Lampiran 1

Pengujian *dynotest*

Gambar 1 Pengujian *dynotest* menggunakan rantai

Gambar 2 Pengujian *Dynotest* Menggunakan V Belt

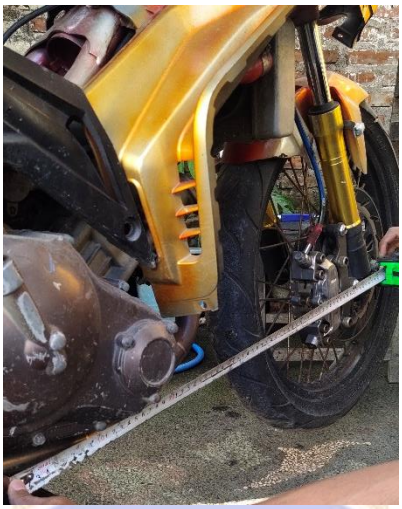
Gambar 3 Pengujian *dynotest*

Lampiran 2

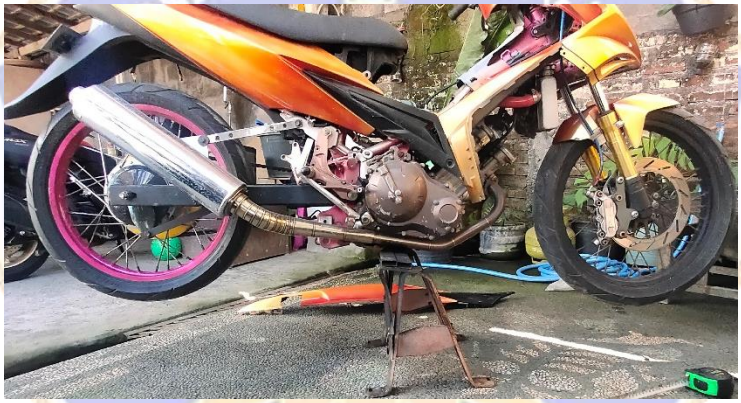
Gambar 4 Penggantian Rantai Menggunakan *v belt*

Gambar 5 Memposisikan Roda Belakang Dengan Sejajar Dengan *roll dynotest*

Lampiran 3



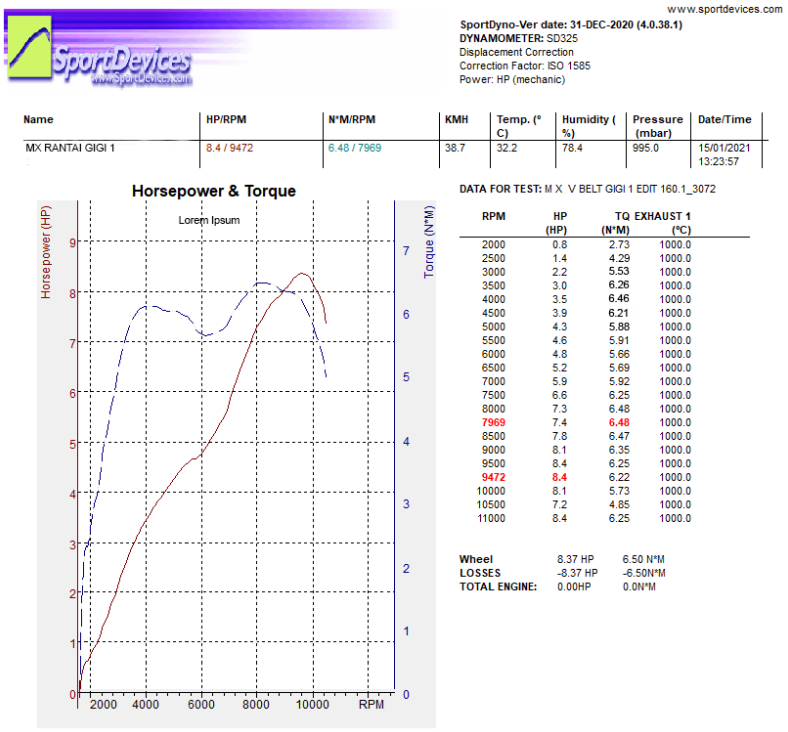
Gambar 6 Mencari Titik Tengah Berat Kendaraan (*wheel base*)



Gambar 7 titik tengah berat kendaraan (*wheel base*)

Lampiran 4

Hasil pengujian *dynotest* pengguna rantai.



www.sportdevices.com
SportDyno-Ver date: 31-DEC-2020 (4.0.38.1)
DYNAMOMETER: SD325
Displacement Correction
Correction Factor: ISO 1585
Power: HP (mechanic)

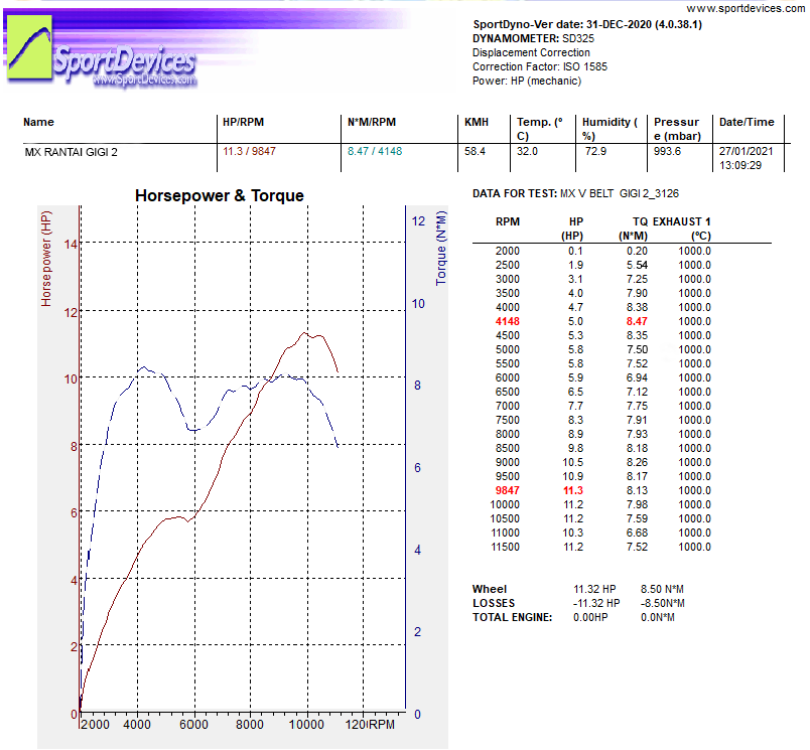
Name	HP/RPM	N*M/RPM	KMH	Temp. (° C)	Humidity (%)	Pressure (mbar)	Date/Time
MX RANTAI GIGI 1	8.4 / 9472	6.48 / 7969	38.7	32.2	78.4	995.0	15/01/2021 13:23:57

DATA FOR TEST: M X V BELT GIGI 1 EDIT 160.1_3072

RPM	HP (HP)	TQ (N*M)	EXHAUST 1 (°C)
2000	0.8	2.73	1000.0
2500	1.4	4.29	1000.0
3000	2.2	5.53	1000.0
3500	3.0	6.26	1000.0
4000	3.5	6.46	1000.0
4500	3.9	6.21	1000.0
5000	4.3	5.88	1000.0
5500	4.6	5.91	1000.0
6000	4.8	5.66	1000.0
6500	5.2	5.69	1000.0
7000	5.9	5.92	1000.0
7500	6.6	6.25	1000.0
8000	7.3	6.48	1000.0
7969	7.4	6.48	1000.0
8500	7.8	6.47	1000.0
9000	8.1	6.35	1000.0
9500	8.4	6.25	1000.0
9472	8.4	6.22	1000.0
10000	8.1	5.73	1000.0
10500	7.2	4.85	1000.0
11000	8.4	6.25	1000.0

Wheel	8.37 HP	6.50 N*M
LOSSES	-8.37 HP	-6.50N*M
TOTAL ENGINE:	0.00HP	0.0N*M

Gambar 8 hasil pengujian *dynotest* pada rantai di gigi 1



www.sportdevices.com
SportDyno-Ver date: 31-DEC-2020 (4.0.38.1)
DYNAMOMETER: SD325
Displacement Correction
Correction Factor: ISO 1585
Power: HP (mechanic)

Name	HP/RPM	N*M/RPM	KMH	Temp. (° C)	Humidity (%)	Pressure (mbar)	Date/Time
MX RANTAI GIGI 2	11.3 / 9847	8.47 / 4148	58.4	32.0	72.9	993.6	27/01/2021 13:09:29

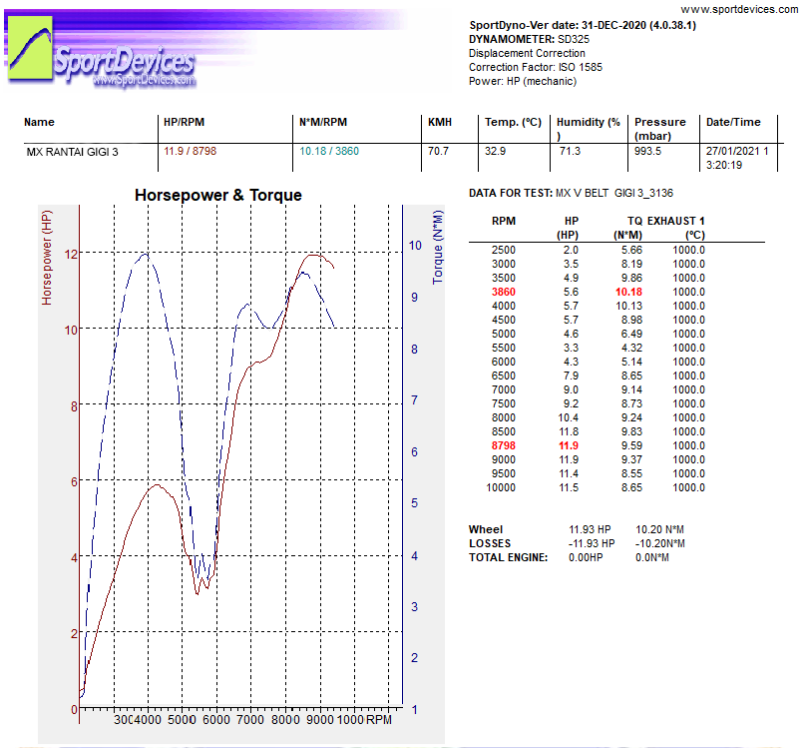
DATA FOR TEST: MX V BELT GIGI 2_3126

RPM	HP (HP)	TQ (N*M)	EXHAUST 1 (°C)
2000	0.1	0.20	1000.0
2500	1.9	5.54	1000.0
3000	3.1	7.25	1000.0
3500	4.0	7.90	1000.0
4000	4.7	8.38	1000.0
4148	5.0	8.47	1000.0
4500	5.3	8.35	1000.0
5000	5.8	7.50	1000.0
5500	5.8	7.52	1000.0
6000	5.9	6.94	1000.0
6500	6.5	7.12	1000.0
7000	7.7	7.75	1000.0
7500	8.3	7.91	1000.0
8000	8.9	7.93	1000.0
8500	9.8	8.18	1000.0
9000	10.5	8.26	1000.0
9500	10.9	8.17	1000.0
9847	11.3	8.13	1000.0
10000	11.2	7.98	1000.0
10500	11.2	7.59	1000.0
11000	10.3	6.68	1000.0
11500	11.2	7.52	1000.0

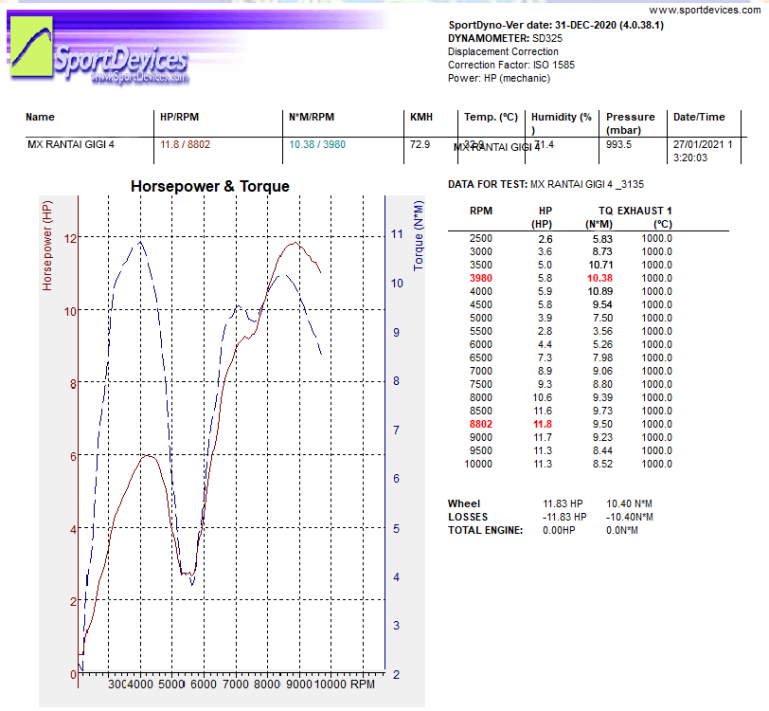
Wheel	11.32 HP	8.50 N*M
LOSSES	-11.32 HP	-8.50N*M
TOTAL ENGINE:	0.00HP	0.0N*M

