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# **LAMPIRAN 1**

## **PETA LOKASI PENELITIAN**



**LAMPIRAN 2**  
**PERHITUNGAN BEBAN BENTURAN**  
**KAPAL SAAT SANDAR KE DERMAGA**

## Beban Sandar Kapal RSA Dr. Lie Dharmawan

Loa	Panjang keseluruhan kapal	37,65	m
Lpp	Panjang garis tegak kapal	30.92	m
B	Lebar kapal	6,91	m
T	Sarat kapal	2	m
H	Tinggi kapal	2,96	m
V	Kecepatan kapal	8	Knot
W	Displacement	346.66	ton

### Perhitungan koefisien blok kapal

$$C_b = 1,17 - \frac{0,361 \times V}{\sqrt{L_{pp}}} = 0,65$$

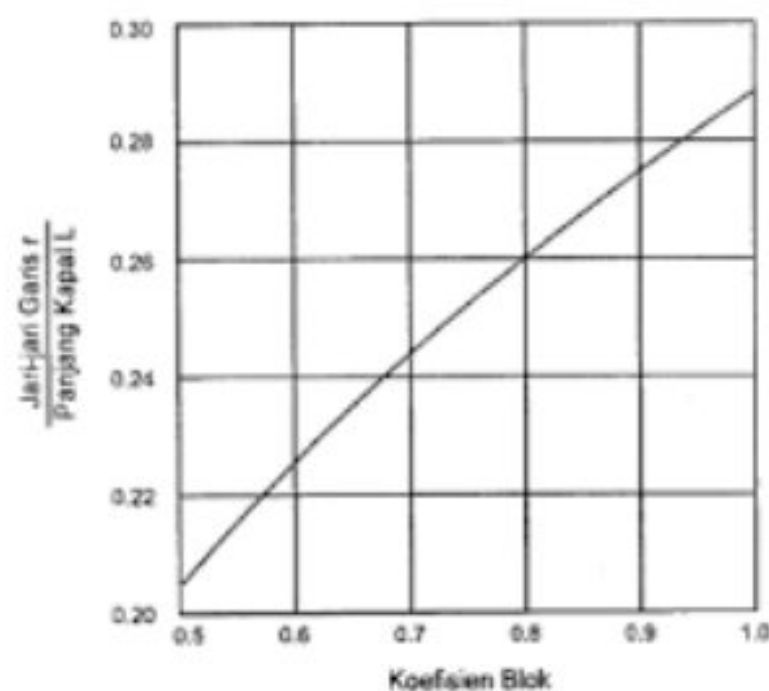
### Perhitungan koefisien massa

$$C_m = 1 + \frac{\pi}{2 \times C_b} \times \frac{T}{B} = 1,29$$

### Perhitungan koefisien eksentrisitas kapal

$$C_e = \frac{1}{1 + \left(\frac{l}{r}\right)} = 0,46$$

$$\text{dermaga: } l = \frac{1}{4} \text{ loa} = 9,41 \text{ m}$$



Dari grafik didapatkan :

$$\frac{r}{37,65} = 0,23$$

$$r = 8,65 \text{ m}$$

### Kecepatan merapat kapal

V merapat kapal berdasarkan tabel 2.1 = 0,25 m/s

### Energi benturan kapal

$$E = \frac{W \times V^2}{2g} \times C_m \times C_e \times C_s \times C_c$$

$$E = \frac{346,66 \times 0,25^2}{2 \times 9,81} \times 1,29 \times 0,46 \times 1 \times 1 = 0,65 \text{ ton.m}$$

### Beban Sandar Kapal Amukti Palapa

Loa	Panjang keseluruhan kapal	51	m
Lpp	Panjang garis tegak kapal	46,63	m
B	Lebar kapal	9	m
T	Sarat kapal	3,2	m
H	Tinggi kapal	4,5	m
V	Kecepatan kapal	7,5	Knot
W	Displacement	1.159,25	ton

