Name : Yip Winn Sheng Alwyn
Student ID : 0326644

Task 1 Description

In this report, the performance simulation results of two manual transmission from two suppliers will be assessed. From the graph, the total resistance forces of the vehicle at a certain gradient, traction force due to vehicle speed in Newton, engine speed in rpm and vehicle speed in km/h can be obtained. This information is evaluated to be fitted into a small sedan which is targeted for fresh graduates. The evaluation can be done by setting a constant for each of the data provided in order to compare with both the suppliers. After doing so, the most suitable transmission can be selected with the appropriate road condition.

One of the most important aspects of the transmission will be the climbing ability. The climbing ability is based on the gap between the total resistance force on the vehicle and the traction force. The total resistance force and traction force were set at 35% and first gear respectively. From the graph, the traction force of supplier A was greater than 50% which exceeds the 35% gradient of the road. On the other hand, the traction force of supplier B was only hovering slightly above the 35% gradient of the road. The transmission of supplier A also shows a consistent ability in climbing slopes at various other gradient whereas supplier B could merely climb slopes at lower gradient only. This result shows that transmission B is only suitable for city driving whereas supplier A is capable of city driving and also hillside driving which makes it a better transmission for a car.

Next, the transmission will be assessed based on the response at low speed below 90 km/h. The rpm and traction force were set at 3000rpm and fourth gear. From the graph, vehicle A is capable to achieve a speed of 85km/h. Whereas, vehicle B only managed to reach a speed of 80km/h. At the same time, vehicle A is capable of climbing a 26% gradient slope at 85km/h while vehicle B only manage to climb a 20% slope at 80km/h. This shows that vehicle A is able to achieve a higher speed at a lower revolutions per minute when compared to vehicle B. However, Vehicle B requires a higher rpm at approximately 3800 rpm to climb a slope of 26% at the same speed of 80km/h. This means that vehicle A has a slightly better response time as it has a lower rpm when compared to vehicle A when climbing on the same slope.

Subsequently, the transmission will be assessed based on the response at high vehicle speed which is above 90km/h. The rpm and traction force were set at 4000rpm at the fifth gear. Based on the graph, vehicle A clocked a speed of 150km/h while vehicle B only managed to clock a speed of approximately 135km/h. This means vehicle A has a faster response time when compared to vehicle B. Vehicle B requires approximately 4500rpm in order to reach a speed of 135km/h.

The last assessment is the fuel consumption of both vehicles. Fuel consumption is affected by the engine speed , the gap between the traction force due to the car and the total resistance of the vehicle at a certain gradient. Based on the graph, vehicle A produces a significantly greater traction force to climb the slope at most gradients when compared to vehicle B. However, vehicle B has a greater engine speed when compared to vehicle A when climbing steep slopes. This would provide better driving experience but it will consume more fuel. Hence, the transmission of vehicle B is more suited for steep slope road condition while vehicle A is suitable for normal slope city driving. Since the target market is for fresh graduate, vehicle A will be chosen as it has a lower engine speed which provides better field consumption for city driving.

As for the emission requirement, the transmission with the best acceptable limits for exhaust emissions of the vehicle will be chosen. From the table, transmission A meets the minimum emission requirement of EU3 while transmission B is fitted with EU5. As per european emission standards, EU3 is suitable for any vehicle while EU5 is suitable for light passenger and commercial vehicles. Hence, transmission B is more suitable as it meets the purpose of a small sedan and also encourages the use of refined field which reduces carbon emissions.

Based on Table 1.1, transmission A offers a better warranty package of 60000km or 5 years when compared to transmission B which has a lower mileage and warranty period. In addition, the cost of parts for supplier A is lower than supplier B by RM1500. However, the price for transmission oil of supplier B is cheaper than supplier A by RM18.

In summary, supplier B is recommended to be fitted in a small sedan. This is because it produces sufficient traction force to ferry the vehicle through most slopes for city driving. Supplier A is more desirable for travelling on roads with high slopes as it has a greater traction force which consumes more fuel. Besides, supplier B meets the better emission requirement of EU5 which is more environmentally friendly as it releases less carbon into the atmosphere.

