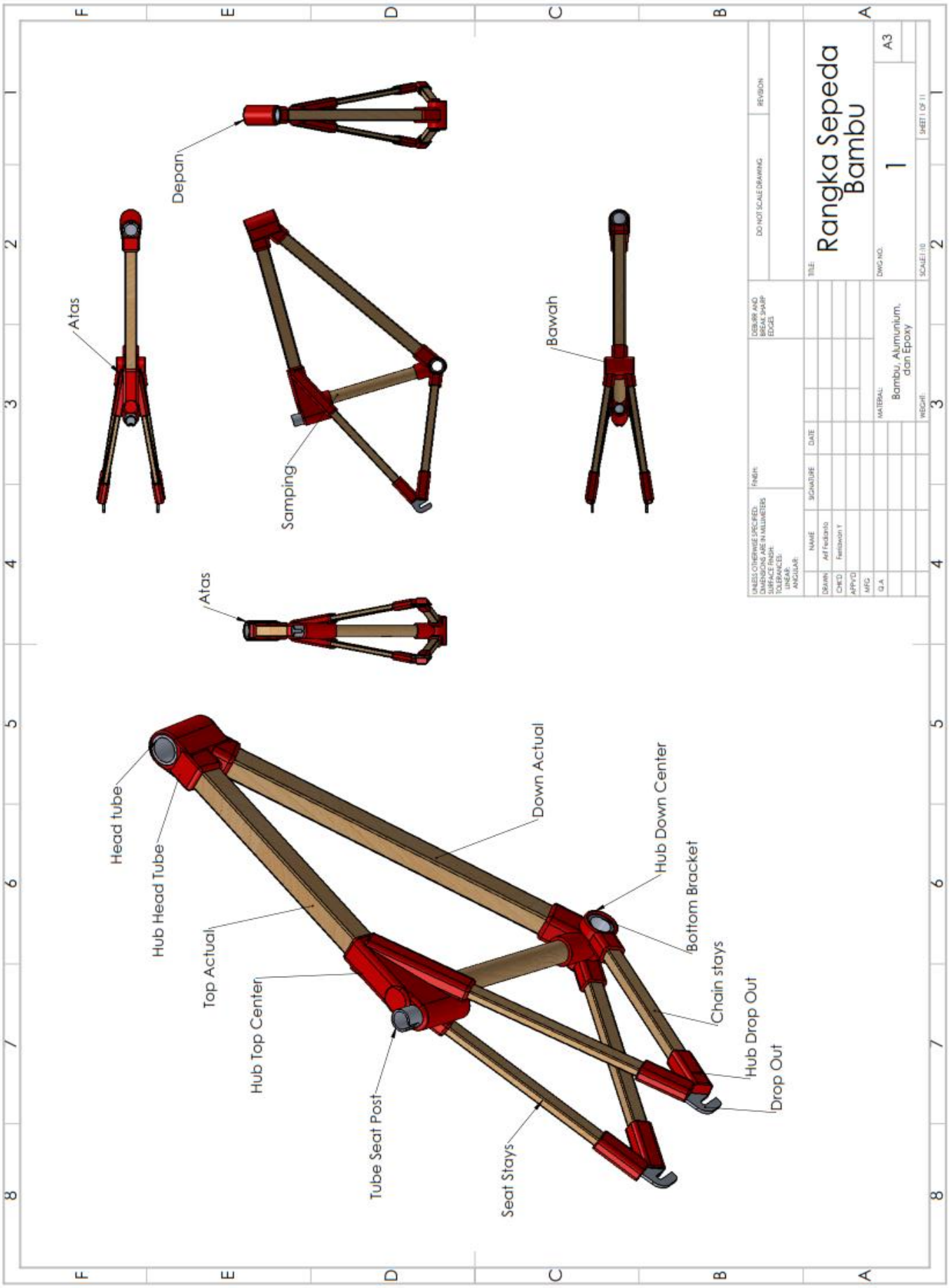
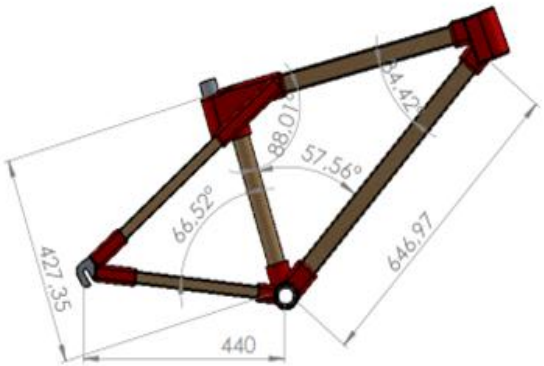
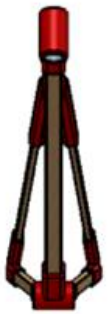
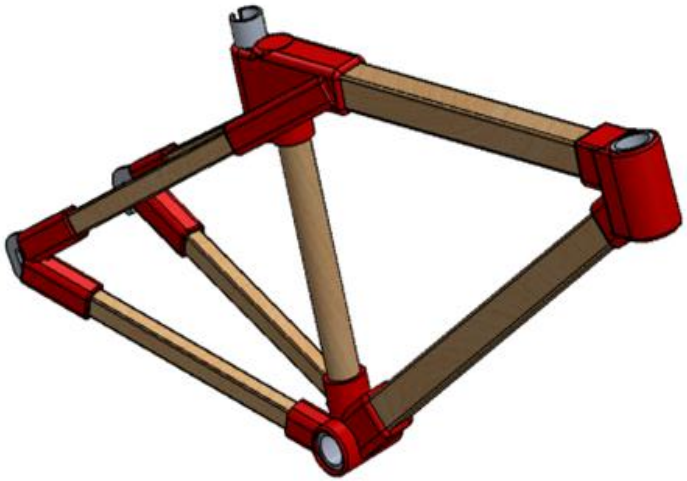
LAMPIRAN 1