Gambar 9 hasil pengujian *dynotest* pada rantai di gigi 2

Lampiran 5



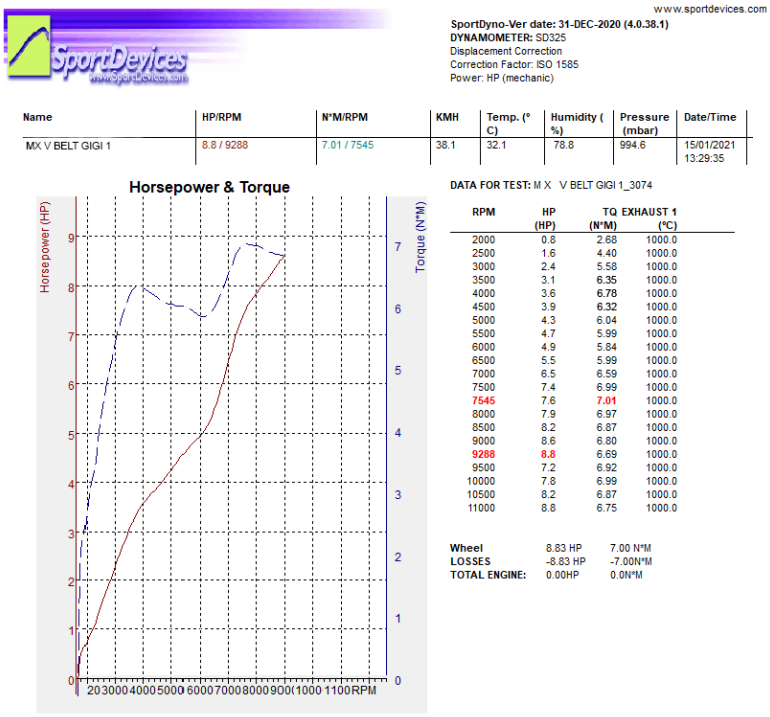
Gambar 10 pengujian *dynotest* pada rantai di gigi 3



Gambar 11 pengujian *dynotest* pada rantai di gigi 4

Lampiran 6

Hasil pengujian *dynotest* pengguna v belt



www.sportdevices.com
SportDyno-Ver date: 31-DEC-2020 (4.0.38.1)
DYNAMOMETER: SD325
Displacement Correction
Correction Factor: ISO 1585
Power: HP (mechanic)

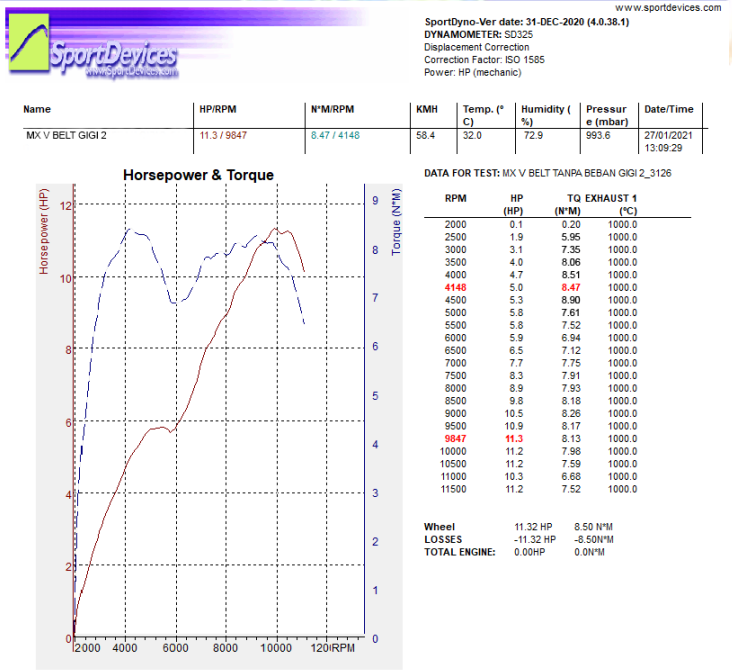
Name	HP/RPM	N*M/RPM	KMH	Temp. (° C)	Humidity (%)	Pressure (mbar)	Date/Time
MX V BELT GIGI 1	8.8 / 9288	7.01 / 7545	38.1	32.1	78.8	994.6	15/01/2021 13:29:35

DATA FOR TEST: M X V BELT GIGI 1_3074

RPM	HP (HP)	TQ (N*M)	EXHAUST 1 (°C)
2000	0.8	2.68	1000.0
2500	1.6	4.40	1000.0
3000	2.4	5.58	1000.0
3500	3.1	6.35	1000.0
4000	3.6	6.78	1000.0
4500	3.9	6.32	1000.0
5000	4.3	6.04	1000.0
5500	4.7	5.99	1000.0
6000	4.9	5.84	1000.0
6500	5.5	5.99	1000.0
7000	6.5	6.59	1000.0
7500	7.4	6.99	1000.0
7545	7.6	7.01	1000.0
8000	7.9	6.97	1000.0
8500	8.2	6.87	1000.0
9000	8.6	6.80	1000.0
9288	8.8	6.69	1000.0
9500	7.2	6.92	1000.0
10000	7.8	6.99	1000.0
10500	8.2	6.87	1000.0
11000	8.8	6.75	1000.0

Wheel	8.83 HP	7.00 N*M
LOSSES	-8.83 HP	-7.00N*M
TOTAL ENGINE:	0.00HP	0.0N*M

Gambar 12 pengujian *dynotest* pada v belt di gigi 1



www.sportdevices.com
SportDyno-Ver date: 31-DEC-2020 (4.0.38.1)
DYNAMOMETER: SD325
Displacement Correction
Correction Factor: ISO 1585
Power: HP (mechanic)

Name	HP/RPM	N*M/RPM	KMH	Temp. (° C)	Humidity (%)	Pressure (mbar)	Date/Time
MX V BELT GIGI 2	11.3 / 9847	8.47 / 4148	58.4	32.0	72.9	993.6	27/01/2021 13:09:29

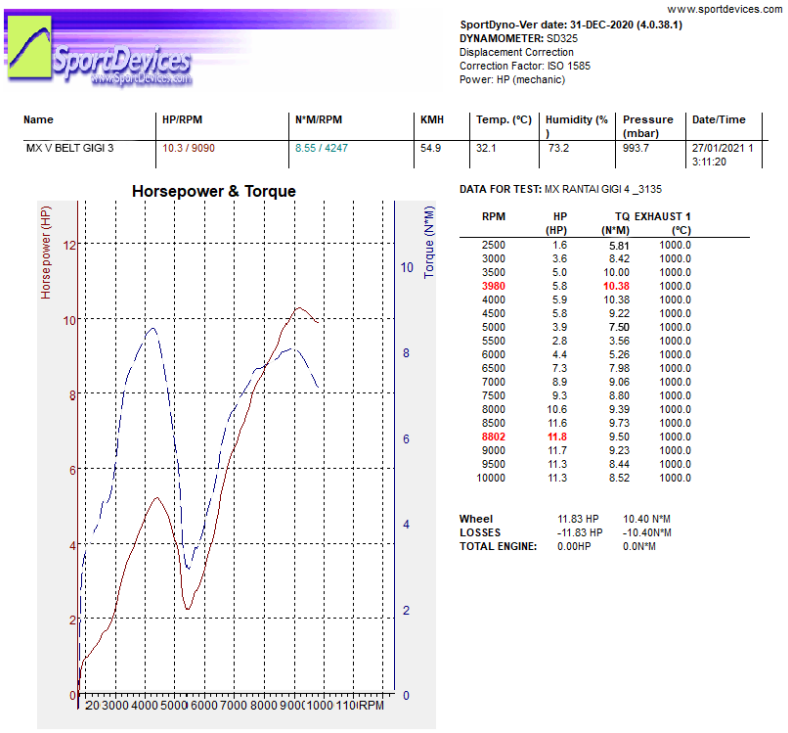
DATA FOR TEST: MX V BELT TANPA BEBAN GIGI 2_3126

RPM	HP (HP)	TQ (N*M)	EXHAUST 1 (°C)
2000	0.1	0.20	1000.0
2500	1.9	5.95	1000.0
3000	3.1	7.35	1000.0
3500	4.0	8.06	1000.0
4000	4.7	8.51	1000.0
4148	5.0	8.47	1000.0
4500	5.3	8.90	1000.0
5000	5.8	7.61	1000.0
5500	5.8	7.52	1000.0
6000	5.9	6.94	1000.0
6500	6.5	7.12	1000.0
7000	7.7	7.75	1000.0
7500	8.3	7.91	1000.0
8000	8.9	7.93	1000.0
8500	9.8	8.18	1000.0
9000	10.5	8.26	1000.0
9500	10.9	8.17	1000.0
9847	11.3	8.13	1000.0
10000	11.2	7.98	1000.0
10500	11.2	7.59	1000.0
11000	10.3	6.68	1000.0
11500	11.2	7.52	1000.0

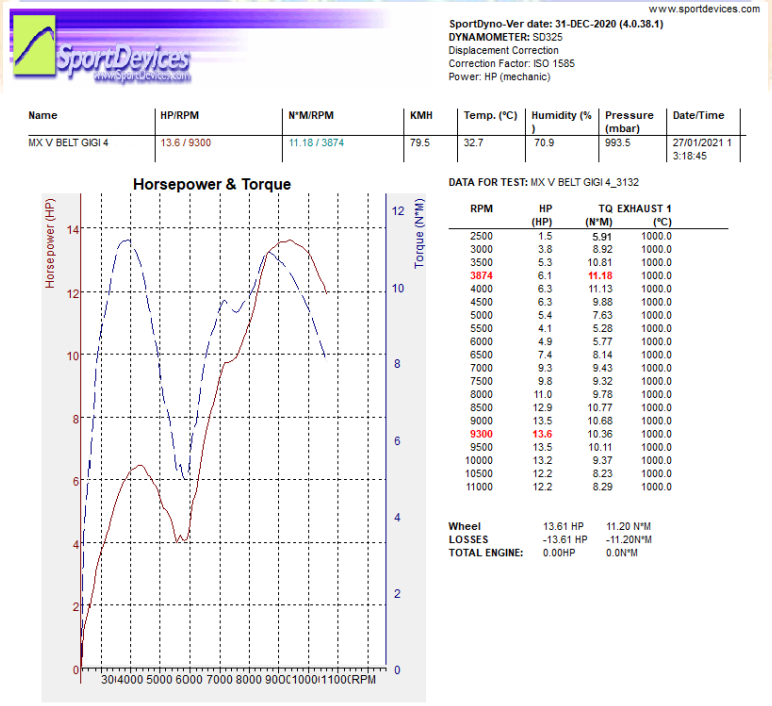
Wheel	11.32 HP	8.50 N*M
LOSSES	-11.32 HP	-8.50N*M
TOTAL ENGINE:	0.00HP	0.0N*M

Gambar 13 pengujian *dynotest* pada v belt di gigi 2

Lampiran 7



Gambar 14 pengujian *dynotest* pada v belt di gigi 3



Gambar 15 pengujian *dynotest* pada v belt di gigi 4

Lampiran 8

Hasil perhitungan traksi kotor dan traksi bersih pada kendaraan yang menggunakan rantai