Task 2 Deliverables

Table 1. Data Tabulation

Plane	Mass(m) , Kg	Radius(r), m	Cent. Force($m.r$) , kg.m	Distance from R.P , l	Couple Moment $(m.r.l)$, kg. m^2
1	400	0.3	120	-0.45	-54
2 (R.P)	m_2	0.3	0.3 m_2	0	0
3	m_3	0.3	0.3 m_3	0.75	0.225 m_3
4	400	0.3	120	1.35	162

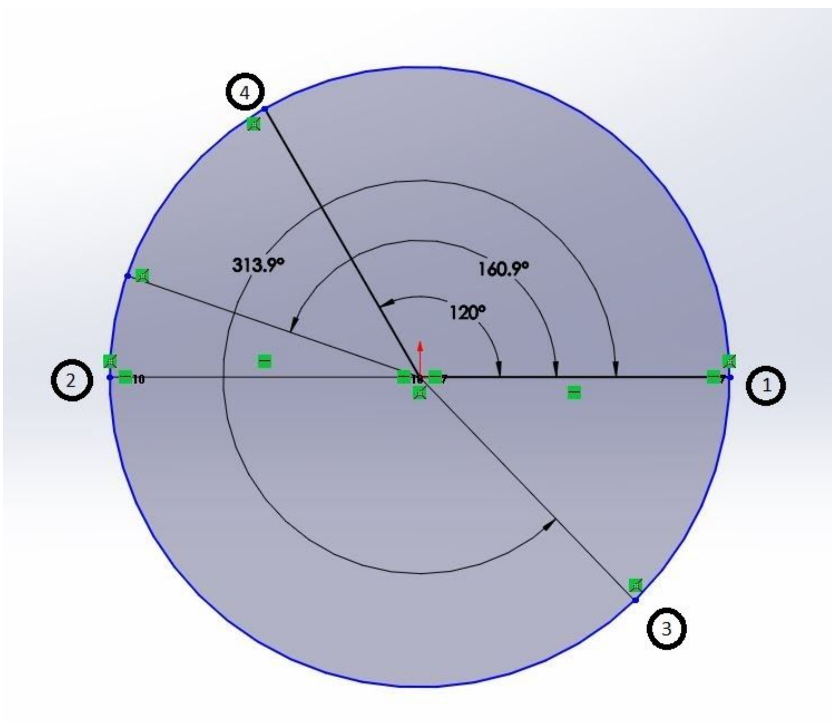

