3.5 % per year (Table 2.3)
- Age plan (UR) : 40 year
- CBR land base : 4.6 % (Attachment 4)
- Shoulder road : Yes (concrete)
- Trellis (dowel) : Yes
- Planned pavement concrete cement For road 2 lane 1 direction
- Planning Pavement concrete continued with reinforcement(BBDT)
- Data traffic daily average :

e-ISSN: 3047-4531; p-ISSN: 3047-4523, Page: 123-137

Table 4.5 Traffic Data

Jenis Kendaraan	LHR2013 (kendaraan/Hari/2arah)	
Spd, Motor, Scroter Dan Kend, Roda 3	2930	Kendaraan
Sedan, Jeep, Station Wagon	1109	Kendaraan
Truk 2 Sumbu 4 Roda	13	Kendaraan
Truk 2 Sumbu 6 Roda	552	Kendaraan
Truk 3 Sumbu	11	Kendaraan
Total	18.189	Kendaraan

Sumber : Perhitungan Sendiri

2. Analysis So Cross

Table 4.6 Calculation of the Number of Axles Based on Type and Load

Jenis Kendaraan	Konfigurasi beban sumbu Ton				Jumlah kendaraan	Jumlah Sumbu Perkendaraan	Jumlah Sumbu	STRT		STRG		STdRG	
	RD	RB	RGD	RGB	bh	bh	bh	BS Ton	JS bh	BS Ton	JS bh	BS Ton	JS bh
1	2				3	4	5	6	7	8	9	10	11
SPD, MOTOR, SCROTER DAN KEND, RODA 3					2930		0						
SEDAN, JEEP, STATION WAGON	1	1			1109		0						
OPLET, PICK-UP, COMBI DAN MINIBUS					0		0						
PICK-UP, MICRO TRUCKDAN MOBIL HANTARAN					0		0						
BUS KECIL					0		0						
BUS BESAR					0		0						
TRUK 2 SUMBU 4 RODA	2	4			13	2	26	2 4	13 13				
TRUK 2 SUMBU 6 RODA	5	8			552	2	1104	5	552	8	552		
TRUK 3 SUMBU	6	14			11	2	22	6	11			14	11
TRUK GANDENGAN					0		0						
TRUK SEMI TRAILER					0		0						
TOTAL							1152		589		552		11

Sumber : Perhitungan Sendiri

Keterangan : RD = Roda Depan, RB = Roda Belakang, RGD = Roda Gandeng Depan, RGB = Roda Gandeng Belakang, BS = Beban Sumbu, JS = Jumlah Sumbu

Factor Growth So Cross (c) :

$$R = \frac{(1+i)^{U.R} - 1}{i}$$

$$R = \frac{(1+0.035)^{40} - 1}{0.035}$$

$R = 84.55$

Amount Lane Based on Wide Pavement And Coefficient Distribution

$C = 0.7$ (Table 2.20)

Amount Axis Vehicle Commerce Daily (JSKNH)JSKNH = 1152

Amount Axis Vehicle Commerce (JSKN) During Age Plan

JSKN = JSKNH × 365 × R × C

= 1152×365×84.55×0.7

= 24886190.55

3. Calculation Repetition Axis

Table 4.7 Calculation Repetition Axis Which Happen

Jenis Sumbu	Beban Sumbu (ton)	Jumlah Sumbu	Proporsi Beban	Proporsi Sumbu	Lalu-Lintas Rencana	Repetisi yang terjadi
(1)	(2)	(3)	(4)	(5)	(6)	(7) = (4) x (5) x (6)
STRT	6	11	0,02	0,51	24886191	237629
	5	552	0,94	0,51	24886191	11924633
	3	13	0,02	0,51	24886191	280834
	2	13	0,02	0,51	24886191	280834
Total		589				
STRG	8	552	1,00	0,48	24886191	11924633
Total		552				
STdRG	14	11	1,0	0,01	24886191	237629
Total		11				
			TOTAL			24886190,55

Sumber : Perhitungan Sendiri
Keterangan : STRT (Sumbu Tunggal Roda Tunggal), STRG (Sumbu Tunggal Ganda), STdRG (Sumbu Tandem Roda Ganda)