#### Perhitungan koefisien blok kapal

$$Cb = 1,17 - \frac{0,361 \times V}{\sqrt{Lpp}} = 0,77$$

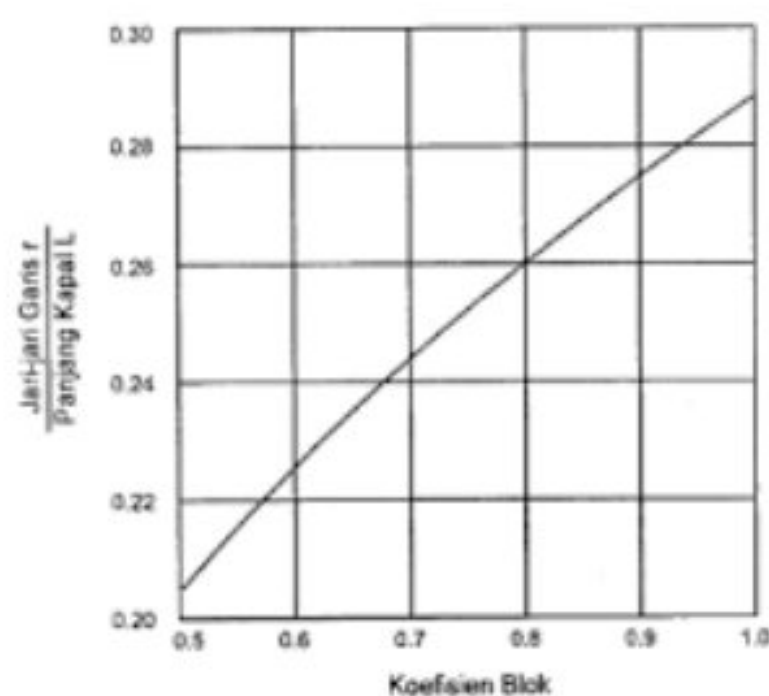
#### Perhitungan koefisien massa

$$Cm = 1 + \frac{\pi}{2 \times Cb} \times \frac{T}{B} = 1,71$$

#### Perhitungan koefisien eksentrisitas kapal

$$Ce = \frac{1}{1 + (\frac{l}{r})} = 0,52$$

$$\text{dermaga: } l = \frac{1}{4} loa = 12,75 \text{ m}$$



Dari grafik didapatkan :

$$\frac{r}{51} = 0,26$$

$$r = 13,26 \text{ m}$$

#### Kecepatan merapat kapal

V merapat kapal berdasarkan tabel 2.1 = 0,15 m/s

#### Energi benturan kapal

$$E = \frac{W \times V^2}{2g} \times C_m \times C_e \times C_s \times C_c$$

$$E = \frac{1.159,25 \times 0,15^2}{2 \times 9,81} \times 1,71 \times 0,52 \times 1 \times 1 = 1,18 \text{ ton.m}$$

### Beban Sandar Kapal LCT Remu Selatan

Loa	Panjang keseluruhan kapal	47	m
Lpp	Panjang garis tegak kapal	40,2	m
B	Lebar kapal	8,5	m
T	Sarat kapal	3,4	m
H	Tinggi kapal	4,2	m
V	Kecepatan kapal	7	Knot
W	Displacement	1.072	ton