Figure 1. Primary Crank Position

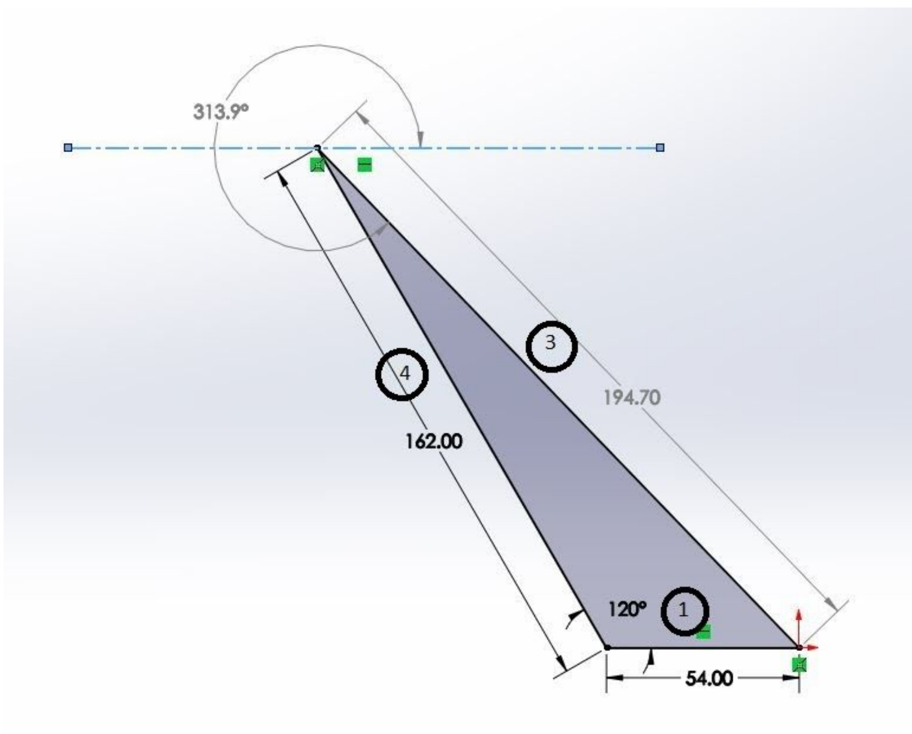

Figure 2. Primary Couple Polygon

By measurement:

$F_3 = 0.225 \cdot m_3$

$194.7 = 0.225 \cdot m_3$

$m_3 = 865.33\ kg$

$\theta = 313.9°$

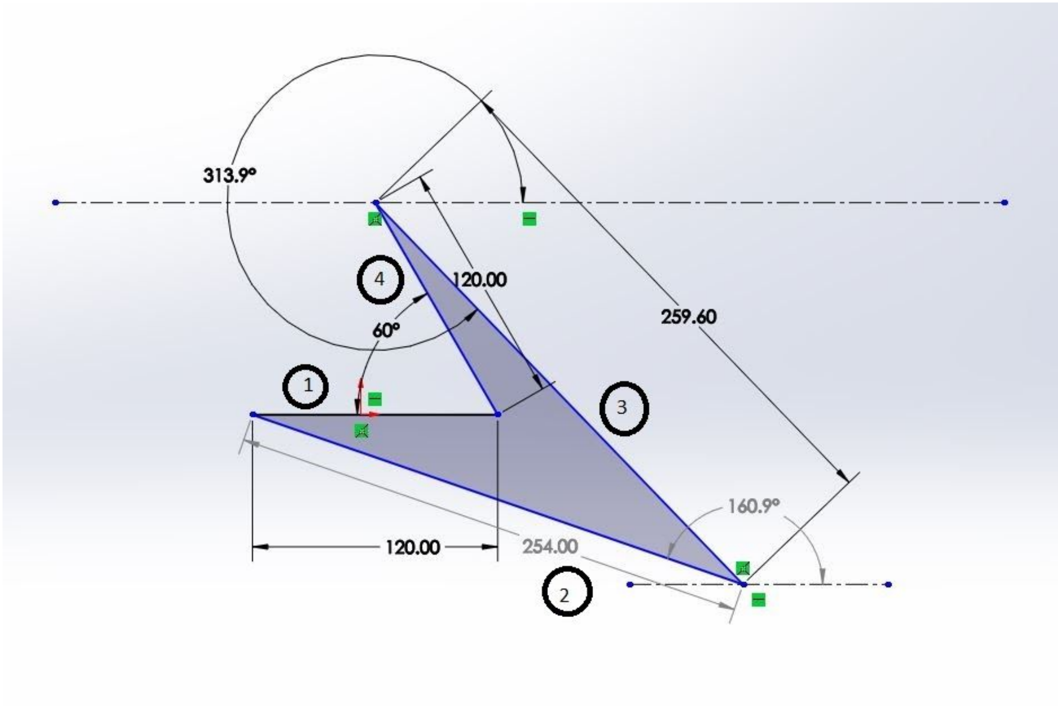

Figure 3. Primary Force Polygon

By measurement :