GEAR	Rpm	Km/jam	m/s	Nm (torsi)	N (traksi kotor)	fr	Flift	Ra	Rr	Fnet (traksi bersih)
	2500	27,6	7,6	4,29	113,64	0,012	0,138	0,305	21,651	91,732
	3000	33,12	9,2	5,53	146,43	0,012	0,361	0,796	21,648	123,99
	3500	38,64	10,17	6,26	165,76	0,012	0,548	1,206	21,646	142,91
1	4000	44,16	12,26	6,46	171,06	0,012	1,081	2,379	21,639	147,04
	4500	49,68	13,8	6,21	164,44	0,012	1,589	3,495	21,633	139,31
	5000	55,21	15,33	5,88	158,01	0,012	2,189	4,816	21,653	131,53
	2500	41,77	11,6	5,54	96,935	0,012	0,893	1,966	21,642	73,327
	3000	50,13	13,92	7,25	126,85	0,012	1,618	3,56	21,633	101,66
	3500	58,48	16,24	7,9	138,22	0,012	2,592	5,703	21,621	113,03
2	4000	66,84	18,56	8,38	146,62	0,012	3,773	8,3	21,607	116,72
	4500	75,19	20,88	8,35	146,1	0,012	5,174	11,383	21,59	116,19
	5000	83,55	23,2	7,5	131,23	0,012	6,797	14,953	21,571	94,706
	2500	57,86	16,07	5,66	71,496	0,012	2,514	5,531	21,622	47,887
	3000	69,44	19,28	8,19	103,45	0,012	4,184	9,205	21,602	72,646
	3500	81,01	22,5	9,86	124,55	0,012	6,284	13,823	21,577	89,149
3	4000	92,59	25,71	10,13	127,96	0,012	8,801	19,362	21,543	87,051
	4500	104,16	28,93	8,98	113,43	0,012	11,75	25,851	21,511	66,07
	5000	115,73	32,14	6,46	81,98	0,012	15,114	33,251	21,471	36,617
	2500	75,11	20,86	5,83	57,732	0,012	5,161	11,355	21,591	24,786
	3000	88,28	24,52	8,73	84,953	0,012	7,798	17,156	21,559	46,238
	3500	105,16	29,21	10,71	104,22	0,012	11,921	26,227	21,509	62,483
	4000	120,19	33,38	10,89	105,97	0,012	16,527	36,359	21,454	48,158
4	4500	135,21	37,55	9,54	92,835	0,012	21,55	47,41	21,394	24,03
	5000	150,23	41,73	7,5	72,984	0,012	27,683	60,903	21,32	-9,24

Tabel 1 hasil perhitungan traksi kotor dan traksi bersih pada kendaraan yang menggunakan rantai

Lampiran 9

Hasil perhitungan traksi kotor dan traksi bersih pada kendaraan yang menggunakan v belt

GEAR	Rpm	Km/jam	m/s	Nm (torsi)	N (traksi kotor)	fr	Flift	Ra	Rr	Fnet (traksi bersih)
	2500	27,6	7,6	4,4	113,64	0,012	0,138	0,305	21,651	94,861
	3000	33,12	9,2	5,58	147,75	0,012	0,361	0,796	21,648	125,31
	3500	38,64	10,17	6,35	168,14	0,012	0,548	1,206	21,646	145,29
1	4000	44,16	12,26	6,78	179,88	0,012	1,081	2,379	21,639	155,87
	4500	49,68	13,8	6,32	167,35	0,012	1,589	3,495	21,633	142,22
	5000	55,21	15,33	6,04	159,93	0,012	2,189	4,816	21,653	133,46
	2500	41,77	11,6	5,95	104,1	0,012	0,893	1,966	21,642	80,501
	3000	50,13	13,92	7,35	128,6	0,012	1,618	3,56	21,633	103,41
	3500	58,48	16,24	8,06	141,02	0,012	2,592	5,703	21,621	115,83
2	4000	66,84	18,56	8,51	148,9	0,012	3,773	8,3	21,607	118,99
	4500	75,19	20,88	8,9	155,72	0,012	5,174	11,383	21,383	125,81
	5000	83,55	23,2	7,6	133,15	0,012	6,797	14,953	21,571	96,639
	2500	57,86	16,07	5,81	73,391	0,012	2,514	5,531	21,622	49,782
	3000	69,44	19,28	8,42	119,26	0,012	4,184	9,205	21,602	88,458
	3500	81,01	22,5	10	126,31	0,012	6,284	13,823	21,577	90,917
3	4000	92,59	25,71	10,38	131,11	0,012	8,801	19,362	21,547	90,209
	4500	104,16	28,93	9,22	116,46	0,012	11,75	25,851	21,511	69,102
	5000	115,73	32,14	7,5	94,738	0,012	15,114	33,251	21,478	47,363
	2500	77,11	20,86	5,91	57,511	0,012	5,161	11,355	21,591	24,565
	3000	88,28	24,52	8,92	86,802	0,012	7,798	17,156	21,559	48,087
	3500	105,19	29,21	10,81	105,19	0,012	11,921	26,227	21,509	63,456
	4000	120,19	33,38	11,13	108,3	0,012	16,527	36,359	21,454	50,493
4	4500	135,21	37,55	9,88	96,144	0,012	21,55	47,41	21,394	27,339
	5000	150,23	41,73	7,63	74,249	0,012	27,683	60,903	21,32	-7,975

Tabel 2 hasil perhituang traksi kotor dan traksi bersih

Lampiran 10

Hasil perhitungan gaya traksi maksimum pada kendaraan yang menggunakan rantai dan v belt

Transmisi	RPM	Kecepatan	Rantai	V belt
	2500	27,6	921,36	957,56
	3000	33,12	921,21	957,53
GIGI 1	3500	38,64	921,1	956,85
	4000	44,16	920,76	956,51
	4500	49,68	920,44	956,18
	5000	55,21	920,07	955,8
	2500	41,77	920,88	956,63
	3000	50,13	920,43	956,16
GIGI 2	3500	58,48	919,82	955,53
	4000	66,84	919,07	954,77
	4500	75,19	918,2	953,86
	5000	83,55	917,6	953,24
	2500	57,86	919,87	955,57
	3000	69,44	918,82	954,5
GIGI 3	3500	81,01	917,51	953,15
	4000	92,59	915,93	951,52
	4500	104,16	914,09	949,63
	5000	115,73	911,99	947,46
	2500	77,11	918,2	953,88
	3000	88,28	917,6	952,48
GIGI 4	3500	105,19	913,98	947,37
	4000	120,19	911,1	946,55
	4500	135,21	907,94	946,26
	5000	150,23	904,56	939,8

Tabel 3 hasil perhitungan gaya traksi maksimum

Lampiran 11

Hasil pergitungan gaya traksi saat menanjak di kecepatan konstan

Transmisi	RPM	Kecepatan	Rantai	V belt
	2500	27,6	2,91	3,01
	3000	33,12	3,94	3,98
GIGI 1	3500	38,64	4,54	4,61
	4000	44,16	4,67	4,95
	4500	49,68	4,42	4,52
	5000	55,21	4,18	4,24
	2500	41,77	2,32	2,55
	3000	50,13	3,22	3,28
GIGI 2	3500	58,48	3,59	3,68
	4000	66,84	3,7	3,78
	4500	75,19	3,69	3,99
	5000	83,55	3	3,07
	2500	57,86	1,52	1,58
	3000	69,44	2,3	2,8
GIGI 3	3500	81,01	2,83	2,88
	4000	92,59	2,76	2,86
	4500	104,16	2,09	2,19
	5000	115,73	1,16	1,5
	2500	77,11	0,78	0,78
	3000	88,28	1,46	1,52
GIGI 4	3500	105,19	1,98	2,01
	4000	120,19	1,52	1,6
	4500	135,21	0,76	0,86
	5000	150,23	-0,29	-0,25

Tabel 4 perbandingan tingkat tanjakan pada setiap gigi transmisi

Di rpm tertentu

Lampiran 12

Pada gigi 1 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3000}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{285{,}0868}{8{,}60603}$$

$$V = 33{,}12\ {}^{km}/_{jam} = 9{,}2\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}53 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 146{,}4349\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{33{,}12}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (9{,}2-5)^2 \cdot 0{,}228$$

Lampiran 13

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 17{,}64 \cdot 0{,}228$

$F_L = 0{,}3619\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (9{,}2 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 17{,}64 \cdot 0{,}228$

$R_a = 0{,}7963\ \ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 0{,}3619)$

$R_r = 0{,}012 \cdot 1804{,}05$

$R_r = 21{,}6486\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 146{,}4349\ \ - (0{,}7963 + 21{,}6486)$

$F_{net} = 146{,}4349\ \ - 22{,}4449$

$F_{net} = \ 123{,}990\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{123{,}990}{183}$

$\alpha = 0{,}677$

Lampiran 14

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 0{,}7963 \ .0{,}066 - 0{,}3619.0{,}3$

$M_P = -0{,}056$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 0{,}3619).0{,}69 - 0{,}012(1804{,}42 - 0{,}3619).0{,}21 - 0{,}056}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 921{,}21$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 3000*rpm*) penggunaan rantai:

$$\theta = arcsin \frac{123{,}990}{1804{,}42}$$

$$\theta = 3{,}94°$$

Pada gigi 1 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 3500}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{8{,}60603}$$

Lampiran 15

$V = 38{,}64\ {}^{km}/_{jam} = 10{,}17\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{6{,}26 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$F = 165{,}7653\ N$

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{38{,}64}{100}\right)^{2{,}5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (10{,}17 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 26{,}72 \cdot 0{,}228$

$F_L = 0{,}5482\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

Lampiran 16

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (10{,}17 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 26{,}72 \cdot 0{,}228$

$R_a = 1{,}2062 \ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 0{,}5482)$

$R_r = 0{,}012 \cdot 1803{,}87$

$R_r = 21{,}6464 \ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 165{,}7653 \quad - (1{,}2062 \ + 21{,}6464)$

$F_{net} = 165{,}7653 \quad - 22{,}8526$

$F_{net} = \ 142{,}9127 \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{142{,}9127}{183}$

$\alpha = 0{,}780$

Lampiran 17

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 1{,}2062 \ .0{,}066 - 0{,}5482.0{,}3$

$M_P = -0{,}084$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 0{,}5482\ ).0{,}69 - 0{,}012(1804{,}42 - 0{,}5482\ ).0{,}21 - 0{,}084}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 921{,}10$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{142{,}9127}{1804{,}42}$$

$\theta = 4{,}54°$

Pada gigi 1 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

Lampiran 18

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4000}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{8{,}60603}$$

$$V = 44{,}16\ {}^{km}/_{jam} = 12{,}26\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{6{,}46 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 171{,}0613\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{44{,}16}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (12{,}26 - 5)^2 \cdot 0{,}228$$

Lampiran 19

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 52{,}70 \cdot 0{,}228$

$F_L = 1{,}0814\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (12{,}26 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 52{,}70 \cdot 0{,}228$

$R_a = 2{,}3790\ \ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 1{,}0814\ )$

$R_r = 0{,}012 \cdot 1803{,}33$

$R_r = 21{,}639\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 171{,}0613\ \ \ - (2{,}3790\ \ + 21{,}639)$

$F_{net} = 171{,}0613\ \ \ \ - 24{,}018$

$F_{net} = 147{,}041\ \ N$

- Percepatan yang dihasilkan

Lampiran 19

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{147{,}041}{183}$$

$$\alpha = 0{,}803$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 2{,}3790\ .0{,}066 - 1{,}0814.0{,}3$$

$$M_P = -0{,}167$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max} = 0{,}8\left[\frac{(1804{,}42 - 1{,}0814\ ).0{,}69 - 0{,}012(1804{,}42 - 1{,}0814\ ).0{,}21 - 0{,}167}{1{,}245 - 0{,}8.0{,}21}\right]$$

$F_{max} = 920{,}768$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{147{,}041}{1804{,}42}$$

$$\theta = 4{,}67°$$

Pada gigi 1 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{2{,}83\ \cdot\ 3{,}041}$$

Lampiran 20

$$V = \frac{427{,}6303}{8{,}60603}$$

$$V = 49{,}68\ {}^{km}/_{jam} = 13{,}8\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{6{,}21 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 164{,}4413\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{49{,}68}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (13{,}8 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 77{,}44 \cdot 0{,}228$$

$$F_L = 1{,}5890\ N$$

Lampiran 21

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (13{,}8 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 77{,}44 \cdot 0{,}228$$

$$R_a = 3{,}4959 \ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 1{,}5890\ )$$

$$R_r = 0{,}012 \cdot 1802{,}83$$

$$R_r = 21{,}6339\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 164{,}4413 \quad - (3{,}4959 \ + 21{,}6339)$$

$$F_{net} = 164{,}4413 \quad - 25{,}1298$$

$$F_{net} = 139{,}3115 \ N$$

Lampiran 22

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{139{,}3115}{183}$$

$$\alpha = 0{,}761$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 3{,}4959\ .0{,}066 - 1{,}5890.0{,}3$$

$$M_P = -0{,}246$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 1{,}5890\ ).0{,}69 - 0{,}012(1804{,}42 - 1{,}5890).0{,}21 - 0{,}246}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 920{,}448$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{139{,}3115}{1804{,}42}$$

$$\theta = 4{,}42°$$

Lampiran 23

Pada gigi 1 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 5000}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{8{,}60603}$$

$$V = 55{,}21\ {}^{km}/_{jam} = 15{,}33\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}88 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 158{,}0040\ \ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{55{,}21}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