#### Perhitungan koefisien blok kapal

$$C_b = 1,17 - \frac{0,361 \times V}{\sqrt{L_{pp}}} = 0,77$$

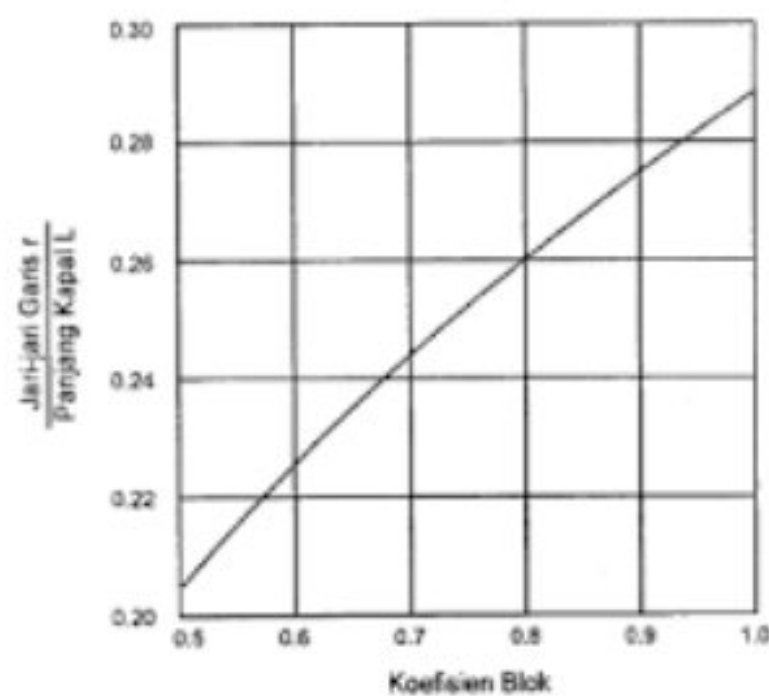
#### Perhitungan koefisien massa

$$C_m = 1 + \frac{\pi}{2 \times C_b} \times \frac{T}{B} = 1,81$$

#### Perhitungan koefisien eksentrisitas kapal

$$C_e = \frac{1}{1 + (\frac{l}{L})} = 0,52$$

$$\text{dermaga: } l = \frac{1}{4} \text{ loa} = 11,75 \text{ m}$$



Dari grafik didapatkan :

$$\frac{r}{47} = 0,26$$

$$r = 12,22 \text{ m}$$

#### Kecepatan merapat kapal

V merapat kapal berdasarkan tabel 2.1 = 0,15 m/s

#### Energi benturan kapal

$$E = \frac{W \times V^2}{2g} \times C_m \times C_e \times C_s \times C_c$$

$$E = \frac{1.072 \times 0,15^2}{2 \times 9,81} \times 1,81 \times 0,52 \times 1 \times 1 = 1,14 \text{ ton. m}$$



## Beban Sandar Kapal LCT Las 2

Loa	Panjang keseluruhan kapal	78,12	m
Lpp	Panjang garis tegak kapal	53	m
B	Lebar kapal	13,5	m
T	Sarat kapal	3,15	m
H	Tinggi kapal	4,2	m
V	Kecepatan kapal	7	Knot
W	Displacement	2.792,19	ton

### Perhitungan koefisien blok kapal

$$C_b = 1,17 - \frac{0,361 \times V}{\sqrt{L_{pp}}} = 0,82$$

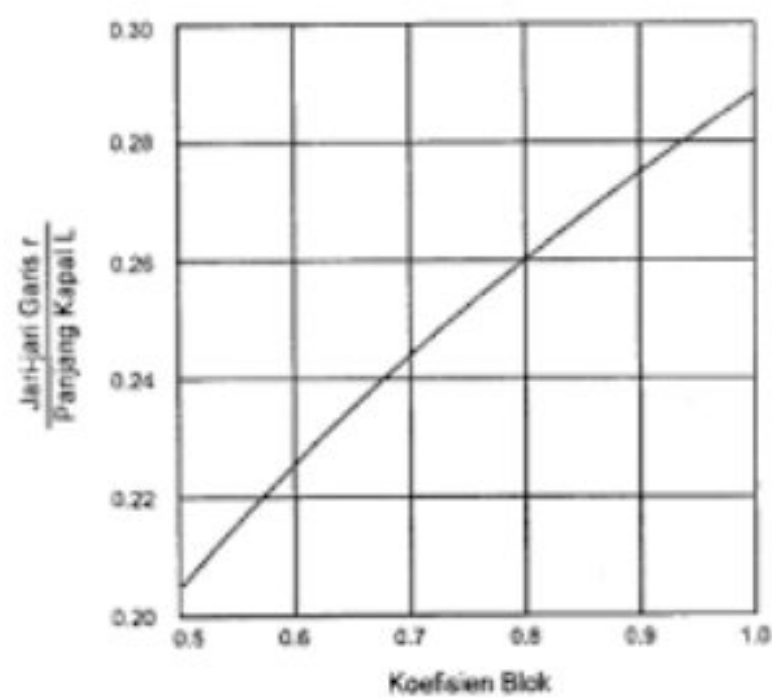
### Perhitungan koefisien massa

$$C_m = 1 + \frac{\pi}{2 \times C_b} \times \frac{T}{B} = 1,45$$

### Perhitungan koefisien eksentrisitas kapal

$$C_e = \frac{1}{1 + (\frac{l}{r})} = 0,52$$

$$\text{dermaga: } l = \frac{1}{4} \text{ loa} = 19,53 \text{ m}$$



Dari grafik didapatkan :

$$\frac{r}{47} = 0,26$$

$$r = 20,31 \text{ m}$$

### Kecepatan merapat kapal

V merapat kapal berdasarkan tabel 2.1 = 0,15 m/s

### Energi benturan kapal

$$E = \frac{W \times V^2}{2g} \times C_m \times C_e \times C_s \times C_c$$

$$E = \frac{2.792,19 \times 0,15^2}{2 \times 9,81} \times 1,45 \times 0,52 \times 1 \times 1 = 2,4 \text{ ton. m}$$