$$F_2 = 0.3 \cdot m_2$$
$$254 = 0.3 \cdot m_2$$
$$m_2 = 846.67\ kg$$

$$\theta = 160.9°$$

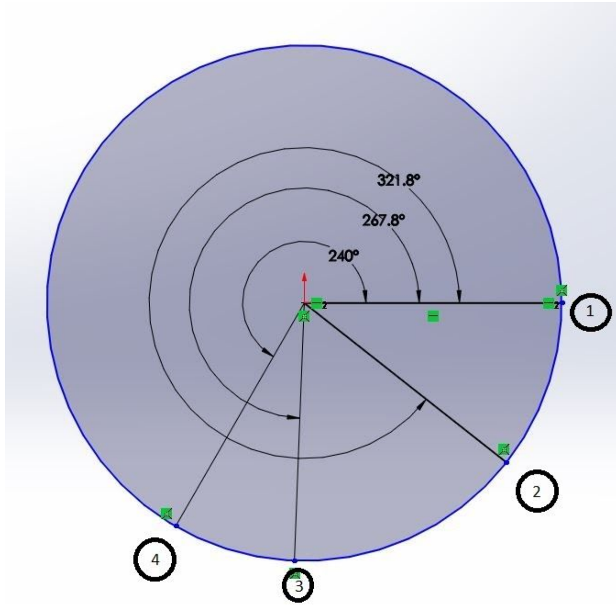

Figure 4. Secondary Crank Position

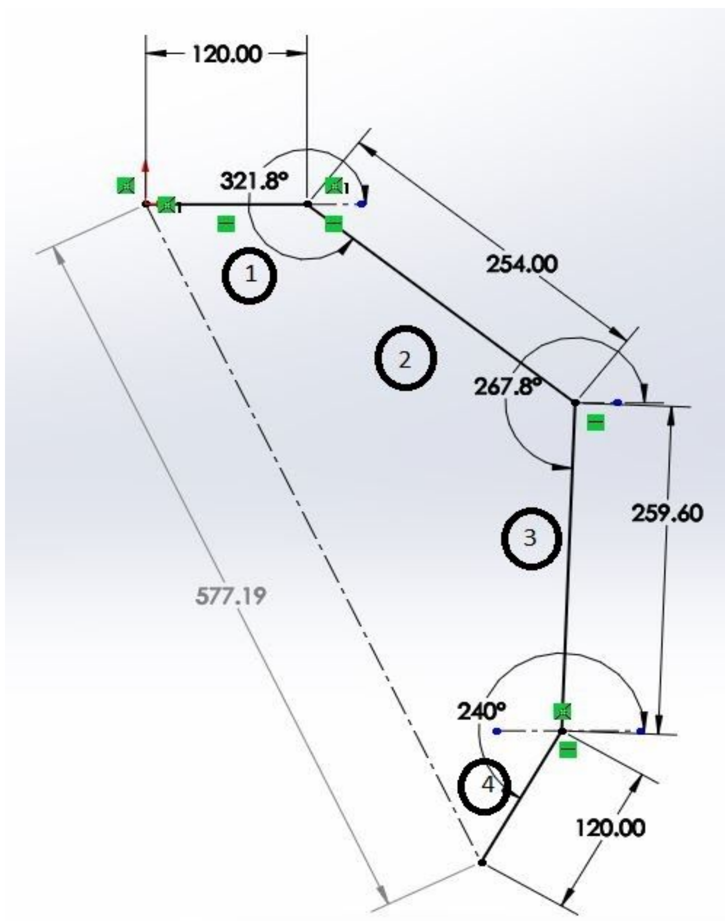

Figure 5. Secondary Force Polygon

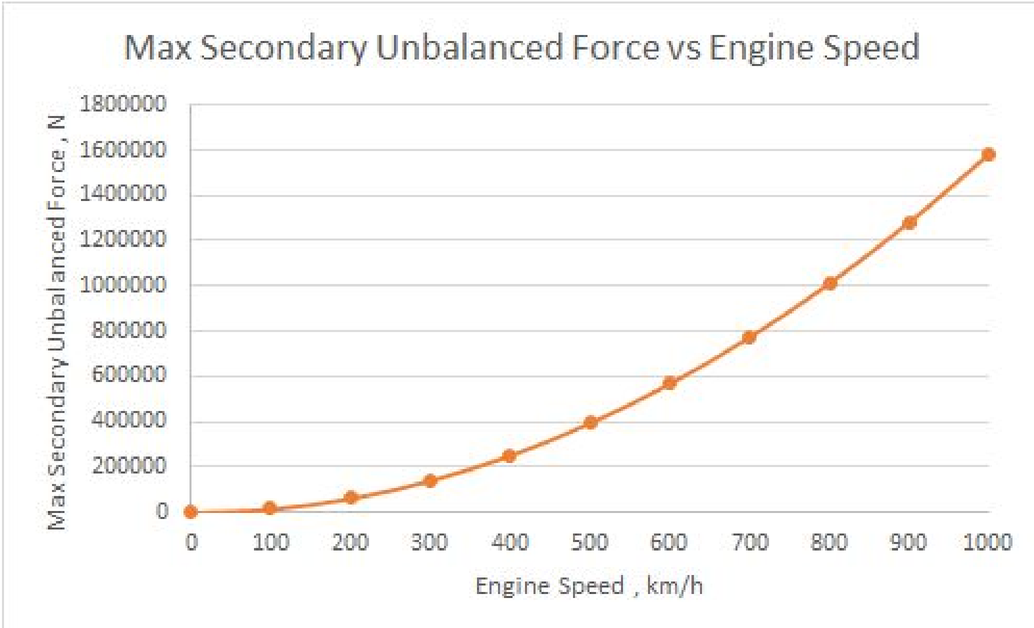

Figure 6. Graph of Maximum Secondary Unbalanced Force against Engine Speed

- The maximum secondary unbalanced force increases linearly as the engine speed increases.