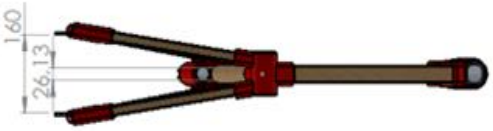
Gambar 2 Dimensi Rangka Sepeda

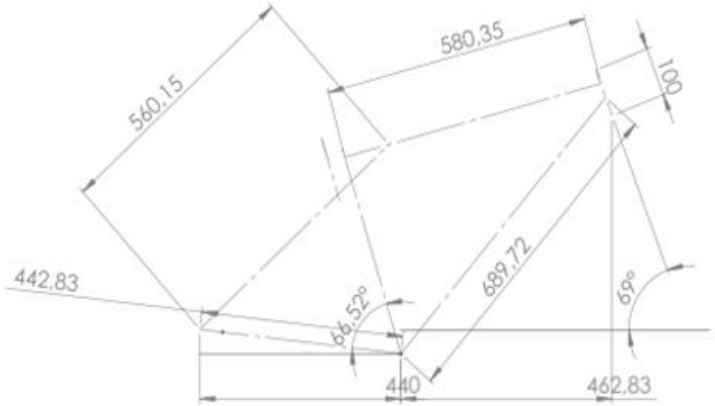






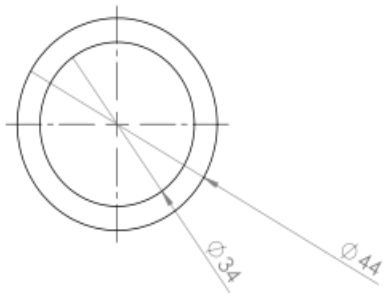


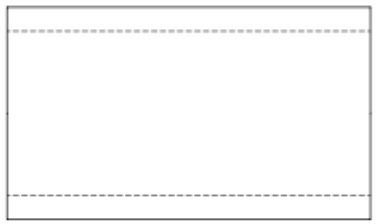


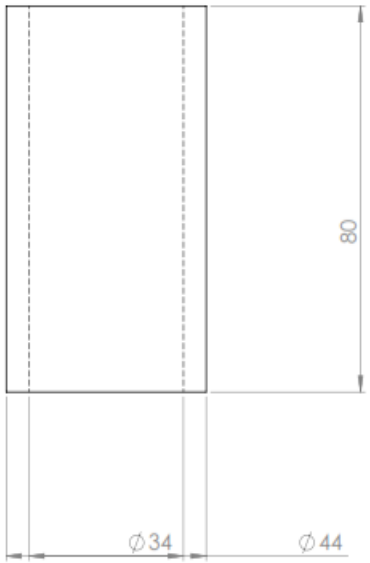


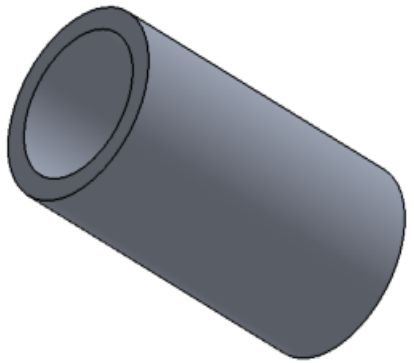
Geometri Sepeda

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:			DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING		REVISION
	NAME	SIGNATURE	DATE			TITLE: Dimensi Rangka		
DRAWN								
CHK'D								
APPV'D								
MFG								
Q.A				MATERIAL:		DWG NO. 2		A3
				WEIGHT:		SCALE:1:10	SHEET 11 OF 11	

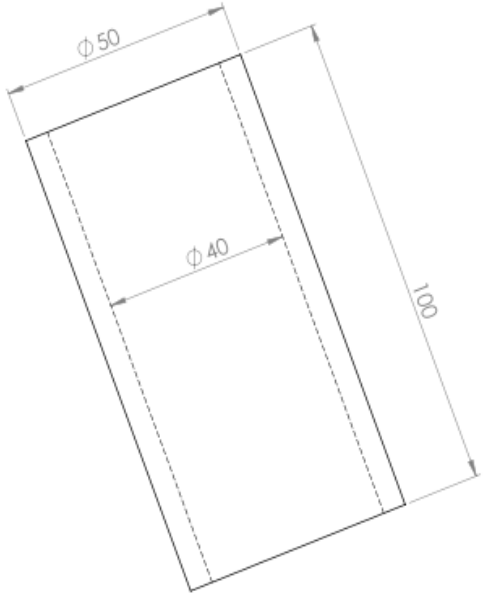


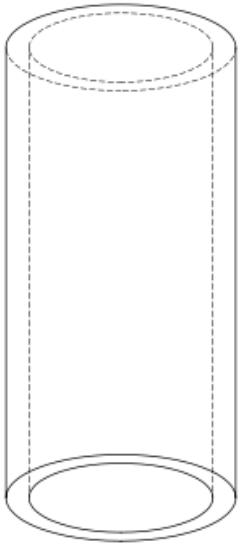


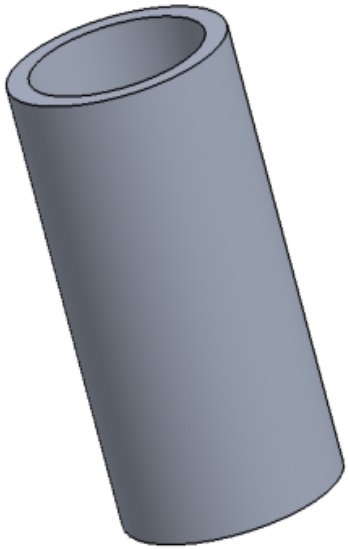


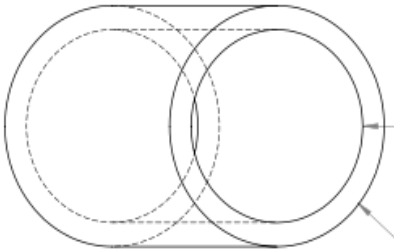


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE			TITLE: Center Tube	
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Alumunium		DWG NO. 3	A3
				WEIGHT:		SCALE:1:1	SHEET 2 OF 11