Lampiran 24

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (15{,}33 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 106{,}70 \cdot 0{,}228$$

$$F_L = 2{,}1894\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (15{,}33 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 106{,}70 \cdot 0{,}228$$

$$R_a = 4{,}8168\ \ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 2{,}1894\ \ )$$

$$R_r = 0{,}012 \cdot 1802{,}23$$

$$R_r = 21{,}6530\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 158{,}0040\ \ - (4{,}8168\ \ + 21{,}6530\ )$$

Lampiran 25

$F_{net} = 158{,}0040 \ - 26{,}4698$

$F_{net} = 131{,}5342 \ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{131{,}5342}{183}$$

$\alpha = 0{,}718$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 4{,}8168 \ .0{,}066 - 2{,}1894.0{,}3$

$M_P = -0{,}338$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L). L_1 - f_r (W - F_L). h + M_P}{L - \mu . h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 2{,}1894 \ ). 0{,}69 - 0{,}012 (1804{,}42 - 2{,}1894). 0{,}21 - 0{,}338}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 920{,}072$ N

Lampiran 26

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{131{,}5342}{1804{,}42}$$

$$\theta = 4{,}18°$$

Pada gigi 2 (pada putaran mesin Rpm 2500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 2500}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 2500}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{237{,}5724}{5{,}68667}$$

$$V = 41{,}77\ {}^{km}/_{jam} = 11{,}60\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}54 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 96{,}9358\ N$$

Lampiran 27

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{41{,}77}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (11{,}60 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 43{,}56 \cdot 0{,}228$

$F_L = 0{,}8938\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (11{,}60 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 43{,}56 \cdot 0{,}228$

$R_a = 1{,}96647\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 0{,}8938)$

Lampiran 28

$R_r = 0{,}012 \cdot 1803{,}52$

$R_r = 21{,}6422\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 96{,}9358\ - (1{,}96647 + 21{,}6422\ )$

$F_{net} = 96{,}9358\ - 23{,}6086$

$F_{net} = 73{,}3272\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{73{,}3272}{183}$

$\alpha = 0{,}400$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 1{,}96647\ .0{,}066 - 0{,}8938.0{,}3$

$M_P = -0{,}138$

Lampiran 29

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 0{,}8938).0{,}69 - 0{,}012(1804{,}42 - 0{,}8938).0{,}21 - 0{,}138}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 920{,}88$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 2500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{73{,}3272}{1804{,}42}$$

$$\theta = 2{,}32°$$

Pada gigi 2 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 3000}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{285{,}086}{5{,}68667}$$

$$V = 50{,}13\ {}^{km}/_{jam} = 13{,}92\ m/s$$

Lampiran 30

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{7{,}25 \cdot 1{,}87 \cdot 3{,}041}{0{,}26} 0{,}8$$

$$F = 126{,}8564\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{50{,}13}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (13{,}92 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 79{,}56 \cdot 0{,}228$$

$$F_L = 1{,}6182\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (13{,}92 - 5)^2 \cdot 0{,}228$$

Lampiran 31

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 79{,}56 \cdot 0{,}228$

$R_a = 3{,}5601\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 1{,}6182)$

$R_r = 0{,}012 \cdot 1802{,}80$

$R_r = 21{,}6336\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 126{,}8564\ - (3{,}5601 + 21{,}6336\ )$

$F_{net} = 126{,}8564\ - 25{,}1937$

$F_{net} = 101{,}6627\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{101{,}6627}{183}$

$\alpha = 0{,}555$

Lampiran 32

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 3{,}5601\ .0{,}066 - 1{,}6182.0{,}3$

$M_P = -0{,}250$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 1{,}6182).0{,}69 - 0{,}012(1804{,}42 - 1{,}6182).0{,}21 - 0{,}250}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 920{,}432$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 3000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{101{,}6627}{1804{,}42}$$

$\theta = 3{,}22°$

Pada gigi 2 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}87 \cdot 3{,}041}$$

Lampiran 33

$$V = \frac{0{,}06 \cdot 0{,}97 \cdot 3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{332{,}6013}{5{,}68667}$$

$$V = 58{,}48\ {}^{km}/_{jam} = 16{,}24\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{7{,}90 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 138{,}229\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{58{,}48}{100}\right)^{2,5}$$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (16{,}24 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 126{,}33 \cdot 0{,}228$$

$$F_L = 2{,}59229\ N$$

Lampiran 34

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (16{,}24 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 126{,}33 \cdot 0{,}228$$

$$R_a = 5{,}7030\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 2{,}59229)$$

$$R_r = 0{,}012 \cdot 1801{,}82$$

$$R_r = 21{,}6218\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 138{,}229\ - (5{,}7030 + 21{,}6218\ )$$

$$F_{net} = 138{,}229\ \ - 25{,}1937$$

$$F_{net} = 113{,}0353\ N$$

Lampiran 35

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{113{,}0353}{183}$$

$$\alpha = 0{,}617$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 5{,}7030\ .0{,}066 - 2{,}59229\ .0{,}3$$

$$M_P = -0{,}400$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max}$$

$$= 0{,}8 \left[\frac{(1804{,}42 - 2{,}5922\ ).0{,}69 - 0{,}012(1804{,}42 - 2{,}59229\ ).0{,}21 - 0{,}400}{1{,}245 - 0{,}8.0{,}21}\right]$$

$F_{max} = 919{,}82$ N

Lampiran 36

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{113{,}0353}{1804{,}42}$$

$$\theta = 3{,}59°$$

Pada gigi 2 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4000}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{5{,}68667}$$

$$V = 66{,}84\ {}^{km}/_{jam} = 18{,}56\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}38 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 146{,}6285\ N$$

Lampiran 37

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{66{,}84}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (18{,}56 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 183{,}87 \cdot 0{,}228$

$F_L = 3{,}7730\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (18{,}56 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 183{,}87 \cdot 0{,}228$

$R_a = 8{,}3006\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 3{,}7730)$

Lampiran 38

$R_r = 0{,}012 \cdot 1800{,}64$

$R_r = 21{,}607\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 146{,}6285\ - (8{,}3006\ + 21{,}6076\ )$

$F_{net} = 146{,}6285\ - 29{,}9082$

$F_{net} = 116{,}720\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{116{,}720}{183}$

$\alpha = 0{,}637$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 8{,}3006\ .0{,}066 - 3{,}7730\ .0{,}3$

$M_P = -0{,}584$

Lampiran 39

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 3{,}7730\ ).0{,}69 - 0{,}012(1804{,}42 - 3{,}7730\ ).0{,}21 - 0{,}584}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 919{,}07$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{116{,}720}{1804{,}42}$$

$$\theta = 3{,}70°$$

Pada gigi 2 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{5{,}68667}$$

Lampiran 40

$V = 75{,}19\ {}^{km}/_{jam} = 20{,}88\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}35 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$F = 146{,}1036\ N$

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{75{,}19}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (20{,}88 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 252{,}17 \cdot 0{,}228$

$F_L = 5{,}1745\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

Lampiran 41

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (20{,}88 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 252{,}17 \cdot 0{,}228$

$R_a = 11{,}3839\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 5{,}1745)$

$R_r = 0{,}012 \cdot 1799{,}24$

$R_r = 21{,}5908\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 146{,}1036 - (11{,}3839\ + 21{,}5908\ )$

$F_{net} = 146{,}1036\ \ - 29{,}9082$

$F_{net} = 116{,}1954\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{116{,}1954}{183}$

$\alpha = 0{,}634$

Lampiran 42

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 11{,}3839 \,.0{,}066 - 5{,}1745 \,.0{,}3$

$M_P = -0{,}800$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 5{,}1745\,).0{,}69 - 0{,}012(1804{,}42 - 5{,}1745).0{,}21 - 0{,}800}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 918{,}2$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{116{,}1954}{1804{,}42}$$

$$\theta = 3{,}69°$$

Pada gigi 2 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}87 \cdot 3{,}041}$$

Lampiran 43

$$V = \frac{0{,}06 \cdot 0{,}97 \cdot 3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{475{,}1448}{5{,}68667}$$

$$V = 83{,}55 \ {}^{km}/_{jam} = 23{,}20 \ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{7{,}50 \cdot 1{,}87 \cdot 3{,}041}{0{,}26} 0{,}8$$

$$F = 131{,}2308 \ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{83{,}55}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (23{,}20 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 331{,}24 \cdot 0{,}228$$

$$F_L = 6{,}7970 \ N$$

Lampiran 44

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (23{,}20 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 331{,}24 \cdot 0{,}228$$

$$R_a = 14{,}9534\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 6{,}7970)$$

$$R_r = 0{,}012 \cdot 1797{,}62$$

$$R_r = 21{,}5714\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 131{,}2308\ - (14{,}9534\ + 21{,}5714\ )$$

$$F_{net} = 131{,}2308\ \ - 36{,}5248$$

$$F_{net} = 94{,}706\ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

Lampiran 45

$$\alpha = \frac{94{,}706}{183}$$

$$\alpha = 0{,}517$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 14{,}9534\ .0{,}066 - 6{,}7970\ .0{,}3$$

$$M_P = -0{,}483$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 6{,}7970\ ).0{,}69 - 0{,}012(1804{,}42 - 6{,}7970).0{,}21 - 0{,}483}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 917{,}608$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{94{,}706}{1804{,}42}$$

$$\theta = 3{,}00°$$

Lampiran 46

Pada gigi 3 (pada putaran mesin Rpm 2500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 2500}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 2500}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{237{,}5724}{4{,}1053}$$

$$V = 57{,}86\ {}^{km}/_{jam} = 16{,}07\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}66 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 71{,}4962\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{57{,}86}{100}\right)^{2{,}5}$$

f_r = 0,012

Lampiran 47

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (16{,}07 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 122{,}54 \cdot 0{,}228$$

$$F_L = 2{,}5145\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (16{,}07 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 122{,}54 \cdot 0{,}228$$

$$R_a = 5{,}5319\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 2{,}5145)$$

$$R_r = 0{,}012 \cdot 1801{,}90$$

$$R_r = 21{,}6228\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 71{,}4962\ - (5{,}5319\ + 21{,}6228\ )$$

Lampiran 48

$F_{net} = 71{,}4962 \ \ - 23{,}6086$

$F_{net} = 47{,}8876\ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{47{,}8876}{183}$$

$\alpha = 0{,}261$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 5{,}5319\ .0{,}066 - 2{,}5145\ .0{,}3$

$M_P = -0{,}389$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 2{,}5145\ ).0{,}69 - 0{,}012(1804{,}42 - 2{,}5145\ ).0{,}21 - 0{,}389}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 919{,}872$ N

Lampiran 49

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 2500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{47{,}8876}{1804{,}42}$$

$$\theta = 1{,}52°$$

Pada gigi 3 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3000}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{285{,}0868}{4{,}1053}$$

$$V = 69{,}44\ {}^{km}/_{jam} = 19{,}28\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}19 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 103{,}4548\ N$$

Lampiran 50

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{69{,}44}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (19{,}28 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 203{,}91 \cdot 0{,}228$

$F_L = 4{,}1842\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (19{,}28 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 203{,}91 \cdot 0{,}228$

$R_a = 9{,}2053\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 4{,}1842\ )$

Lampiran 51

$R_r = 0{,}012 \cdot 1800{,}23$

$R_r = 21{,}6027\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 103{,}4548\ - (9{,}2053\ + 21{,}6027)$

$F_{net} = 103{,}4548\ - 30{,}808$

$F_{net} = 72{,}6468\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{72{,}6468}{183}$

$\alpha = 0{,}396$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 9{,}2053\ .0{,}066 - 4{,}1842\ .0{,}3$

$M_P = -0{,}647$

Lampiran 52

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 4{,}1842\ ).0{,}69 - 0{,}012(1804{,}42 - 4{,}1842\ ).0{,}21 - 0{,}647}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 918{,}824$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 3000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{72{,}6468}{1804{,}42}$$

$$\theta = 2{,}30°$$

Pada gigi 3 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{4{,}1053}$$

Lampiran 53

$V = 81{,}01\ {}^{km}/_{jam} = 22{,}50\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{9{,}86 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$F = 124{,}5500\ N$

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{81{,}01}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (22{,}50 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 306{,}25 \cdot 0{,}228$

$F_L = 6{,}2842\ N$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

Lampiran 54

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (22{,}50 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 306{,}25 \cdot 0{,}228$