4. Calculation Thick Plate Concrete / Slabs Concrete

Type Pavement = BBDT

Type Shoulder Road = Concrete

Age Plan (UR) = 40 Year

Factor Security Burden (FKB) = 1,2 (Table 2.15)Strong

Pull Flexible Concrete F'cf age 28 days = 4.5 Mpa

Amount Axis Vehicle (JSK) = 24886190.55 = 2.5×10^{7}

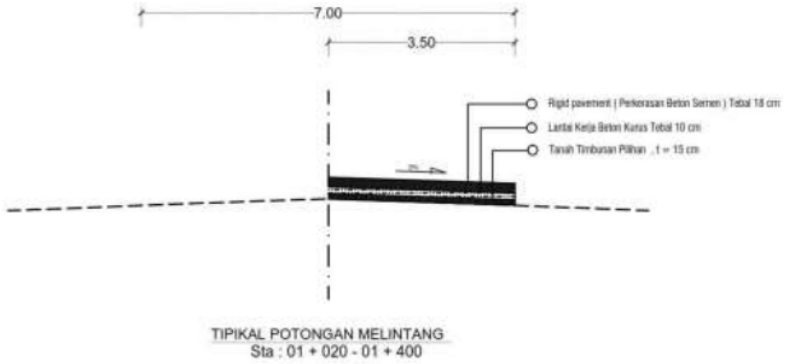
CBR Land Basic = 4.6 % (Attachment 3) Thick

Layer Foundation Bottom = 125 mmm (Picture 4.2)CBR

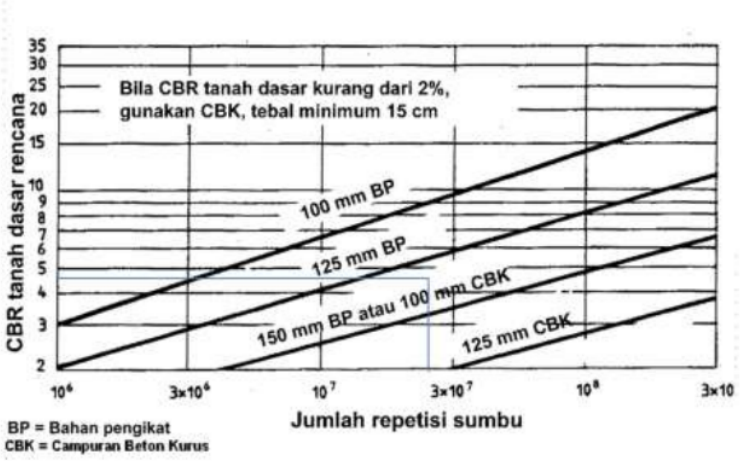
Effective = 49 % (Picture 4.3)

e-ISSN: 3047-4531; p-ISSN: 3047-4523, Page: 123-137

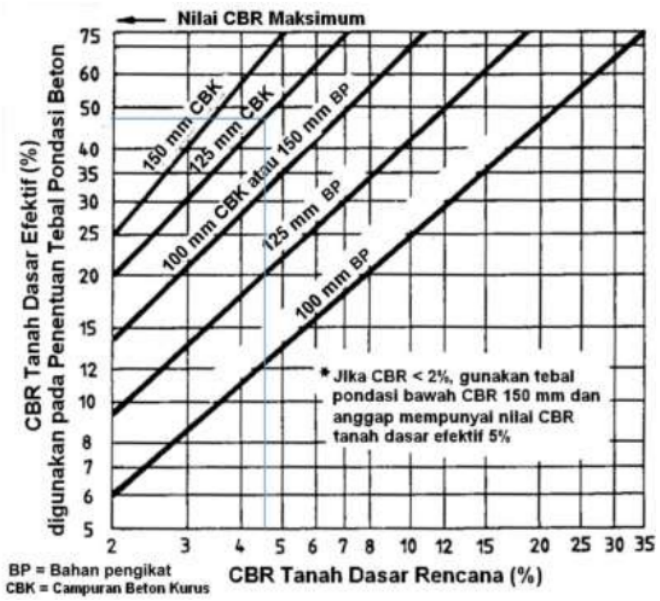
Thick Estimate Plate Concrete = 180 mmm (Picture 4.4)