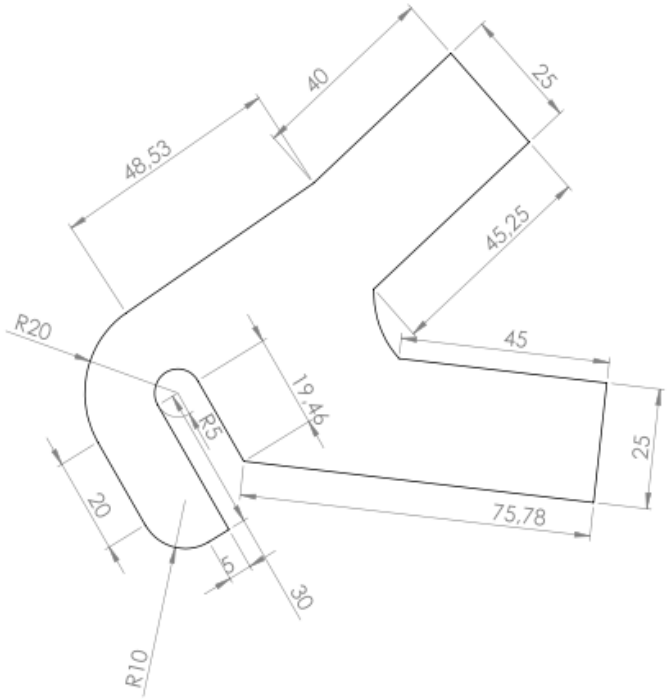


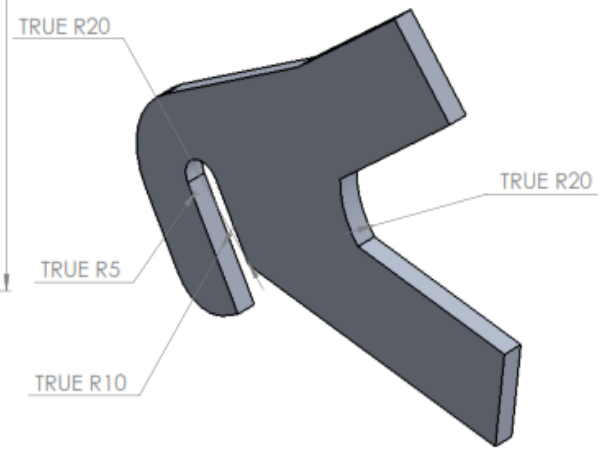


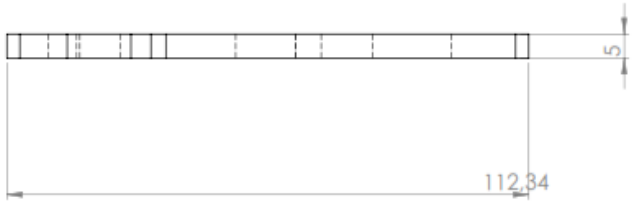




UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE			TITLE: Head Tube	
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Alumunium		DWG NO. 4	A3
				WEIGHT:		SCALE:1:1	SHEET 3 OF 11