$R_a = 13{,}8235\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 6{,}2842\ )$

$R_r = 0{,}012 \cdot 1798{,}13$

$R_r = 21{,}5775\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 124{,}5500\ \ - (13{,}8235\ \ + 21{,}5775)$

$F_{net} = 124{,}5500\ \ - 35{,}401$

$F_{net} = 89{,}149\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{89{,}149}{183}$

$\alpha = 0{,}487$

Lampiran 55

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 13{,}8235\ .0{,}066 - 6{,}2842\ .0{,}3$

$M_P = -0.972$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 6{,}2842\ ).0{,}69 - 0{,}012(1804{,}42 - 6{,}2842\ ).0{,}21 - 0{,}972}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 917{,}512$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 3500 *rpm*) penggunaan rantai:

$\theta = arcsin \frac{89{,}149}{1804{,}42}$

$\theta = 2{,}83°$

Pada gigi 3 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

Lampiran 56

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4000}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{4{,}1053}$$

$$V = 92{,}59\,{}^{km}/_{jam} = 25{,}71\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{10{,}13 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 127{,}9606\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{92{,}59}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (25{,}71 - 5)^2 \cdot 0{,}228$$

Lampiran 57

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 428{,}90 \cdot 0{,}228$

$F_L = 8{,}8010\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (25{,}71 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 428{,}90 \cdot 0{,}228$

$R_a = 19{,}3622\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 8{,}8010\ )$

$R_r = 0{,}012 \cdot 1795{,}61$

$R_r = 21{,}5473\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 127{,}9606\ \ - (19{,}3622\ \ + 21{,}5473)$

$F_{net} = 127{,}9606\ \ - 40{,}9095$

$F_{net} = 87{,}0511\ N$

Lampiran 58

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{87{,}0511}{183}$$

$$\alpha = 0{,}475$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 19{,}3622\ .0{,}066 - 8{,}8010\ .0{,}3$$

$$M_P = -1{,}363$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max}$$

$$= 0{,}8\left[\frac{(1804{,}42 - 8{,}8010\ ).0{,}69 - 0{,}012(1804{,}42 - 8{,}8010\ ).0{,}21 - 1{,}363}{1{,}245 - 0{,}8.0{,}21}\right]$$

$F_{max} = 915{,}936$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{87{,}0511}{1804{,}42}$$

$$\theta = 2{,}76°$$

Lampiran 59

Pada gigi 3 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4500}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{4{,}1053}$$

$$V = 104{,}16\ {}^{km}/_{jam} = 28{,}93\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}98 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 113{,}4339\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{104{,}16}{100}\right)^{2{,}5}$$

f_r = 0,012

Lampiran 60

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (28{,}93 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 572{,}64 \cdot 0{,}228$$

$$F_L = 11{,}7505\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (28{,}93 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 572{,}64 \cdot 0{,}228$$

$$R_a = 25{,}8512\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 11{,}7505\ )$$

$$R_r = 0{,}012 \cdot 1792{,}66$$

$$R_r = 21{,}5119\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 113{,}4339\ \ - (25{,}8512\ \ + 21{,}5119)$$

Lampiran 61

$F_{net} = 113{,}4339 \quad - 47{,}3631$

$F_{net} = \ 66{,}0708 \ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{66{,}0708}{183}$$

$\alpha = 0{,}361$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 25{,}8512 \ .0{,}066 - 11{,}7505 \ .0{,}3$

$M_P = -1{,}819$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 11{,}7505 \ ).0{,}69 - 0{,}012(1804{,}42 - 11{,}7505 \ ).0{,}21 - 1{,}819}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 914{,}09$ N

Lampiran 62

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{66{,}0708}{1804{,}42}$$

$$\theta = 2{,}09°$$

Pada gigi 3 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{4{,}1053}$$

$$V = 115{,}73\ {}^{km}/_{jam} = 32{,}14\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{6{,}49 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 81{,}9806\ N$$

Lampiran 63

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{115{,}73}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (32{,}14 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 736{,}57 \cdot 0{,}228$

$F_L = 15{,}1144\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (32{,}14 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 736{,}67 \cdot 0{,}228$

$R_a = 33{,}2517\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 15{,}1144\ )$

Lampiran 64

$R_r = 0{,}012 \cdot 1789{,}30$

$R_r = 21{,}4715\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 81{,}9806\ \ - (33{,}2517\ \ + 21{,}4715)$

$F_{net} = 81{,}9806\ \ - 47{,}3631$

$F_{net} = \ 36{,}6175\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{36{,}6175}{183}$

$\alpha = 0{,}200$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 33{,}2517\ .0{,}066 - 15{,}1144\ .0{,}3$

$M_P = -2{,}339$

Lampiran 65

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 15{,}1144).0{,}69 - 0{,}012(1804{,}42 - 15{,}1144).0{,}21 - 2{,}339}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 911{,}992$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{36{,}6175}{1804{,}42}$$

$$\theta = 1{,}16°$$

Pada gigi 4 (pada putaran mesin Rpm 2500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 2500}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 2500}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{237{,}5724}{3{,}1626}$$

Lampiran 66

$V = 75{,}11\,{}^{km}/_{jam} = 20{,}86\,m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}83 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$F = 57{,}7328\,N$

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{75{,}11}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (20{,}86 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 251{,}53 \cdot 0{,}228$

$F_L = 5{,}1613\,N$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

Lampiran 67

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (20{,}86 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 251{,}53 \cdot 0{,}228$

$R_a = 11{,}3550\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 5{,}1613\ )$

$R_r = 0{,}012 \cdot 1799{,}25$

$R_r = 21{,}591\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 57{,}7328\ \ - (11{,}3550\ \ + 21{,}591)$

$F_{net} = 57{,}7328\ \ - 32{,}946$

$F_{net} =\ 24{,}7868\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{24{,}7868}{183}$

$\alpha = 0{,}135$

Lampiran 68

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 11{,}3550\ .0{,}066 - 5{,}1613\ .0{,}3$

$M_P = -0{,}798$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 5{,}1613\ ).0{,}69 - 0{,}012(1804{,}42 - 5{,}1613\ ).0{,}21 - 0{,}798}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 918{,}208$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 2500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{24{,}7868}{1804{,}42}$$

$$\theta = 0{,}78°$$

Pada gigi 4 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

Lampiran 69

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3000}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{279{,}2088}{3{,}1626}$$

$$V = 88{,}28\,{}^{km}/_{jam} = 24{,}52\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}73 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 84{,}9533\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{88{,}28}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (24{,}52 - 5)^2 \cdot 0{,}228$$

Lampiran 70

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 381{,}03 \cdot 0{,}228$

$F_L = 7{,}7982\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (24{,}52 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 381{,}03 \cdot 0{,}228$

$R_a = 17{,}1560\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 7{,}7982\ )$

$R_r = 0{,}012 \cdot 1796{,}62$

$R_r = 21{,}559\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 84{,}9533\ \ - (17{,}1560\ \ \ + 21{,}559)$

$F_{net} = 84{,}9533\ \ \ - 38{,}715$

$F_{net} = \ 46{,}2383\ \ N$

Lampiran 71

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{46{,}2383}{183}$$

$$\alpha = 0{,}252$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 17{,}1560\ .0{,}066 - 7{,}7982.0{,}3$$

$$M_P = -1{,}207$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 7{,}7982).0{,}69 - 0{,}012(1804{,}42 - 7{,}7982\ ).0{,}21 - 0{,}798}{1{,}245 - 0{,}8.0{,}21}\right]$$

$F_{max} = 917{,}6$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 3000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{46{,}2383}{1804{,}42}$$

$$\theta = 1{,}46°$$

Lampiran 72

Pada gigi 4 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{3{,}1626}$$

$$V = 105{,}16\ {}^{km}/_{jam} = 29{,}21\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{10{,}71 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 104{,}2211\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{105{,}16}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

Lampiran 73

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (29{,}21 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 586{,}12 \cdot 0{,}228$$

$$F_L = 11{,}9216\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (29{,}21 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 586{,}12 \cdot 0{,}228$$

$$R_a = 26{,}2276\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 11{,}9216\ )$$

$$R_r = 0{,}012 \cdot 1792{,}49$$

$$R_r = 21{,}5098\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 104{,}2211\ \ - (26{,}2276\ \ + 21{,}5098)$$

Lampiran 74

$F_{net} = 104{,}2211 \quad - 41{,}7374$

$F_{net} = \ 62{,}4837 \ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{62{,}4837}{183}$$

$\alpha = 0{,}341$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 26{,}2276 \ .0{,}066 - 11{,}9216.0{,}3$

$M_P = -1{,}845$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L). L_1 - f_r (W - F_L). h + M_P}{L - \mu . h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 11{,}9216). 0{,}69 - 0{,}012(1804{,}42 - 11{,}9216). 0{,}21 - 1{,}845}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 913{,}98$ N

Lampiran 75

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{62{,}4837}{1804{,}42}$$

$$\theta = 1{,}98°$$

Pada gigi 4 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4000}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{3{,}1626}$$

$$V = 120{,}19\,{}^{km}/_{jam} = 33{,}38\,m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{10{,}89 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 105{,}9727\ N$$

Lampiran 76

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{120{,}19}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (33{,}38 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 805{,}42 \cdot 0{,}228$

$F_L = 16{,}5272\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (33{,}38 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 805{,}42 \cdot 0{,}228$

$R_a = 36{,}3598\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 16{,}5272)$

Lampiran 77

$R_r = 0{,}012 \cdot 1787{,}89$

$R_r = 21{,}4546\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 105{,}9727 - (36{,}3598\ + 21{,}4546)$

$F_{net} = 105{,}9727 - 57{,}8144$

$F_{net} =\ 48{,}158\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{48{,}158}{183}$

$\alpha = 0{,}263$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 36{,}3598\ .0{,}066 - 16{,}5272.0{,}3$

$M_P = -2{,}559$

Lampiran 78

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 16{,}5272.).0{,}69 - 0{,}012(1804{,}42 - 16{,}5272.).0{,}21 - 2{,}559}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 911{,}10$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{48{,}158}{1804{,}42}$$

$$\theta = 1{,}52°$$

Pada gigi 4 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{3{,}1626}$$

Lampiran 79

$V = 135{,}21\ {}^{km}/_{jam} = 37{,}55\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{9{,}54 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$F = 92{,}8356\ N$

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{135{,}21}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (33{,}38 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 805{,}42 \cdot 0{,}228$

$F_L = 21{,}5502\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

Lampiran 79

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (37{,}55 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 1059{,}50 \cdot 0{,}228$

$R_a = 47{,}4105\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 21{,}5502)$

$R_r = 0{,}012 \cdot 1782{,}86$

$R_r = 21{,}3943\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 92{,}8356\ - (47{,}4105 + 21{,}3943)$

$F_{net} = 92{,}8356\ - 68{,}8048$

$F_{net} = \ 24{,}0308\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{24{,}0308}{183}$

$\alpha = 0{,}131$

Lampiran 80

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 47{,}4105 \ \ .0{,}066 - 21{,}5502.0{,}3$

$M_P = -3{,}336$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

F_{max}

$$= 0{,}8 \left[\frac{(1804{,}42 - 21{,}5502.).0{,}69 - 0{,}012(1804{,}42 - 21{,}5502.).0{,}21 - 3{,}336}{1{,}245 - 0{,}8.0{,}21} \right]$$

$F_{max} = 907{,}944$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{24{,}0308}{1804{,}42}$$

$$\theta = 0{,}76°$$

Pada gigi 4 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

Lampiran 81

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{3{,}1626}$$

$$V = 150{,}23\ {}^{km}/_{jam} = 41{,}73\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{7{,}50 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 72{,}984\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{150{,}23}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (41{,}73 - 5)^2 \cdot 0{,}228$$

Lampiran 82

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 1349{,}09 \cdot 0{,}228$

$F_L = 27{,}6833\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (41{,}73 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 1349{,}09 \cdot 0{,}228$

$R_a = 60{,}9033\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 27{,}6833\ )$

$R_r = 0{,}012 \cdot 1776{,}73$

$R_r = 21{,}3207\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 72{,}984\ - (60{,}9033\ + 21{,}3207)$

$F_{net} = 72{,}984\ - 82{,}224$

$F_{net} = -9{,}24\ N$

Lampiran 83

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{-9{,}24}{183}$$

$$\alpha = -0{,}050$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 60{,}9033 \ .0{,}066 - 27{,}6833.0{,}3$$

$$M_P = -3{,}685$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max}$$

$$= 0{,}8 \left[\frac{(1804{,}42 - 27{,}6833).0{,}69 - 0{,}012(1804{,}42 - 27{,}6833).0{,}21 - 3{,}685}{1{,}245 - 0{,}8.0{,}21}\right]$$