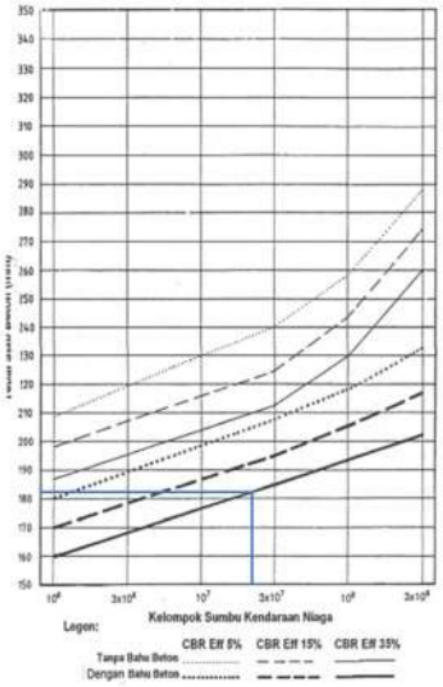
Picture 4.2 Thick Pavement Rigid Pavement According to Method Binamarga Pd T-14-2003



Picture 4.3 Thick Foundation lower minimum For pavement concrete cement



Picture 4.4 CBR land base effective and thick Foundation



Picture 4.5 Chart Planning

e-ISSN: 3047-4531; p-ISSN: 3047-4523, Page: 123-137

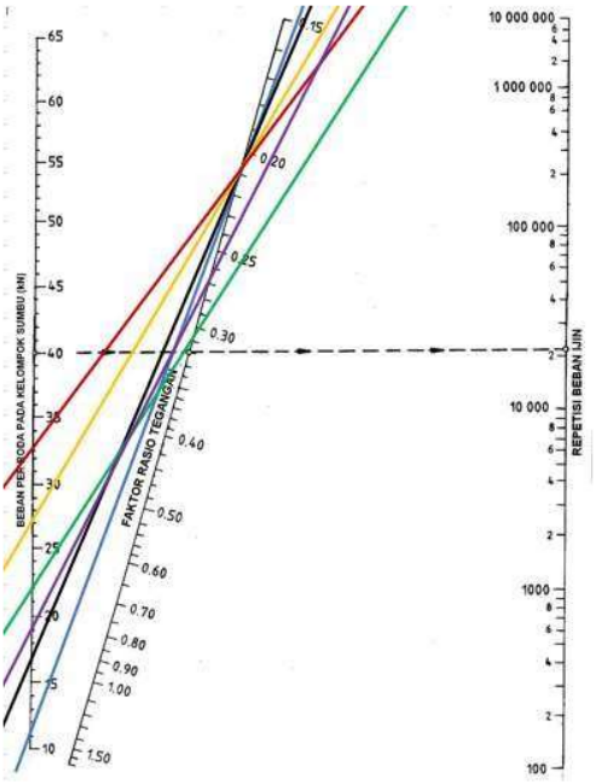
5. Analysis Fatigue and Erosion

Table 4.8 Analysis Fatigue And Erosion

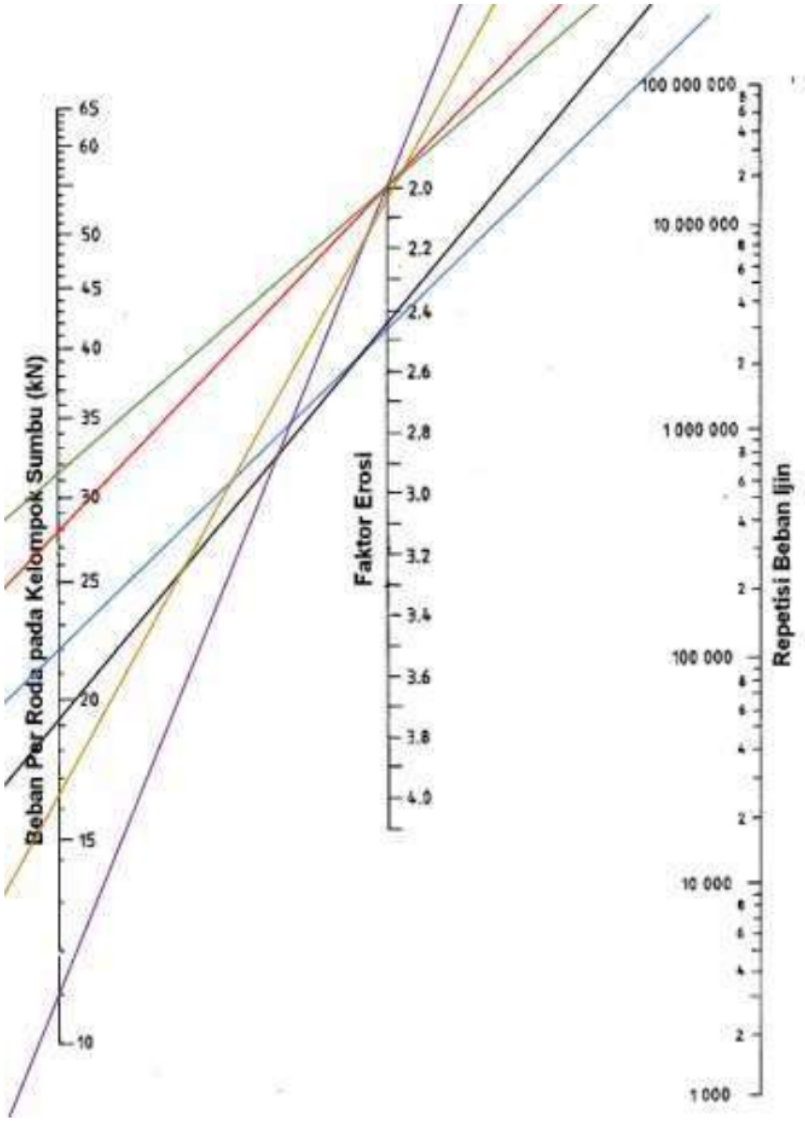
Jenis Sumbu	beban sumbu ton (kN)		Beban Rencana Per roda (kN)	Repetisi yang terjadi	Faktor Tegangan dan Erosi	Analisa Fatik		Analisa Erosi	
						Repetisi Ijin	Persen Rusak (%)	Repetisi ijin	Persen Rusak (%)
(1)	(2)		(3)	(4)	(5)	(6)	(7) = (4)*100/(6)	(8)	(9)=(4)*100/(8)
STRT	6	60	33	32971,08048	TE : 0,95	TT	0	TT	0
	5	50	27,5	1654548,766	FRT : 0,21	TT	0	TT	0
	3	30	16,5	38965,82238	FE : 1,84	TT	0	TT	0
	2	20	11	38965,82238		TT	0	TT	0