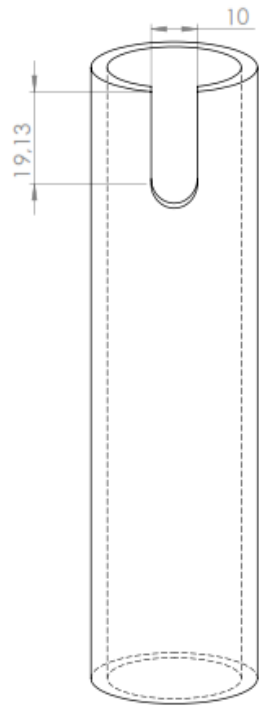


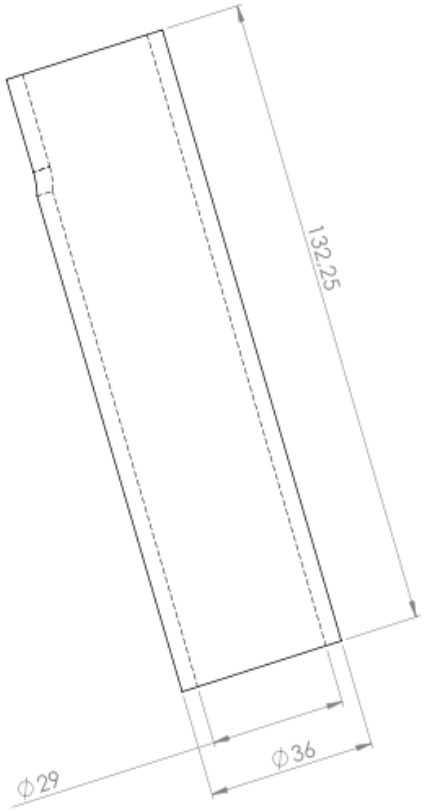


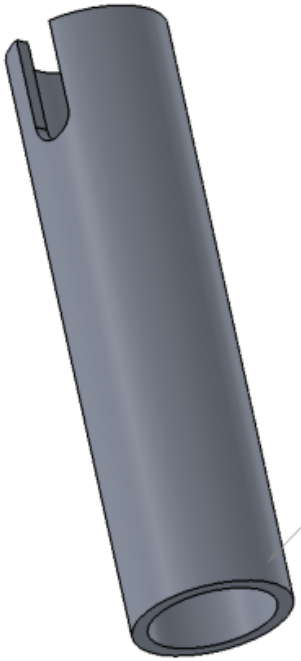


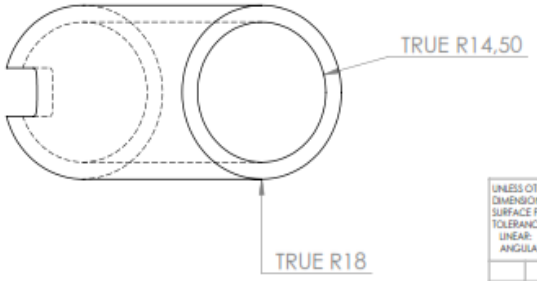
NB : untuk Ukuran Shaft Center Wheel Kanan dan kiri sama

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:		DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
	NAME	SIGNATURE	DATE	TITLE: Shaft Center Wheel		
DRAWN						
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Alumunium	DWG NO. 5	A3
				WEIGHT:	SCALE:1:1	SHEET 4 OF 11