**LAMPIRAN 3**  
**PERHITUNGAN KUAT TEKAN BETON**  
**LANTAI DERMAGA PELABUHAN**  
**PAOTERE**

Lantai Dermaga 1	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D1L1	35	35	38	31	39	43	40	40	38	43	42	45	42	41	42	40	44	358.94
D1L2	36	37	41	42	39	37	35	40	35	35	40	36	39	34	38	38	41	334.47
D1L3	48	31	34	39	29	30	36	27	48	37	34	42	37	38	41	37	40	326.31
D1L4	24	15	18	15	22	15	16	19	15	15	18	19	16	15	15	17	10	81.58
D1L5	22	24	20	18	23	21	25	25	24	27	26	5	25	27	25	22	16	130.52
D1L6	27	29	28	30	29	24	27	28	31	31	24	29	31	30	35	29	26	212.10
D1L7	30	30	34	39	37	28	30	35	34	35	31	24	27	29	28	31	30	244.73
D1L8	28	25	29	31	33	27	28	26	33	33	27	28	28	30	33	29	26	212.10
D1L9	34	28	23	23	26	34	35	23	24	25	35	30	28	23	23	28	24	195.79
<b>K dermaga 1 (kg/cm<sup>2</sup>)</b>																		<b>232.95</b>

Lantai Dermaga 2	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D2L1	40	35	38	37	38	35	38	36	33	36	41	34	36	36	38	37	40	326.31
D2L2	36	37	40	37	35	35	39	35	36	40	38	38	35	40	35	37	40	326.31
D2L3	25	27	30	32	27	27	29	31	27	33	25	24	27	31	27	28	24	195.79
D2L4	36	35	33	30	25	39	38	34	33	28	30	37	38	35	32	34	34	277.36
D2L5	42	46	46	39	41	42	38	43	40	39	45	43	40	40	43	42	48	391.57
D2L6	43	45	48	45	44	43	42	45	42	42	41	42	45	40	40	43	50	407.89
D2L7	43	44	40	45	44	48	45	40	40	45	46	42	44	40	41	43	50	407.89
D2L8	43	45	42	46	40	39	42	45	43	42	38	45	45	40	40	42	48	391.57
D2L9	37	45	44	44	43	41	40	42	38	43	42	43	40	38	43	42	48	391.57
<b>K dermaga 2 (kg/cm<sup>2</sup>)</b>																		<b>346.25</b>

Lantai Dermaga 3	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D3L1	41	42	41	41	38	40	39	38	39	38	40	39	37	38	40	39	42	342.63
D3L2	43	40	41	42	40	43	42	42	45	42	41	40	40	40	45	42	48	391.57
D3L3	38	39	37	35	39	35	42	38	38	37	35	42	40	39	42	38	41	334.47
D3L4	41	41	43	50	48	45	43	48	43	44	50	43	43	42	44	45	53	432.36
D3L5	48	44	43	44	44	43	42	42	42	46	41	40	43	43	43	43	50	407.89
D3L6	30	29	29	28	35	30	30	35	30	35	32	30	33	28	32	31	30	244.73
D3L7	32	34	35	29	35	31	31	33	30	32	28	34	29	28	27	31	30	244.73
D3L8	40	38	41	42	44	42	38	40	41	42	40	41	38	40	42	41	46	375.26
D3L9	28	30	30	31	25	33	32	30	30	28	34	32	30	33	24	30	28	228.42
<b>K dermaga 3 (kg/cm<sup>2</sup>)</b>																		<b>333.56</b>

Lantai Dermaga 4	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D4L1	43	38	44	42	40	40	41	39	40	40	38	40	38	43	41	40	44	358.94
D4L2	23	27	38	42	42	26	32	36	39	40	27	34	32	28	42	34	34	277.36
D4L3	45	41	38	32	24	42	33	34	30	25	43	41	33	25	27	34	34	277.36
D4L4	35	40	44	41	42	40	44	40	42	42	41	45	45	44	45	42	48	391.57
D4L5	41	43	41	44	40	41	47	48	47	40	46	45	46	47	45	44	52	424.20
D4L6	43	43	47	45	45	46	47	46	45	45	44	47	45	46	45	45	53	432.36
D4L7	40	40	42	41	40	44	41	40	40	43	41	40	42	40	42	41	46	375.26
D4L8	42	43	42	43	40	40	41	40	43	41	44	42	41	40	42	42	48	391.57
D4L9	41	40	42	41	40	39	41	42	40	41	40	39	41	42	40	41	46	375.26
<b>K dermaga 4 (kg/cm<sup>2</sup>)</b>																		<b>367.10</b>