STRG	8	80	22	1654548,766	TE : 1,38 FRT : 0,3067 FE : 2,44	TT	0	TT	0
STdRG	14	140	19,25	32971,08048	TE : 1,16 FRT : 0,25778 FE : 2,42	TT	0	TT	0
	Total					0	>100%	0	>100%

Sumber : Perhitungan Sendiri

Keterangan : TE = Tegangan Ekivaleo FRT = Faktor Rasio Tulangan FE = Faktor Eros TT = Tidak Terbata



Picture 4.6 Analysis Fatigue and Burden Permission Based on Ratio Voltage withor Without Concrete Shoulder



Picture 4.7 Analysis And Amount Repetition Burden Permission Based on Factor Erosionwith Shoulder Concrete

3. Calculation of Reinforcement in Concrete

Type Pavement Concrete Continued With Reinforcement (BBDT) With

Thick Plate 265 mmm

Thick Plate concrete	: 265 mm	= 0.265 m
Wide Plate Concrete	: 7 m	= 3.5 × 2 m

Long Plate	: 12 m
Strong Pull Permission Steel	: 240 Mpa
Heavy fill Concrete	: 2400 kg/m ^{3}
Gravity (g)	: 9.81 m/s ^{2}

Coefficient swipe between plate concrete with Foundation bring : 1.5 (Table2.20).