$F_{max} = 904{,}568$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{-9{,}24}{1804{,}42}$$

$$\theta = -0{,}29°$$

Lampiran 84

Perumusan traksi pada v belt

Pada gigi 1 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3000}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{285{,}0868}{8{,}60603}$$

$$V = 33{,}12\ {}^{km}/_{jam} = 9{,}2\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}58 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 147{,}7589\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{33{,}12}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (9{,}2-5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 17{,}64 \cdot 0{,}228$$

$$F_L = 0{,}3619\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

Lampiran 85

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (9{,}2 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 17{,}64 \cdot 0{,}228$

$R_a = 0{,}7963\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 0{,}3619)$

$R_r = 0{,}012 \cdot 1804{,}05$

$R_r = 21{,}6486\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 147{,}7589\ - (0{,}7963 + 21{,}6486)$

$F_{net} = 147{,}7589\ - 22{,}4449$

$F_{net} = 125{,}314\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{125{,}314}{183}$

$\alpha = 0{,}684$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 0{,}7963\ .0{,}066 - 0{,}3619.0{,}3$

$M_P = -0{,}056$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$

$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 0{,}3619).0{,}72 - 0{,}012(1804{,}42 - 0{,}3619).0{,}21 - 0{,}056}{1{,}250 - 0{,}8.0{,}21} \right]$

$F_{max} = 957{,}536$ N

Lampiran 86

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 3000*rpm*) penggunaan rantai:

$$\theta = arcsin\frac{125{,}314}{1804{,}42}$$

$$\theta = 3{,}98°$$

Pada gigi 1 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3500}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{8{,}60603}$$

$$V = 38{,}64\ {}^{km}/_{jam} = 10{,}17\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{6{,}35 \cdot 2{,}83 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 168{,}1485\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{38{,}64}{100}\right)^{2{,}5}$$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (10{,}17-5)^2 \cdot 0{,}228$$

Lampiran 87

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 26{,}72 \cdot 0{,}228$

$F_L = 0{,}5482\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (10{,}17 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 26{,}72 \cdot 0{,}228$

$R_a = 1{,}2062\ \ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 0{,}5482)$

$R_r = 0{,}012 \cdot 1803{,}87$

$R_r = 21{,}6464\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 168{,}1485 \quad - (1{,}2062 \ \ + 21{,}6464)$

$F_{net} = 168{,}1485 \quad - 22{,}8526$

$F_{net} = \ 145{,}2959\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{145{,}2959}{183}$

$\alpha = 0{,}793$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 1{,}2062\ .0{,}066 - 0{,}5482.0{,}3$

$M_P = -0{,}084$

Lampiran 88

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 0{,}5482).0{,}72 - 0{,}012(1804{,}42 - 0{,}5482).0{,}21 - 0{,}084}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 956{,}856$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{145{,}2959}{1804{,}42}$$

$$\theta = 4{,}61°$$

Pada gigi 1 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4000}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{8{,}60603}$$

$V = 44{,}16\ {}^{km}/_{jam} = 12{,}26\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{6{,}78 \cdot 2{,}83 \cdot 3{,}041}{0{,}26} 0{,}8$$

$F = 179{,}8895\ N$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

Lampiran 89

f_r = 0,012 + 0,06 $\cdot \left(\frac{44,16}{100}\right)^{2,5}$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot (12,26 - 5)^2 \cdot 0,228$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot 52,70 \cdot 0,228$

$F_L = 1,0814\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot (12,26 - 5)^2 \cdot 0,228$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot 52,70 \cdot 0,228$

$R_a = 2,3790\ \ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0,012 \cdot (1804,42 - 1,0814\ )$

$R_r = 0,012 \cdot 1803,33$

$R_r = 21,639\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 179,8895 \quad - (2,3790 \ \ + 21,639)$

$F_{net} = 179,8895 \quad\ \ - 24,018$

$F_{net} = 155,8715\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{155,8715}{183}$

$\alpha = 0,851$

Lampiran 90

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 2{,}3790\ .0{,}066 - 1{,}0814.0{,}3$

$M_P = -0{,}167$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 1{,}0814\ ).0{,}72 - 0{,}012(1804{,}42 - 1{,}0814\ ).0{,}21 - 0{,}167}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 956{,}512$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{155{,}8715}{1804{,}42}$$

$$\theta = 4{,}95°$$

Pada gigi 1 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{8{,}60603}$$

$V = 49{,}68\ {}^{km}/_{jam} = 13{,}8\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

Lampiran 91

$$F = \frac{6{,}32 \cdot 2{,}83 \cdot 3{,}041}{0{,}26} 0{,}8$$

$$F = 167{,}3541 \ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{49{,}68}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (13{,}8 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 77{,}44 \cdot 0{,}228$$

$$F_L = 1{,}5890 \ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (13{,}8 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 77{,}44 \cdot 0{,}228$$

$$R_a = 3{,}4959 \ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 1{,}5890\ )$$

$$R_r = 0{,}012 \cdot 1802{,}83$$

$$R_r = 21{,}6339 \ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 167{,}3541 \quad - (3{,}4959 \ + 21{,}6339)$$

$$F_{net} = 167{,}3541 \quad - 25{,}1298$$

$$F_{net} = 142{,}2243 \ N$$

Lampiran 92

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{142{,}2243}{183}$$

$$\alpha = 0{,}777$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 3{,}4959\ .0{,}066 - 1{,}5890.0{,}3$$

$$M_P = -0{,}246$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 1{,}5890\ ).0{,}72 - 0{,}012(1804{,}42 - 1{,}5890).0{,}21 - 0{,}246}{1{,}250 - 0{,}8.0{,}21}\right]$$

$F_{max} = 956{,}184$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{142{,}2243}{1804{,}42}$$

$$\theta = 4{,}52°$$

Pada gigi 1 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 5000}{2{,}83 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{2{,}83\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{8{,}60603}$$

$$V = 55{,}21\ {}^{km}/_{jam} = 15{,}33\ m/s$$

Lampiran 93

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{6{,}04 \cdot 2{,}83 \cdot 3{,}041}{0{,}26} 0{,}8$$

$$F = 159{,}9397 \ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{55{,}21}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (15{,}33 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 106{,}70 \cdot 0{,}228$$

$$F_L = 2{,}1894 \ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (15{,}33 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 106{,}70 \cdot 0{,}228$$

$$R_a = 4{,}8168 \ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 2{,}1894 \ )$$

$$R_r = 0{,}012 \cdot 1802{,}23$$

$$R_r = 21{,}6530 \ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 159{,}9397 \ - (4{,}8168 \ + 21{,}6530 \ )$$

Lampiran 94

$F_{net} = 159{,}9397 - 26{,}4698$

$F_{net} = 133{,}4699\ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{133{,}4699}{183}$$

$\alpha = 0{,}729$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 4{,}8168\ .0{,}066 - 2{,}1894.0{,}3$

$M_P = -0{,}338$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 2{,}1894\ ).0{,}72 - 0{,}012(1804{,}42 - 2{,}1894).0{,}21 - 0{,}338}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 955{,}8$ N

Sebagai contoh perhitungan di ambil pada gigi 1 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{133{,}4699}{1804{,}42}$$

$\theta = 4{,}24°$

Pada gigi 2 (pada putaran mesin Rpm 2500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 2500}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 2500}{1{,}87\ \cdot\ 3{,}041}$$

Lampiran 95

$$V = \frac{237{,}5724}{5{,}68667}$$

$$V = 41{,}77\ {}^{km}/_{jam} = 11{,}60\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{5{,}95 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 104{,}1098\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{41{,}77}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (11{,}60 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 43{,}56 \cdot 0{,}228$$

$$F_L = 0{,}8938\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (11{,}60 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 43{,}56 \cdot 0{,}228$$

$$R_a = 1{,}96647\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 0{,}8938)$$

$$R_r = 0{,}012 \cdot 1803{,}52$$

$$R_r = 21{,}6422\ N$$

Lampiran 96

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 104{,}1098 - (1{,}96647 + 21{,}6422)$

$F_{net} = 104{,}1098 - 23{,}6086$

$F_{net} = 80{,}5012\ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{80{,}5012}{183}$$

$\alpha = 0{,}439$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 1{,}96647\ .0{,}066 - 0{,}8938.0{,}3$

$M_P = -0{,}138$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 0{,}8938).0{,}72 - 0{,}012(1804{,}42 - 0{,}8938).0{,}21 - 0{,}138}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 956{,}63$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 2500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{80{,}5012}{1804{,}42}$$

$\theta = 2{,}55°$

Pada gigi 2 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

Lampiran 97

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3000}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{285{,}086}{5{,}68667}$$

$$V = 50{,}13\ {}^{km}/_{jam} = 13{,}92\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{7{,}35 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 128{,}606\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{50{,}13}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \ \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (13{,}92 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 79{,}56 \cdot 0{,}228$$

$$F_L = 1{,}6182\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (13{,}92 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 79{,}56 \cdot 0{,}228$$

$$R_a = 3{,}5601\ N$$

Lampiran 98

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 1{,}6182)$

$R_r = 0{,}012 \cdot 1802{,}80$

$R_r = 21{,}6336\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 128{,}606\ - (3{,}5601 + 21{,}6336\ )$

$F_{net} = 128{,}606\ - 25{,}1937$

$F_{net} = 103{,}4123\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{103{,}4123}{183}$

$\alpha = 0{,}565$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 3{,}5601\ .0{,}066 - 1{,}6182.0{,}3$

$M_P = -0{,}250$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$

$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 1{,}6182).0{,}72 - 0{,}012(1804{,}42 - 1{,}6182).0{,}21 - 0{,}250}{1{,}250 - 0{,}8.0{,}21}\right]$

$F_{max} = 956{,}16$ N

Lampiran 99

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 3000 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{103{,}4123}{1804{,}42}$$

$$\theta = 3{,}28°$$

Pada gigi 2 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{5{,}68667}$$

$$V = 58{,}48\ {}^{km}/_{jam} = 16{,}24\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}06 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 141{,}029\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{58{,}48}{100}\right)^{2{,}5}$$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (16{,}24 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 126{,}33 \cdot 0{,}228$$

Lampiran 100

$F_L = 2{,}59229\ N$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (16{,}24 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 126{,}33 \cdot 0{,}228$$

$$R_a = 5{,}7030\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 2{,}59229)$$

$$R_r = 0{,}012 \cdot 1801{,}82$$

$$R_r = 21{,}6218\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 141{,}029\ \ - (5{,}7030 + 21{,}6218\ )$$

$$F_{net} = 141{,}029\ \ - 25{,}1937$$

$$F_{net} = 115{,}835\ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{115{,}835}{183}$$

$$\alpha = 0{,}632$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 5{,}7030\ .0{,}066 - 2{,}59229\ .0{,}3$$

$$M_P = -0{,}400$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L) . L_1 - f_r (W - F_L) . h + M_P}{L - \mu . h} \right]$$

Lampiran 101

$$F_{max} = 0{,}8\left[\frac{(1804{,}42 - 2{,}5922\ ).\,0{,}72 - 0{,}012(1804{,}42 - 2{,}59229\ ).\,0{,}21 - 0{,}400}{1{,}250 - 0{,}8.0{,}21}\right]$$

$F_{max} = 955{,}536$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{115{,}835}{1804{,}42}$$

$$\theta = 3{,}68°$$

Pada gigi 2 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4000}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{5{,}68667}$$

$$V = 66{,}84\ {}^{km}/_{jam} = 18{,}56\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}51 \cdot 1{,}87 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 148{,}9032\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{66{,}84}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

Lampiran 102

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (18{,}56 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 183{,}87 \cdot 0{,}228$$

$$F_L = 3{,}7730\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (18{,}56 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 183{,}87 \cdot 0{,}228$$

$$R_a = 8{,}3006\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 3{,}7730)$$

$$R_r = 0{,}012 \cdot 1800{,}64$$

$$R_r = 21{,}607\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 148{,}9032 - (8{,}3006 + 21{,}6076)$$

$$F_{net} = 148{,}9032 - 29{,}9082$$

$$F_{net} = 118{,}9950\ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{118{,}9950}{183}$$

$$\alpha = 0{,}650$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 8{,}3006\ .0{,}066 - 3{,}7730\ .0{,}3$$

Lampiran 103

$M_P = -0{,}584$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 3{,}7730\ ).0{,}72 - 0{,}012(1804{,}42 - 3{,}7730\ ).0{,}21 - 0{,}584}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 954{,}776$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{118{,}9950}{1804{,}42}$$

$$\theta = 3{,}78°$$

Pada gigi 2 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{5{,}68667}$$

$V = 75{,}19\ {}^{km}/_{jam} = 20{,}88\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{8{,}90 \cdot 1{,}87 \cdot 3{,}041}{0{,}26} 0{,}8$$