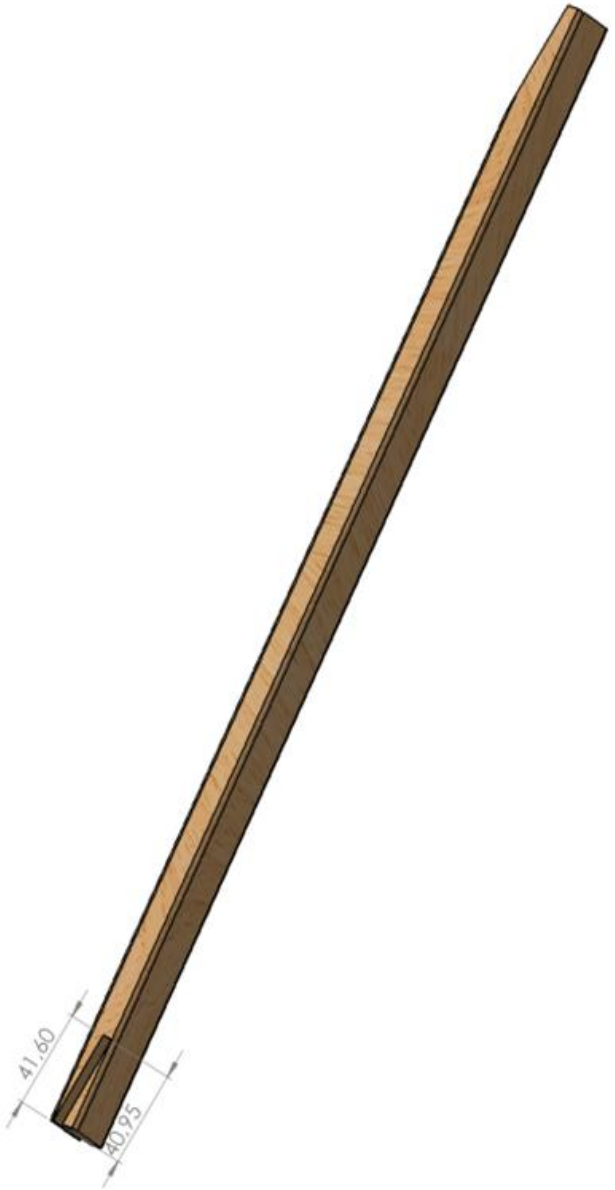






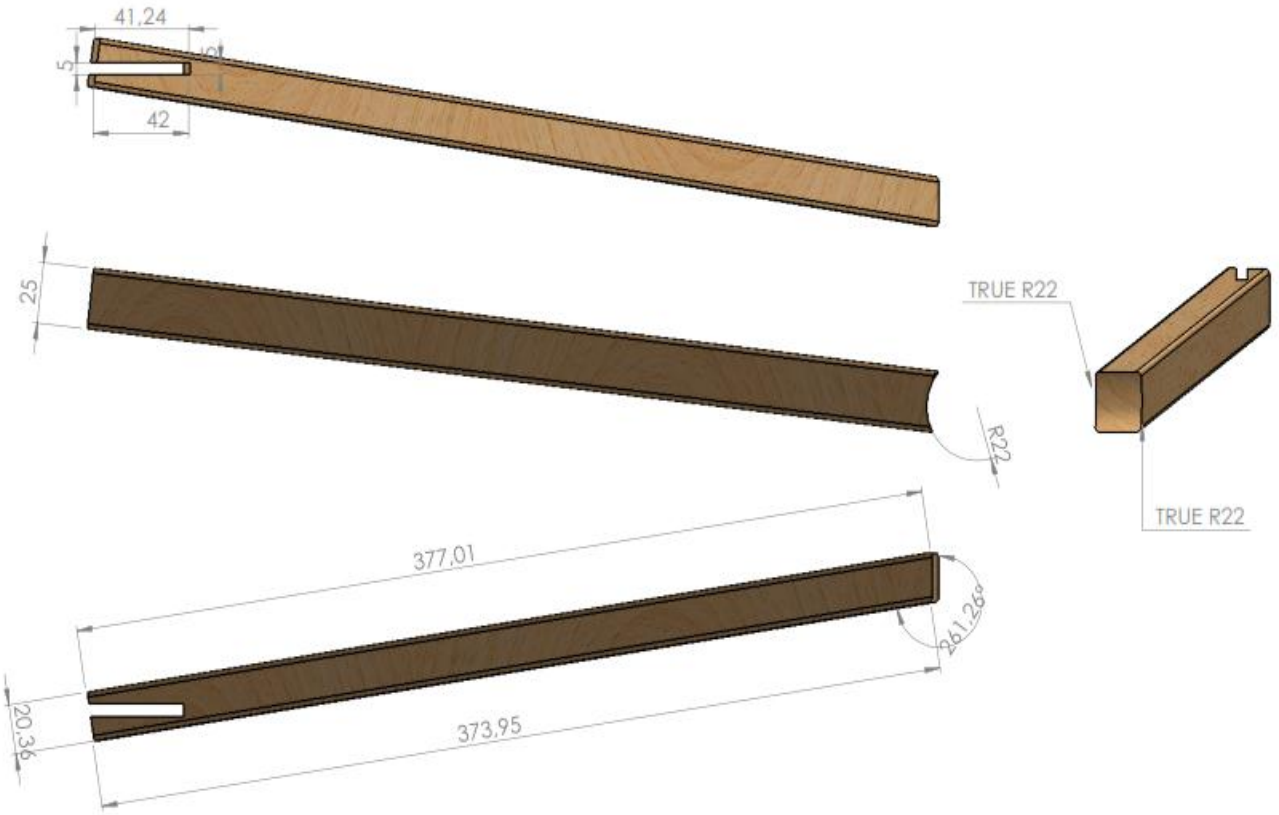


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:			DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE			TITLE: Seat Tube	
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Alumunium		DWG NO. 6	A3
				WEIGHT:		SCALE:1:2	SHEET 5 OF 11

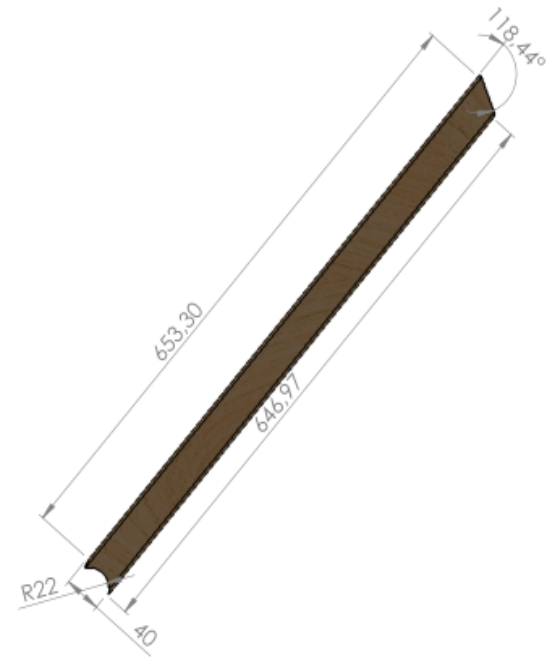


Nb: untuk ukuran kanan dan kiri sama

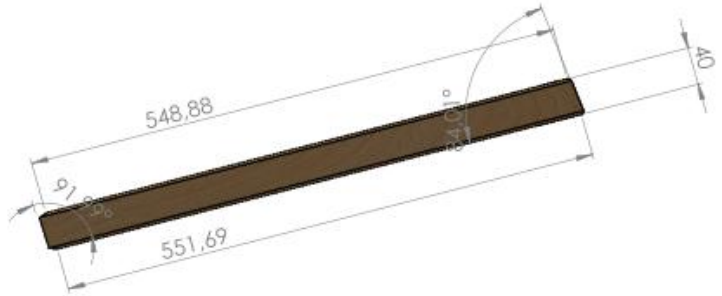
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:				DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE				TITLE: seat stays kiri	
DRAWN								
CHK'D								
APPV'D								
MFG								
Q.A				MATERIAL:			DWG NO. 7	A3
				WEIGHT:			SCALE:1:5	SHEET 6 OF 11