Lantai Dermaga 5	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D5L1	43	43	45	45	44	43	43	44	45	44	46	47	45	46	46	45	53	432.36
D5L2	42	43	45	43	44	45	47	44	42	43	45	42	41	43	45	44	52	424.20
D5L3	42	41	40	43	44	42	45	41	42	44	40	42	45	44	41	42	48	391.57
D5L4	40	40	41	42	41	42	43	41	40	43	41	42	42	40	41	41	46	375.26
D5L5	44	45	45	43	44	47	47	47	45	46	45	44	46	45	46	45	53	432.36
D5L6	42	44	42	42	41	41	40	45	45	42	43	41	42	41	42	42	48	391.57
D5L7	44	43	46	46	45	46	47	47	44	43	44	44	45	46	46	45	53	432.36
D5L8	42	41	40	41	40	41	43	42	40	40	39	40	40	41	42	41	46	375.26
D5L9	40	41	39	39	40	41	43	42	40	40	39	38	40	41	42	40	44	358.94
<b>K dermaga 5 (kg/cm<sup>2</sup>)</b>																		<b>401.54</b>

Lantai Dermaga 7	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D7L1	24	25	26	24	25	25	26	24	23	26	26	27	25	26	25	25	21	171.31
D7L2	28	32	29	28	25	28	25	30	29	24	32	30	31	32	28	29	26	212.10
D7L3	25	26	26	27	25	28	27	28	26	25	24	25	23	23	25	26	22	179.47
D7L4	44	47	45	47	45	42	48	48	48	46	42	44	42	46	48	45	53	432.36
D7L5	48	46	44	42	42	43	46	45	45	44	43	44	45	43	44	44	52	424.20
D7L6	43	48	46	44	49	48	44	45	44	47	43	42	43	44	43	45	53	432.36
D7L7	32	30	33	29	30	34	33	32	35	33	30	31	33	32	32	32	31	252.89
D7L8	33	32	32	34	36	35	37	33	32	32	31	34	35	37	35	34	34	277.36
D7L9	33	42	38	39	46	35	36	37	32	37	38	38	40	33	33	37	40	326.31
<b>K dermaga 7 (kg/cm<sup>2</sup>)</b>																		<b>300.93</b>

Lantai Dermaga 6	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D6L1	48	43	45	45	43	47	44	45	43	43	48	43	44	45	43	45	53	432.36
D6L2	41	40	39	35	34	40	39	40	36	35	40	41	40	36	37	38	41	334.47
D6L3	40	41	40	40	39	40	39	39	40	41	39	40	40	41	40	40	44	358.94
D6L4	38	37	39	38	40	38	38	37	37	40	38	39	40	38	41	39	42	342.63
D6L5	45	45	43	42	45	44	43	42	41	45	45	44	42	41	44	43	50	407.89
D6L6	38	40	39	40	39	39	40	38	40	39	38	38	40	40	40	39	42	342.63
D6L7	36	38	40	39	38	35	38	40	42	37	36	37	40	38	36	38	41	334.47
D6L8	45	44	41	40	40	44	42	40	40	39	42	42	40	39	39	41	46	375.26
D6L9	44	45	43	40	40	44	42	41	40	40	42	40	42	40	40	42	48	391.57
D6L10	28	29	30	29	31	30	29	30	30	28	29	31	30	29	30	30	28	228.42
D6L11	40	41	44	42	45	42	43	41	40	44	45	42	43	44	41	42	48	391.57
D6L12	38	39	41	42	40	39	39	40	41	42	40	40	41	40	40	40	44	358.94
D6L13	25	23	24	22	21	20	22	23	24	24	22	23	20	21	22	22	16	130.52
D6L14	45	46	44	45	42	44	45	41	43	42	45	44	42	44	43	44	52	424.20
D6L15	12	11	16	18	18	18	19	19	14	14	15	19	15	16	15	16	10	81.58
<b>K dermaga 6 (kg/cm<sup>2</sup>)</b>																		<b>368.91</b>