4. Calculation Results

Comparison of Rigid Pavement Thickness Planning Results Based on Method Bina Marga 2003/PD T-14 of 2003 and the Pavement Design Manual method Jalan 2017/MDPJ 2017 on Jalan Kerang to Tanah City Limits Grogot East Kalimantan STA 1+020 – 4+200, comparison of results obtained planning both of them Which can seen on table in bottomComparison of Rigid Pavement Thickness Planning Results Based on method Bina Marga 2003/PD T-14 of 2003 and the Pavement Design Manual method Jalan 2017/MDPJ 2017 on Jalan Kerang to Tanah City Limits Grogot East Kalimantan STA 1+020 – 4+200, comparison of results obtained planning both of them Which can seen on table in lower.

Table 4.9 Comparison of Calculation Results

Metode yang Digunakan	Tebal Pelat Beton
Bina Marga 2003/PD T-14 Tahun 2003	26,5 cm
Manual Desain Perkerasan Jalan 2017/MDPJ 2017	18 cm

Sumber : Perhitungan Sendiri

Based on results calculation on in can comparison as Following :

1. Based on the thickness of the concrete slab, it is clear that there are differences according to the method Bina Marga 2003/PD T-14 2003 concrete slab thickness is 18 cm Meanwhile, according to the manual calculation method for road pavement design 2017/MDPJ 2017 thick Plate Is 26.5 cm.
2. See from results Calculation Thick Plate Concrete from second method the For thick Plate Concrete Based on Calculation method Buildmarga 2003/PD T-14 in 2003 18 cm and this in terms of cost will be more cheap.
3. See the results obtained from calculating the thickness of the concrete slab based on method Manuals Design Work Road 2017/ MDPJ 2017 more practicalAnd results Which obtained include plate thickness Concrete, thick, Foundation Layer, And

Layer Drainage, Because Already become One unity in table 4.3.

4. Based on Description comparison calculation thick pavement rigid (*rigid pavement*) using the Road Pavement Design Manual Method (Revised 2017) with thick rigid pavement *using* the Bina Method Clan Pd T-14-2003 For use method MDPJ 2017 show will more thick compared to method PD Q 14 Year 2003.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on results thickness calculation pavement rigid according to method Road Pavement Design Manual (Revised 2017) for the Kerang Road Section to Tanah Grogot City Limits, East Kalimantan STA 1+020 – 4+200is 26.5 cm.

Based on the results calculation of rigid pavement thickness according to Method Bina Marga Pd T-14-2003 on the Jalan Kerang to City Limits Land Grogot Kalimantan East STA 1+020 – 4+200 is 18 cm,

Based on calculation reinforcement US Min < US Need so obtained Efficient reinforcement for a concrete plate thickness of 180 mm is reinforcement diameter 10 mmm with distance reinforcement transverse And reinforcement extends 300 mm, connection transverse (Dowel) required Ø 28 mm, with a length (L) of 450 mm and a distance (s) between dowels of 300 mm, whereas connection elongated (*Tie Bars*) that is with Ø 16 mmmwith long 700 mmm And distance 60 mmm. As well as Based on reinforcement calculation As Min > As Necessary to obtain adequate reinforcement efficient for thick plates 265 mm concrete is 12 diameter reinforcement mm with a distance of 300 mm between transverse and longitudinal reinforcement, connection transverse (Dowel) required Ø 32 mmm, with long (L) 450 mmm And distance (s) between dowel 300 mmm, whereas connection elongated (*Tie Bars*) that is with Ø 16 mmm with long 700 mmmAnd distance 60 mmm.

Based on Description comparison calculation thick pavement rigid (*rigid pavement*) with Method Manuals Design Pavement Road (Revision 2017) thickly pavement rigid (*rigid pavement*) with Bina Marga Method Pd T-14-2003 to use the MDPJ method 2017 show will more thick compared to method PD Q 14 Year 2003.

Need exists planning Which thorough especially in planning structure so that change work can minimized so that implementation work can walk fluent.

Safety factor And comfort very important in planning road kingdom.

Practical methods that has been implemented in the field, preferably still refers to standard ones has set to avoid failure technical.