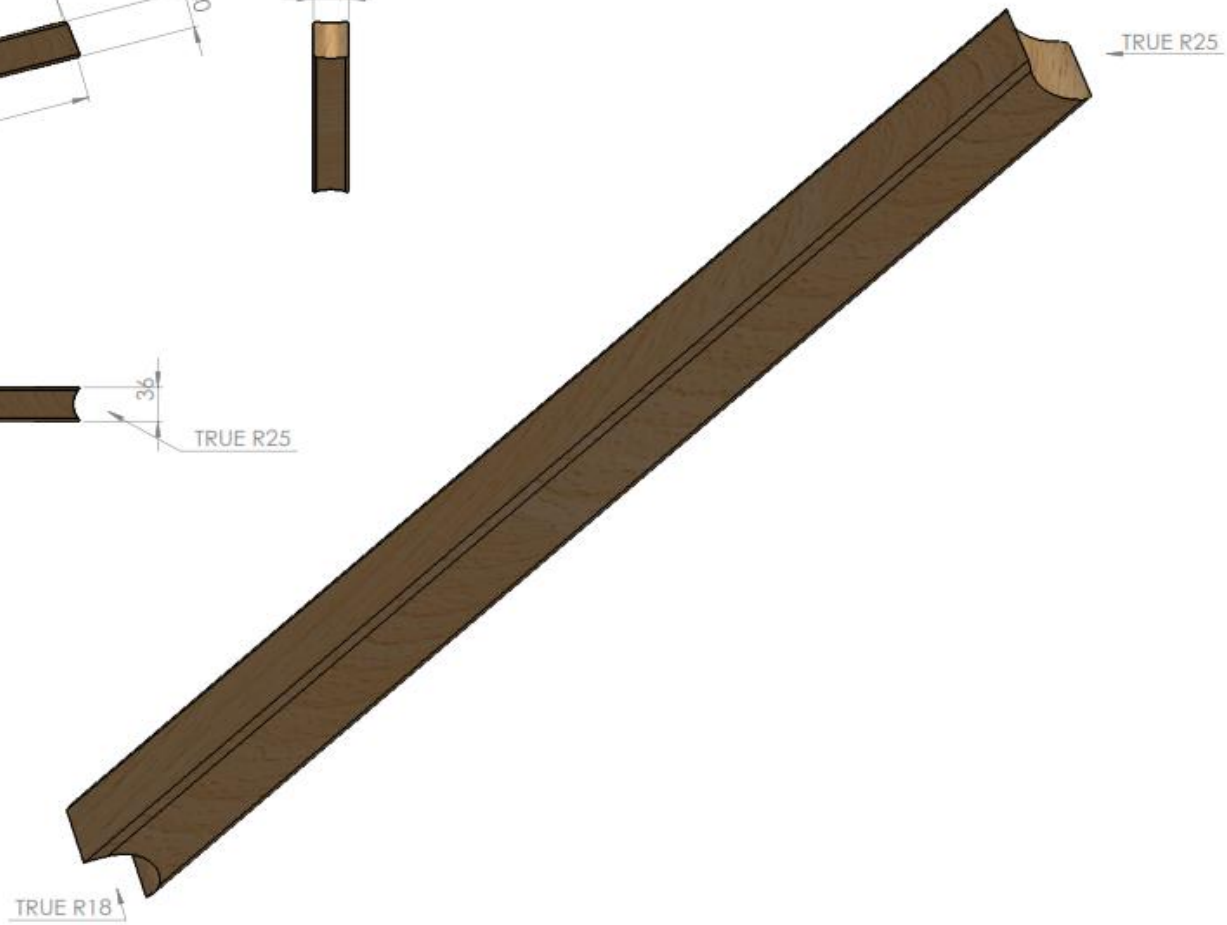


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:			FINISH:			DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE				TITLE: Chain Stays kiri	
DRAWN								
CHK'D								
APPV'D								
MFG								
Q.A				MATERIAL:			DWG NO. 8	A3
				WEIGHT:			SCALE:1:2	SHEET 7 OF 11

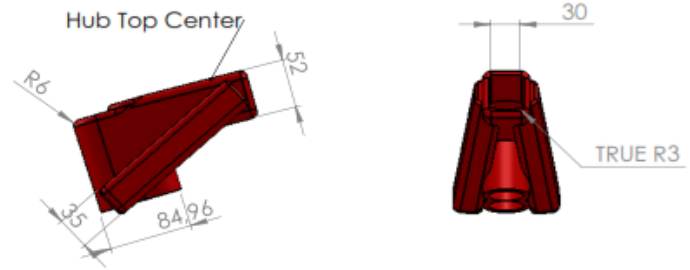


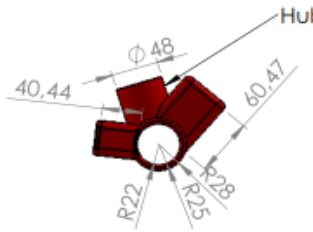
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:			FINISH:			DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE				TITLE: Down Actual	
DRAWN								
CHK'D								
APPV'D								
MFG								
Q.A				MATERIAL:			DWG NO. 9	A3
				WEIGHT:			SCALE:1:5	SHEET 8 OF 11

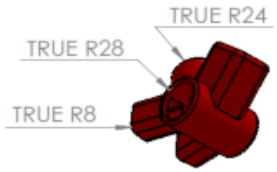


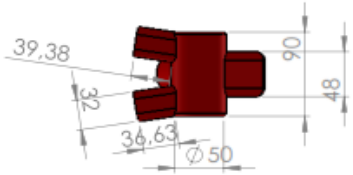


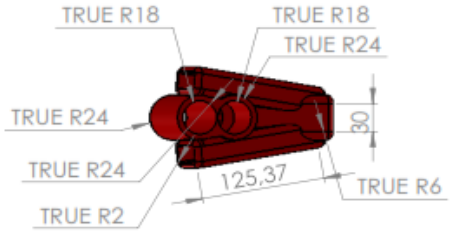
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:				DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE				TITLE: Top Actual
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL:			DWG NO. 10
							A3
				WEIGHT:			SCALE:1:5 SHEET 9 OF 11

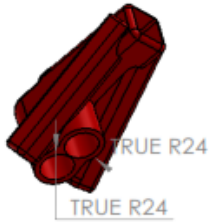


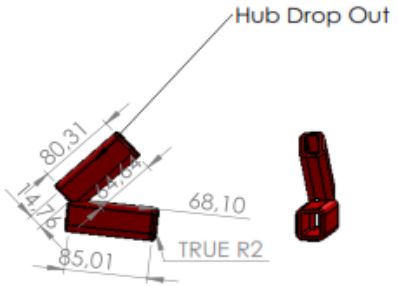


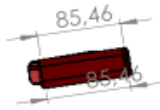


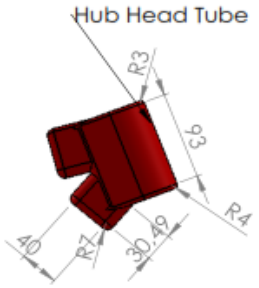


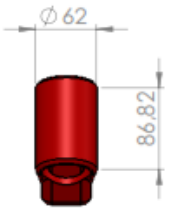


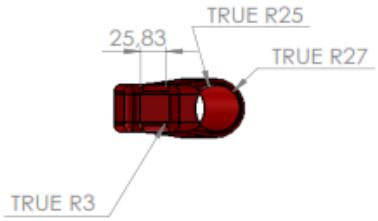












UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:		DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE		TITLE: sambungan	
DRAWN						
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO. 11	A3
				WEIGHT:	SCALE:1:2	SHEET 10 OF 11

Lampiran 2

Analisa perhitungan beban maksimal

Dari tabel diatas dapat diketahui nilai beban maksimal dan nilai tegangan maksimal rangka sepeda bambu sebagai berikut :

a. Rangka sepeda menggunakan bambu raw material.