Lantai Dermaga 8	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D8L1	25	26	26	27	25	26	24	24	23	26	27	23	23	24	27	25	21	171.31
D8L2	36	44	43	38	40	45	45	44	43	45	40	38	38	44	45	42	48	391.57
D8L3	33	34	35	33	38	38	37	40	36	41	38	41	37	35	33	37	40	326.31
D8L4	22	24	24	23	25	25	24	26	26	22	27	25	28	28	27	25	21	171.31
D8L5	34	35	33	37	39	32	36	37	36	35	33	39	33	32	36	35	36	293.68
D8L6	37	35	33	32	36	36	37	36	35	36	37	38	35	33	32	35	36	293.68
D8L7	45	45	47	46	41	43	47	47	45	45	44	48	47	46	46	45	53	432.36
D8L8	40	39	40	43	44	42	44	39	40	41	41	42	40	42	41	41	46	375.26
D8L9	36	35	32	33	34	35	34	36	33	35	36	32	36	33	38	35	36	293.68
<b>K dermaga 8 (kg/cm<sup>2</sup>)</b>																		<b>288.46</b>

Lantai Dermaga 9	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D9L1	29	28	29	31	30	30	28	28	27	26	25	29	28	29	30	28	25	203.94
D9L2	38	39	41	36	38	40	39	40	41	42	42	38	41	39	40	40	44	358.94
D9L3	43	42	45	46	40	46	43	44	46	45	40	45	43	44	47	44	52	424.20
D9L4	42	39	40	38	41	40	42	41	38	38	37	37	39	40	42	40	44	358.94
D9L5	32	34	36	32	33	37	35	37	37	35	33	37	36	38	37	35	36	293.68
D9L6	31	32	30	32	31	30	27	31	28	28	31	32	31	31	30	30	28	228.42
D9L7	40	41	42	44	38	39	40	41	42	43	40	41	38	38	39	40	44	358.94
D9L8	31	32	31	30	33	34	32	35	36	34	32	33	37	36	35	33	33	269.21
D9L9	25	28	27	28	26	28	29	28	29	28	27	27	27	29	28	28	25	203.94
<b>K dermaga 9 (kg/cm<sup>2</sup>)</b>																		<b>300.02</b>

Lantai Dermaga 10	Angka Pantul Palu Beton (R)															R Rata-Rata	N/mm <sup>2</sup>	K (kg/cm <sup>2</sup> )
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
D10L1	29	28	31	31	30	28	27	28	29	28	31	30	30	27	27	29	26	212.10
D10L2	32	33	33	31	31	33	30	29	29	28	30	31	33	30	31	31	30	244.73
D10L3	41	40	39	40	41	39	39	38	40	41	42	39	39	40	41	40	44	358.94
D10L4	27	27	28	27	29	29	30	28	28	29	31	30	27	29	28	28	24	195.79
D10L5	34	35	34	33	30	30	31	29	30	31	32	29	30	32	29	31	30	244.73
D10L6	35	35	34	35	32	32	31	34	30	31	30	30	29	28	29	32	31	252.89
D10L7	38	38	39	37	37	38	36	40	38	40	37	38	39	37	37	38	41	334.47
D10L8	24	25	24	24	21	23	26	26	25	24	26	24	23	24	23	24	20	163.16
D10L9	29	28	29	28	30	30	31	30	27	28	27	27	30	31	27	29	26	212.10
D10L10	39	40	38	38	39	38	37	37	41	38	37	39	38	38	37	38	41	334.47
D10L11	38	38	37	38	39	36	38	36	38	37	38	37	37	37	36	37	40	326.31
D10L12	30	31	30	32	32	29	29	31	30	31	30	31	33	33	32	31	30	244.73
D10L13	35	34	35	35	33	33	31	30	30	31	30	29	29	30	32	32	31	252.89
D10L14	41	40	40	39	39	40	41	38	39	40	38	39	42	41	42	40	44	358.94
D10L15	39	39	37	37	38	37	39	40	40	38	38	37	39	40	37	38	41	334.47
D10L16	34	32	33	36	34	31	31	30	34	34	32	31	31	30	33	32	31	252.89
D10L17	38	36	31	35	34	36	37	33	35	31	34	35	32	36	33	34	34	277.36
D10L18	40	40	41	38	38	39	41	40	38	39	41	42	38	40	41	40	44	358.94
D10L19	37	36	39	40	41	41	38	37	39	40	41	37	38	39	39	39	42	342.63
D10L20	31	33	30	34	32	34	31	30	29	30	33	34	32	31	30	32	31	252.89
<b>K dermaga 10 (kg/cm<sup>2</sup>)</b>																		<b>277.77</b>