$F = 155{,}7272\ N$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

Lampiran 104

f_r = 0,012 + 0,06 · $\left(\frac{75,19}{100}\right)^{2,5}$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot (20,88 - 5)^2 \cdot 0,228$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot 252,17 \cdot 0,228$

$F_L = 5,1745\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot (20,88 - 5)^2 \cdot 0,228$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot 252,17 \cdot 0,228$

$R_a = 11,3839\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0,012 \cdot (1804,42 - 5,1745)$

$R_r = 0,012 \cdot 1799,24$

$R_r = 21,5908\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 155,7272 - (11,3839 + 21,5908)$

$F_{net} = 155,7272 - 29,9082$

$F_{net} = 125,819\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{125,819}{183}$

$\alpha = 0,687$

Lampiran 105

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 11{,}3839 \,.0{,}066 - 5{,}1745 \,.0{,}3$

$M_P = -0{,}800$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 5{,}1745\,).0{,}72 - 0{,}012(1804{,}42 - 5{,}1745).0{,}21 - 0{,}800}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 953{,}864$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{125{,}819}{1804{,}42}$$

$$\theta = 3{,}99°$$

Pada gigi 2 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}87 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{5{,}68667}$$

$V = 83{,}55\ {}^{km}/_{jam} = 23{,}20\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{7{,}61 \cdot 1{,}87 \cdot 3{,}041}{0{,}26} 0{,}8$$

$F = 133{,}1555\ N$

Lampiran 106

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{83{,}55}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (23{,}20 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 331{,}24 \cdot 0{,}228$

$F_L = 6{,}7970\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (23{,}20 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 331{,}24 \cdot 0{,}228$

$R_a = 14{,}9534\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 6{,}7970)$

$R_r = 0{,}012 \cdot 1797{,}62$

$R_r = 21{,}5714\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 133{,}1555 - (14{,}9534 + 21{,}5714)$

$F_{net} = 133{,}1555 - 36{,}5248$

$F_{net} = 96{,}6397\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

Lampiran 107

$$\alpha = \frac{96{,}6397}{183}$$

$$\alpha = 0{,}528$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 14{,}9534\ .0{,}066 - 6{,}7970\ .0{,}3$$

$$M_P = -0{,}483$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 6{,}7970\ ).0{,}72 - 0{,}012(1804{,}42 - 6{,}7970).0{,}21 - 0{,}483}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 953{,}24$ N

Sebagai contoh perhitungan di ambil pada gigi 2 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{96{,}6397}{1804{,}42}$$

$$\theta = 3{,}07°$$

Pada gigi 3 (pada putaran mesin Rpm 2500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 2500}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 2500}{1{,}87\ \cdot\ 3{,}041}$$

$$V = \frac{237{,}5724}{4{,}1053}$$

$$V = 57{,}86\ {}^{km}/_{jam} = 16{,}07\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

Lampiran 108

$$F = \frac{5{,}81 \cdot 1{,}35 \cdot 3{,}041}{0{,}26} 0{,}8$$

$$F = 73{,}3910\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{57{,}86}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (16{,}07 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 122{,}54 \cdot 0{,}228$$

$$F_L = 2{,}5145\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (16{,}07 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 122{,}54 \cdot 0{,}228$$

$$R_a = 5{,}5319\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 2{,}5145)$$

$$R_r = 0{,}012 \cdot 1801{,}90$$

$$R_r = 21{,}6228\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 73{,}3910 - (5{,}5319 + 21{,}6228)$$

$$F_{net} = 73{,}3910 - 23{,}6086$$

$$F_{net} = 49{,}7824\ N$$

Lampiran 109

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{49{,}7824}{183}$$

$$\alpha = 0{,}272$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 5{,}5319\ .0{,}066 - 2{,}5145\ .0{,}3$$

$$M_P = -0{,}389$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max} = 0{,}8\left[\frac{(1804{,}42 - 2{,}5145\ ).0{,}72 - 0{,}012(1804{,}42 - 2{,}5145\ ).0{,}21 - 0{,}389}{1{,}250 - 0{,}8.0{,}21}\right]$$

$F_{max} = 955{,}576$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 2500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{49{,}7824}{1804{,}42}$$

$$\theta = 1{,}58°$$

Pada gigi 3 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 3000}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{285{,}0868}{4{,}1053}$$

Lampiran 110

$V = 69{,}44\ {}^{km}/_{jam} = 19{,}28\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}42 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 119{,}2660\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{69{,}44}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (19{,}28 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 203{,}91 \cdot 0{,}228$$

$$F_L = 4{,}1842\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (19{,}28 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 203{,}91 \cdot 0{,}228$$

$$R_a = 9{,}2053\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 4{,}1842\ )$$

$$R_r = 0{,}012 \cdot 1800{,}23$$

$$R_r = 21{,}6027\ N$$

Lampiran 111

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 119{,}2660 \ - (9{,}2053 \ + 21{,}6027)$

$F_{net} = 119{,}2660 \ - 30{,}808$

$F_{net} = 88{,}458\ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{88{,}458}{183}$$

$\alpha = 0{,}483$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 9{,}2053 \ .0{,}066 - 4{,}1842 \ .0{,}3$

$M_P = -0{,}647$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 4{,}1842 \ ).0{,}72 - 0{,}012(1804{,}42 - 4{,}1842 \ ).0{,}21 - 0{,}647}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 954{,}504\text{N}$

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 3000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{88{,}458}{1804{,}42}$$

$\theta = 2{,}80°$

Pada gigi 3 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik \ \cdot id}$$

Lampiran 112

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{4{,}1053}$$

$$V = 81{,}01\ {}^{km}/_{jam} = 22{,}50\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{10{,}00 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 126{,}3184\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{81{,}01}{100}\right)^{2{,}5}$$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$$F_L = \ \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (22{,}50 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 306{,}25 \cdot 0{,}228$$

$$F_L = 6{,}2842\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (22{,}50 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 306{,}25 \cdot 0{,}228$$

$$R_a = 13{,}8235\ N$$

Lampiran 113

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 6{,}2842\ )$

$R_r = 0{,}012 \cdot 1798{,}13$

$R_r = 21{,}5775\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 126{,}3184 \quad - (13{,}8235 \quad + 21{,}5775)$

$F_{net} = 126{,}3184 \quad - 35{,}401$

$F_{net} = 90{,}9174\ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{90{,}9174}{183}$$

$\alpha = 0{,}496$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 13{,}8235\ .0{,}066 - 6{,}2842\ .0{,}3$

$M_P = -0.972$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 6{,}2842\ ).0{,}72 - 0{,}012(1804{,}42 - 6{,}2842\ ).0{,}21 - 0{,}972}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 953{,}152\text{N}$

Lampiran 114

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{90{,}9174}{1804{,}42}$$

$$\theta = 2{,}88°$$

Pada gigi 3 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4000}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{4{,}1053}$$

$$V = 92{,}59\ {}^{km}/_{jam} = 25{,}71\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{10{,}38 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 131{,}1185\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{92{,}59}{100}\right)^{2{,}5}$$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (25{,}71-5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 428{,}90 \cdot 0{,}228$$

Lampiran 115

$F_L = 8{,}8010\ N$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (25{,}71 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 428{,}90 \cdot 0{,}228$$

$$R_a = 19{,}3622\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 8{,}8010\ )$$

$$R_r = 0{,}012 \cdot 1795{,}61$$

$$R_r = 21{,}5473\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 131{,}1185 \quad - (19{,}3622 \quad + 21{,}5473)$$

$$F_{net} = 131{,}1185 \quad - 40{,}9095$$

$$F_{net} = 90{,}209\ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{90{,}209}{183}$$

$$\alpha = 0{,}492$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 19{,}3622\ .0{,}066 - 8{,}8010\ .0{,}3$$

$$M_P = -1{,}363$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L) . L_1 - f_r (W - F_L) . h + M_P}{L - \mu . h} \right]$$

Lampiran 116

$$F_{max} = 0{,}8\left[\frac{(1804{,}42 - 8{,}8010\ ).0{,}72 - 0{,}012(1804{,}42 - 8{,}8010\ ).0{,}21 - 1{,}363}{1{,}250 - 0{,}8.0{,}21}\right]$$

$F_{max} = 951{,}528$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{90{,}209}{1804{,}42}$$

$$\theta = 2{,}86°$$

Pada gigi 3 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{4{,}1053}$$

$$V = 104{,}16\ {}^{km}/_{jam} = 28{,}93\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{9{,}22 \cdot 1{,}35 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 116{,}4656\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{104{,}16}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

Lampiran 117

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (28{,}93 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 572{,}64 \cdot 0{,}228$$

$$F_L = 11{,}7505\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (28{,}93 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 572{,}64 \cdot 0{,}228$$

$$R_a = 25{,}8512\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 11{,}7505\ )$$

$$R_r = 0{,}012 \cdot 1792{,}66$$

$$R_r = 21{,}5119\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 116{,}4656\ \ - (25{,}8512\ \ + 21{,}5119)$$

$$F_{net} = 116{,}4656\ \ \ - 47{,}3631$$

$$F_{net} = \ 69{,}1025\ \ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{69{,}1025}{183}$$

$$\alpha = 0{,}377$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 25{,}8512\ .0{,}066 - 11{,}7505\ \ .0{,}3$$

Lampiran 118

$M_P = -1{,}819$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 11{,}7505\ ).0{,}72 - 0{,}012(1804{,}42 - 11{,}7505\ ).0{,}21 - 1{,}819}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 949{,}632$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{69{,}1025}{1804{,}42}$$

$$\theta = 2{,}19°$$

Pada gigi 3 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}35 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{1{,}35\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{4{,}1053}$$

$V = 115{,}73\ {}^{km}/_{jam} = 32{,}14\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{7{,}50 \cdot 1{,}35 \cdot 3{,}041}{0{,}26} 0{,}8$$

$F = 94{,}7388\ N$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

Lampiran 119

f_r = 0,012 + 0,06 · $\left(\frac{115,73}{100}\right)^{2,5}$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot (32,14 - 5)^2 \cdot 0,228$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot 736,57 \cdot 0,228$

$F_L = 15,1144\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot (32,14 - 5)^2 \cdot 0,228$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot 736,67 \cdot 0,228$

$R_a = 33,2517\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0,012 \cdot (1804,42 - 15,1144\ )$

$R_r = 0,012 \cdot 1789,30$

$R_r = 21,4715\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 94,7388\ - (33,2517\ \ + 21,4715)$

$F_{net} = 94,7388\ \ - 47,3631$

$F_{net} =\ 47,3557\ \ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{47,3557}{183}$

$\alpha = 0,258$

Lampiran 120

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 33{,}2517 \,.0{,}066 - 15{,}1144 \,.0{,}3$

$M_P = -2{,}339$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 15{,}1144\,).\,0{,}72 - 0{,}012(1804{,}42 - 15{,}1144\,).\,0{,}21 - 2{,}339}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 947{,}464\text{N}$

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{47{,}3557}{1804{,}42}$$

$$\theta = 1{,}50°$$

Pada gigi 4 (pada putaran mesin Rpm 2500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 2500}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 2500}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{237{,}5724}{3{,}1626}$$

$V = 75{,}11\,{}^{km}/_{jam} = 20{,}86\,m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{5{,}91 \cdot 1{,}04 \cdot 3{,}041}{0{,}26} 0{,}8$$

Lampiran 121

$F = 57{,}5113\ N$

- Koefisien roling resistance (f_r)

$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$

$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{75{,}11}{100}\right)^{2,5}$

$f_r = 0{,}012$

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (20{,}86 - 5)^2 \cdot 0{,}228$

$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 251{,}53 \cdot 0{,}228$

$F_L = 5{,}1613\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (20{,}86 - 5)^2 \cdot 0{,}228$

$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 251{,}53 \cdot 0{,}228$

$R_a = 11{,}3550\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 5{,}1613\ )$

$R_r = 0{,}012 \cdot 1799{,}25$

$R_r = 21{,}591\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 57{,}5113\ \ - (11{,}3550\ \ + 21{,}591)$

$F_{net} = 57{,}5113\ \ - 32{,}946$

$F_{net} = \ 24{,}5653\ \ N$

Lampiran 122

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{24{,}5653}{183}$$

$$\alpha = 0{,}134$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 11{,}3550\ .0{,}066 - 5{,}1613\ .0{,}3$$

$$M_P = -0{,}798$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h}\right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 5{,}1613\ ).0{,}72 - 0{,}012(1804{,}42 - 5{,}1613\ ).0{,}21 - 0{,}798}{1{,}250 - 0{,}8.0{,}21}\right]$$