Faktor keamanan dirumuskan :

$$\eta = \frac{Kekutan\ sebenarnya(beban\ sebenarnya)}{kekuatan\ yang\ dibutuhkan\ (beban\ yang\ dibutuhkan)}$$

Maka jika ,

1. Diketahui $P_e = 80$ kg nilai factor safety n = 7

σ_e = 13,55 Mpa $u = 0{,}03125\ mm$

σ_{yield} = ? P_{max} = ?

u_{max} =?

Hasil :

a) $7 = \frac{P_{Max}}{80}$

$P_{max} = n \times P_e = 7 \times 80 = 560$ kg

P_{max} = 560 kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$7 = \frac{\sigma_{yield}}{13{,}55}$$

$\sigma_{yield} = \eta \times \sigma_e = 7 \times 13{,}55 = 94{,}85$ Mpa

$\sigma_{yield} = 94{,}85$ Mpa

c) $\eta = \frac{u_{max}}{u}$

$$7 = \frac{u_{max}}{0{,}03125}$$

$$u_{max} = \eta \times u = 7 \times 0{,}03125 = 0{,}218$$

$$u_{max} = 0{,}218 \text{ mm}$$

2. Diketahui $P_e = 100$ kg Nilai factor safety n = 5,6

   σ_e = 16,95 Mpa $u = 0{,}03907$mm

   σ_{yield} = ? P_{max} = ?

   u_{max} =?

   Hasil :

   a) $5{,}6 = \frac{P_{max}}{100}$

   $$P_{max} = n \times P_e = 5{,}6 \times 100 = 560 \text{ kg}$$

   $$P_{max} = 560 \text{ kg}$$

   b) $\eta = \frac{\sigma_{max}}{\sigma_e}$

   $$5{,}6 = \frac{\sigma_{yield}}{16{,}95}$$

   $$\sigma_{yield} = \eta \times \sigma_e = 5{,}6 \times 16{,}95 = 94{,}92 \text{ Mpa}$$

   $$\sigma_{yield} = 94{,}92 \text{ Mpa}$$

   c) $\eta = \frac{u_{max}}{u}$

   $$5{,}6 = \frac{u_{max}}{0{,}03907}$$

   $$u_{max} = \eta \times u = 5{,}6 \times 0{,}03907 = 0{,}218$$

   $$u_{max} = 0{,}218 \text{ mm}$$

3. Diketahui $P_e = 150$ kg Nilai factor safety n = 3,737

   σ_e = 25,42 $u = 0{,}0586$ mm

σ_{yield} = ? P_{max} = ?

u_{max} =?

Hasil :

a) 3,7 = $\frac{P_{max}}{150}$

$P_{max} = n \times P_e = 3{,}737 \times 150 = 560$kg

$P_{max} = 550$ kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$3{,}7 = \frac{\sigma_{yield}}{25{,}42}$$

$\sigma_{yield} = \eta \times \sigma_e = 3{,}737 \times 25{,}42 = 94{,}99$ Mpa

$\sigma_{yield} = 94{,}99$ Mpa

c) $\eta = \frac{u_{max}}{u}$

$$3{,}7 = \frac{u_{max}}{0{,}03907}$$

$u_{max} = \eta \times u = 3{,}7 \times 0{,}0586 = 0{,}218$

$u_{max} = 0{,}218$ mm

Jadi beban maksimal dari rangka adalah sebesar 560 kg

Jika nilai factor safety 4 maka,

4 = $\frac{560}{P_e}$ = x = $\frac{560}{4}$ = 140 kg

Jadi beban untuk nilai factor safety 4 sebesar 140 kg berat pengendara, sebagai nilai keamanan sepeda untuk dipergunakan.

b. Rangka bambu *Sandwict non treatment*

Faktor keamanan dirumuskan :

$$n = \frac{Kekutan\ sebenarnya(beban\ sebenarnya)}{kekuatan\ yang\ dibutuhkan\ (beban\ yang\ dibutuhkan)}$$

Maka jika ,

1. Diketahui $P_e = 80$ kg nilai factor safety η = 6,7

   σ_e = 14,16 Mpa $u = 0{,}037$ mm

   σ_{yield} = ? P_{max} = ?

   u_{max} =?

   Hasil :

   a) $7 = \frac{P_{max}}{80}$

   $P_{max} = \eta \times P_e = 6{,}7 \times 80 = 536$ kg

   $P_{max} = 536$ kg

   b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

   $$7 = \frac{\sigma_{yield}}{14{,}17}$$

   $\sigma_{yield} = \eta \times \sigma_e = 6{,}7 \times 14{,}16 = 94{,}93$ Mpa

   $\sigma_{yield} = 94{,}93$ Mpa

   c) $\eta = \frac{u_{max}}{u}$

   $$6{,}7 = \frac{u_{max}}{0{,}037}$$

   $u_{max} = \eta \times u = 6{,}7 \times 0{,}037 = 0{,}247$

   $u_{max} = 0{,}247$ mm

2. Diketahui $P_e = 100$ kg nilai factor safety η = 5,36

   σ_e = 17,72 Mpa u =0,046 mm

σ_{yield} = ? u_{max} = ?