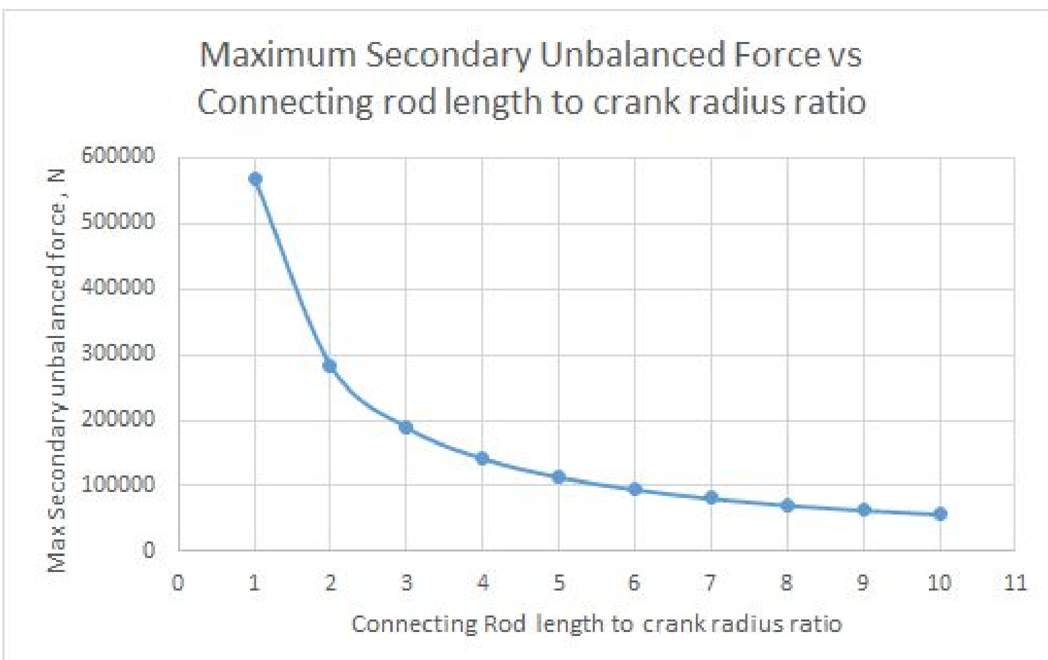

Figure 7. Graph of Maximum Secondary Unbalanced Force against Connecting Rod Length to crank radius ratio

- The maximum Secondary Unbalanced Force decreases as the connecting rod Length to crank radius ratio increases.

Conclusion

The engine speed increases due to the presence of the number of reciprocating parts such as piston and connecting rod which increases the maximum unbalanced force.