$F_{max} = 953{,}88$ N

Sebagai contoh perhitungan di ambil pada gigi 3 (putaran mesin 2500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{24{,}5653}{1804{,}42}$$

$$\theta = 0{,}78°$$

Pada gigi 4 (pada putaran mesin Rpm 3000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 3000}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3000}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{279{,}2088}{3{,}1626}$$

Lampiran 123

$V = 88{,}28\,{}^{km}/_{jam} = 24{,}52\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{8{,}92 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 86{,}8023\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0 + f_s \cdot \left(\frac{V}{100}\right)^{2,5}$$

$$f_r = 0{,}012 + 0{,}06 \cdot \left(\frac{88{,}28}{100}\right)^{2,5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (24{,}52 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 381{,}03 \cdot 0{,}228$$

$$F_L = 7{,}7982\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (24{,}52 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 381{,}03 \cdot 0{,}228$$

$$R_a = 17{,}1560\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 7{,}7982\ )$$

$$R_r = 0{,}012 \cdot 1796{,}62$$

$$R_r = 21{,}559\ N$$

Lampiran 124

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 86{,}8023 - (17{,}1560 \quad + 21{,}559)$

$F_{net} = 86{,}8023 \quad - 38{,}715$

$F_{net} = \ 48{,}0873 \ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{48{,}0873}{183}$$

$\alpha = 0{,}262$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 17{,}1560 \ .0{,}066 - 7{,}7982.0{,}3$

$M_P = -1{,}207$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 7{,}7982).0{,}72 - 0{,}012(1804{,}42 - 7{,}7982\ ).0{,}21 - 0{,}798}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 952{,}48$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 3000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{48{,}0873}{1804{,}42}$$

$\theta = 1{,}52°$

Pada gigi 4 (pada putaran mesin Rpm 3500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik \ \cdot id}$$

Lampiran 125

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 3500}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 3500}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{332{,}6013}{3{,}1626}$$

$$V = 105{,}16\ {}^{km}/_{jam} = 29{,}21\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{10{,}81 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 105{,}1942\ \ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{105{,}16}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012$$

- Gaya angkat aerodinamis (F_L)

$$F_L = \ \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (29{,}21 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 586{,}12 \cdot 0{,}228$$

$$F_L = 11{,}9216\ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (29{,}21 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 586{,}12 \cdot 0{,}228$$

$$R_a = 26{,}2276\ N$$

Lampiran 126

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0{,}012 \cdot (1804{,}42 - 11{,}9216\ )$

$R_r = 0{,}012 \cdot 1792{,}49$

$R_r = 21{,}5098\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 105{,}1942\ \ - (26{,}2276\ \ + 21{,}5098)$

$F_{net} = 105{,}1942\ \ - 41{,}7374$

$F_{net} = \ 63{,}4568\ \ N$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{63{,}4568}{183}$$

$\alpha = 0{,}346$

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 26{,}2276\ .0{,}066 - 11{,}9216.0{,}3$

$M_P = -1{,}845$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 11{,}9216).0{,}72 - 0{,}012(1804{,}42 - 11{,}9216\ ).0{,}21 - 1{,}845}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 947{,}376\text{N}$

Lampiran 127

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 3500 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{63{,}4568}{1804{,}42}$$

$$\theta = 2{,}01°$$

Pada gigi 4 (pada putaran mesin Rpm 4000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1-S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1-3)3{,}14 \cdot 0{,}52 \cdot 4000}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4000}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{380{,}1158}{3{,}1626}$$

$$V = 120{,}19\ {}^{km}/_{jam} = 33{,}38\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{11{,}13 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 108{,}3082\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{120{,}19}{100}\right)^{2{,}5}$$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (33{,}38 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 805{,}42 \cdot 0{,}228$$

Lampiran 128

$F_L = 16{,}5272\ N$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (33{,}38 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 805{,}42 \cdot 0{,}228$$

$$R_a = 36{,}3598\ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 16{,}5272)$$

$$R_r = 0{,}012 \cdot 1787{,}89$$

$$R_r = 21{,}4546\ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 108{,}3082\ - (36{,}3598\ + 21{,}4546)$$

$$F_{net} = 108{,}3082\ - 57{,}8144$$

$$F_{net} =\ 50{,}4938\ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{50{,}4938}{183}$$

$$\alpha = 0{,}275$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 36{,}3598\ .0{,}066 - 16{,}5272.0{,}3$$

$$M_P = -2{,}559$$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

Lampiran 129

$$F_{max} = 0{,}8\left[\frac{(1804{,}42 - 16{,}5272.).0{,}72 - 0{,}012(1804{,}42 - 16{,}5272.).0{,}21 - 2{,}559}{1{,}250 - 0{,}8.0{,}21}\right]$$

$F_{max} = 946{,}552$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 4000 *rpm*) penggunaan rantai:

$$\theta = arcsin\frac{50{,}4938}{1804{,}42}$$

$$\theta = 1{,}60°$$

Pada gigi 4 (pada putaran mesin Rpm 4500)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 4500}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 4500}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{427{,}6303}{3{,}1626}$$

$$V = 135{,}21\ {}^{km}/_{jam} = 37{,}55\ m/s$$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r}\mu$$

$$F = \frac{9{,}88 \cdot 1{,}04 \cdot 3{,}041}{0{,}26}0{,}8$$

$$F = 96{,}1442\ N$$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

$$f_r = 0{,}012 + \ 0{,}06 \cdot \left(\frac{135{,}21}{100}\right)^{2{,}5}$$

$f_r = 0{,}012$

Lampiran 130

- Gaya angkat aerodinamis (F_L)

$$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot (33{,}38 - 5)^2 \cdot 0{,}228$$

$$F_L = 0{,}5 \cdot 0{,}15 \cdot 1{,}2 \cdot 805{,}42 \cdot 0{,}228$$

$$F_L = 21{,}5502 \ N$$

- Gaya hambat aerodinamis (R_a)

$$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot (37{,}55 - 5)^2 \cdot 0{,}228$$

$$R_a = 0{,}5 \cdot 0{,}33 \cdot 1{,}2 \cdot 1059{,}50 \cdot 0{,}228$$

$$R_a = 47{,}4105 \ N$$

- Roling resistance (R_r)

$$R_r = f_r \cdot (W - F_L)$$

$$R_r = 0{,}012 \cdot (1804{,}42 - 21{,}5502)$$

$$R_r = 0{,}012 \cdot 1782{,}86$$

$$R_r = 21{,}3943 \ N$$

- Traksi bersih (F_{net})

$$F_{net} = F - (R_a + R_r)$$

$$F_{net} = 96{,}1442 \ - (47{,}4105 + 21{,}3943)$$

$$F_{net} = 96{,}1442 \ - 68{,}8048$$

$$F_{net} = \ 27{,}3394 \ N$$

- Percepatan yang dihasilkan

$$\alpha = \frac{F_{net}}{m}$$

$$\alpha = \frac{27{,}3394}{183}$$

$$\alpha = 0{,}149$$

- Momen pitching (M_P)

$$M_P = R_a . Z_P - F_L . X_P$$

$$M_P = 47{,}4105 \ .0{,}066 - 21{,}5502.0{,}3$$

Lampiran 131

$M_P = -3{,}336$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 21{,}5502.).0{,}72 - 0{,}012(1804{,}42 - 21{,}5502.).0{,}21 - 3{,}336}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 946{,}264$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 4500 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{27{,}3394}{1804{,}42}$$

$$\theta = 0{,}86°$$

Pada gigi 4 (pada putaran mesin Rpm 5000)

- Kecepatan kendaraan (V).

$$V = \frac{0{,}06\ (1 - S)\pi \cdot D \cdot N}{ik\ \cdot id}$$

$$V = \frac{0{,}06\ (1 - 3)3{,}14 \cdot 0{,}52 \cdot 5000}{1{,}04 \cdot 3{,}041}$$

$$V = \frac{0{,}06\ \cdot 0{,}97\ \cdot 3{,}14\ \cdot 0{,}52\ \cdot 5000}{1{,}04\ \cdot\ 3{,}041}$$

$$V = \frac{475{,}1448}{3{,}1626}$$

$V = 150{,}23\ {}^{km}/_{jam} = 41{,}73\ m/s$

- Traksi total (F)

$$F = \frac{Me \cdot (V) \cdot ik \cdot id}{r} \mu$$

$$F = \frac{7{,}63 \cdot 1{,}04 \cdot 3{,}041}{0{,}26} 0{,}8$$

$F = 74{,}2490\ \ N$

- Koefisien roling resistance (f_r)

$$f_r = f_0\ + f_s\ \cdot \left(\frac{V}{100}\right)^{2{,}5}$$

Lampiran 132

f_r = 0,012 + 0,06 · $\left(\frac{150,23}{100}\right)^{2,5}$

f_r = 0,012

- Gaya angkat aerodinamis (F_L)

$F_L = \frac{1}{2} \cdot C_L \cdot \rho \cdot V_a^2 \cdot A_f$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot (41,73 - 5)^2 \cdot 0,228$

$F_L = 0,5 \cdot 0,15 \cdot 1,2 \cdot 1349,09 \cdot 0,228$

$F_L = 27,6833\ N$

- Gaya hambat aerodinamis (R_a)

$R_a = \frac{1}{2} \cdot C_d \cdot \rho \cdot V_a^2 \cdot A_f$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot (41,73 - 5)^2 \cdot 0,228$

$R_a = 0,5 \cdot 0,33 \cdot 1,2 \cdot 1349,09 \cdot 0,228$

$R_a = 60,9033\ N$

- Roling resistance (R_r)

$R_r = f_r \cdot (W - F_L)$

$R_r = 0,012 \cdot (1804,42 - 27,6833\ )$

$R_r = 0,012 \cdot 1776,73$

$R_r = 21,3207\ N$

- Traksi bersih (F_{net})

$F_{net} = F - (R_a + R_r)$

$F_{net} = 74,2490\ - (60,9033\ \ + 21,3207)$

$F_{net} = 74,2490\ \ - 82,224$

$F_{net} = \ -7,975\ N$

- Percepatan yang dihasilkan

$\alpha = \frac{F_{net}}{m}$

$\alpha = \frac{-7,975}{183}$

$\alpha = -0,043$

Lampiran 133

- Momen pitching (M_P)

$M_P = R_a . Z_P - F_L . X_P$

$M_P = 60{,}9033 \ .0{,}066 - 27{,}6833.0{,}3$

$M_P = -3{,}685$

- Traksi maksimum (F_{max}) pada bidang kontak anyatan ban dan jalan aspal kering.

$$F_{max} = \mu \left[\frac{(W - F_L).L_1 - f_r(W - F_L).h + M_P}{L - \mu.h} \right]$$

$$F_{max} = 0{,}8 \left[\frac{(1804{,}42 - 27{,}6833).0{,}72 - 0{,}012(1804{,}42 - 27{,}6833).0{,}21 - 3{,}685}{1{,}250 - 0{,}8.0{,}21} \right]$$

$F_{max} = 939{,}8$ N

Sebagai contoh perhitungan di ambil pada gigi 4 (putaran mesin 5000 *rpm*) penggunaan rantai:

$$\theta = arcsin \frac{-7{,}975}{1804{,}42}$$

$$\theta = -0{,}25°$$

Lampiran 134

RIWAYAT HIDUP

Kadek Bima Aditya Mahayuda lahir di Desa Pelapuan pada tanggal 16 agustus 1998. penulis lahir dari pasangan suami istri Bapak Nyoman Lita dan Ibu Kadek Sriwahyuni. Kini penulis beralamat di Banjar Dinas Pelapuan, Kecamatan Busungbiu, Kabupaten Buleleng, Provinsi Bali. Penulis menyelesaikan Pendidikan Dasar di SD No.1 Pelapuan, dan lulus pada tahun 2010. Kemudian penulis melanjutkan Pendidikan di SMP Negeri 1 Busungbiu, dan lulus pada tahun 2013. Pada tahun 2016, penulis lulus dari SMA Negeri 1 Busungbiu, jurusan IPA, dan melanjutkan ke Sarjana I Program Studi Pendidikan Teknik Mesin Jurusan Teknologi Industri Fakultas Teknik Dan Kejuruan di Universitas Pendidikan Ganesha. Pada semester 11, tahun 2021 Penulis telah menyelesaikan Skripsi yang berjudul " Analisa Perbandingan Variasi Penggerak Roda Belakang Berjenis *Driving Belt* Dan Rantai Pada Sepeda Motor Bertransmisi Manual".