Hasil :

a) $5{,}36 = \frac{P_{max}}{100}$

$P_{max} = \eta \times P_e = 5{,}36 \times 100 = 536$ kg

$P_{max} = 536$ kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$5{,}36 = \frac{\sigma_{yield}}{17{,}72}$$

$\sigma_{yield} = \eta \times \sigma_e = 5{,}36 \times 17{,}72 = 94{,}97$ Mpa

$\sigma_{yield} = 94{,}97$Mpa

c) $\eta = \frac{u_{max}}{u}$

$$5{,}36 = \frac{u_{max}}{0{,}046}$$

$u_{max} = \eta \times u = 5{,}36 \times 0{,}046 = 0{,}246$

$u_{max} = 0{,}246$ mm

3. Diketahui $P_e = 150$ kg nilai factor safety η = 3,577

σ_e = 26,55 Mpa P_{max} = ?

σ_{yield} = ? u =0,036 mm

u_{max} = ?

Hasil :

a) $3{,}57 = \frac{P_{max}}{150}$

$P_{max} = \eta \times P_e = 3{,}577 \times 150 = 536{,}5$kg

$P_{max} = 535{,}5$kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$3{,}57 = \frac{\sigma_{yield}}{26{,}57}$$

$$\sigma_{yield} = \eta \times \sigma_e = 3{,}577 \times 26{,}57 = 94{,}96\text{Mpa}$$

σ_{yield} =94,96Mpa

c) $\eta = \frac{u_{max}}{u}$

$$3{,}577 = \frac{u_{max}}{0{,}069}$$

$$u_{max} = \eta \times u = 3{,}577 \times 0{,}069 = 0{,}246$$

$u_{max} = 0{,}246$ mm

Jadi beban maksimal dari rangka adalah sebesar 536 kg

Jika nilai factor safety 4 maka,

$$4 = \frac{536}{P_e}\ x = \frac{536}{4} = 134 \text{ kg}$$

Jadi beban untuk nilai *factor safety* 4 sebesar 134 kg berat pengendara, sebagai nilai keamanan sepeda untuk dipergunakan.

c. Bambu *sandwich composite* dengan *treatment*

Faktor keamanan dirumuskan :

$$\eta = \frac{Kekutan\ sebenarnya(beban\ sebenarnya)}{kekuatan\ yang\ dibutuhkan\ (beban\ yang\ dibutuhkan)}$$

Maka jika ,

1. Diketahui $P_e = 80$kg nilai factor safety η = 7,5

   σ_e = 12,62 Mpa P_{max} = ?

   σ_{yield} = ? $u = 0{,}021$ mm

   u_{max} = ?

Hasil :

a) $7{,}5 = \frac{P_{max}}{80}$

$P_{max} = \eta \times P_e = 7{,}5 \times 80 = 600$ kg

$P_{max} = 600$ kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$7{,}5 = \frac{\sigma_{max}}{12{,}62}$$

$\sigma_{yield} = \eta \times \sigma_e = 7{,}5 \times 12{,}62 = 94{,}65$Mpa

$\sigma_{yield} = 94{,}65$Mpa

c) $\eta = \frac{u_{max}}{u}$

$$7{,}5 = \frac{u_{max}}{0{,}021}$$

$u_{max} = \eta \times u = 7{,}5 \times 0{,}021 = 0{,}157$

$u_{max} = 0{,}157$mm

2. Diketahui $P_e = 100$ kg nilai factor safety η = 6

σ_{max} = 15,78 Mpa P_{max} = ?

σ_{max} = ? $u = 0{,}026$

Hasil :

a) $6 = \frac{P_{max}}{100}$

$P_{max} = \eta \times P_e = 6 \times 100 = 600$ kg

$P_{max} = 600$ kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$6 = \frac{\sigma_{max}}{15{,}78}$$

$$\sigma_{yield} = \eta \times \sigma_e = 6 \times 15{,}78 \ = 94{,}68 \text{ Mpa}$$

$$\sigma_{yield} = 94{,}68 \text{ Mpa}$$

c) $\eta = \frac{u_{max}}{u}$

$$6 = \frac{u_{max}}{0{,}026}$$

$$u_{max} = \eta \times u = 6 \times 0{,}026 = 0{,}156$$

$$u_{max} = 0{,}156 \text{ mm}$$

3. Diketahui $P_e = 150$ kg nilai factor safety η = 4

σ_e = 23,76 Mpa P_{max} = ?

σ_{yield} = ? $u = 0{,}039$

u_{max} = ?

Hasil :

a) $4 = \frac{P_{max}}{150}$

$P_{max} = \eta \times P_e = 4 \times 150 = 600$ kg

$P_{max} = 600$ kg

b) $\eta = \frac{\sigma_{yield}}{\sigma_e}$

$$4 = \frac{\sigma_{max}}{23{,}76}$$

$$\sigma_{yield} = \eta \times \sigma_e = 4 \times 23{,}76 = 95{,}04 \text{ Mpa}$$

$$\sigma_{yield} = 95{,}04 \text{ Mpa}$$

c) $\eta = \frac{u_{max}}{u}$

$$4 = \frac{u_{max}}{0{,}039}$$

$$u_{max} = \eta \times u = 4 \times 0{,}039 = 0{,}156$$

$$u_{max} = 0{,}156 \text{ mm}$$

Jadi beban maksimal dari rangka adalah sebesar 600 kg jika menggunakan bambu *sandwict non treatment* sebagai material dan tegangan maksimum dari sepeda tersebut adalah

Jika nilai factor safety 4 maka,

$$4 = \frac{600}{P_e} = x = \frac{600}{4} = 150 \text{ kg}$$

Jadi beban untuk nilai *factor safety* 4 sebesar 150 kg berat pengendara, sebagai nilai keamanan sepeda untuk dipergunaka