REFERENCE LIST

Yoder, E. J., & Witczak, M. W. (1975). Principles of Pavement Design (2nd ed.). A Wiley-Interscience Publications, New York.

Totomihardjo, S. (2004). Material and Structure Road Raya. Yogyakarta: Bureau Publisher KMTS FT UGM.

Suryawan, A. (2016). Pavement Road Cement Concrete Portland (Rigid Pavement): Series Book Technique Civil Practical. Yogyakarta: Beta Offset.

Sukirman, S. (1999). Planning Basics Geometric Road. Bandung: Nova.

Shirley, L., & Hendarsin. (2000). Planning Technique Road Raya. Bandung: Polytechnic Country Bandung Major Technique Civil.

Rahman, M. A., & Surya, A. (2023). Analysis and solutions to traffic congestion on city roads (Case study of Jalan Sungai Andai – Padat Karya, Banjarmasin City) (Unpublished thesis). Muhammad Arsyad Al Banjari Islamic University, Banjarmasin.

Pratama, S. H. (2021). Study of the use of coal ash waste (fly ash) as a substitute for filler in AC-WC mixtures on Marshall test characteristics (Unpublished thesis). Mataram Muhammadiyah University, Mataram.

Huang, C., et al. (2005). Identification of an antifungal chitinase from a potential biocontrol agent, Bacillus cereus. Journal of Biochemistry and Molecular Biology, 38, 82-88.

Department of Public Works. (2008c). Indonesian National Standard 2417-2008, how to test aggregate wear with a Los Angeles abrasion machine. Jakarta: Department of Public Works.

Department of Public Works. (2008b). Indonesian National Standard 1970-2008, method for testing specific gravity and water absorption of fine aggregates. Jakarta: Department of Public Works.

Department of Public Works. (1990). Indonesian National Standard 03-1968-1990, test method for fine and coarse aggregate sieve analysis. Jakarta: Department of Public Works.

Department of Public Works. (1987). Instruction Planning Thick Pavement Rigid Road Raya with Method MDPJ 2017. Jakarta.

Department of Public Works, Directorate General of Highways. (2008). Instructions Rigid Highway Pavement Thickness Planning Austroads Method 1992, Pd T-14-2003.

Croney, D. (1977). The Design and Performance of Road Pavements. Transport and Road Research Laboratories, Department of The Environment, Department of Transport, Her Majesty's Stationery Office, London.

Basuki, H. (1986). Designing and plan field fly print second. PT ALUMNI, Bandung.

Aulia, R. N. (2022). Calculation of HRS-WC Asphalt Mixture Using Fly Ash (Unpublished thesis). Banjarmasin State Polytechnic, Banjarmasin.

Comparison Calculation Thick Pavement Rigid (Rigid Pavement) Between Method Manual Design Pavement Road (Revision 2017) With Method Build Clan Pd-T-14-2003, on Ruas Road Shell Until Limit City Land Gr

ORIGINALITY REPORT

12%	12%	6%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	international.aritekin.or.id Internet Source	4%
2	eprints.uniska-bjm.ac.id Internet Source	2%
3	conference.ft.unand.ac.id Internet Source	2%
4	ejournal.polbeng.ac.id Internet Source	2%
5	Syaiful Syaiful, Hendra Rusfana. "RIGID PAVEMENT PLANNING IN TRAFFIC: CASE STUDY IN CIHERANG ROAD AND PEMUDA ROAD, BOGOR REGENCY, INDONESIA", Journal of Applied Engineering Science, 2022 Publication	1%
6	ascelibrary.org Internet Source	1%
	seaninstitute.org	

7	Internet Source	<1%
8	A P N Siregar, A Rivani, H Mellisa, A Aswin, Karlina. "Effect of partial fly ash as cement substitute on the fracture toughness", IOP Conference Series: Earth and Environmental Science, 2022 Publication	<1%
9	academic.oup.com Internet Source	<1%
10	www.ncbi.nlm.nih.gov Internet Source	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		

Comparison Calculation Thick Pavement Rigid (Rigid Pavement) Between Method Manual Design Pavement Road (Revision 2017) With Method Build Clan Pd-T-14-2003, on Ruas Road Shell Until Limit City Land Gr

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15