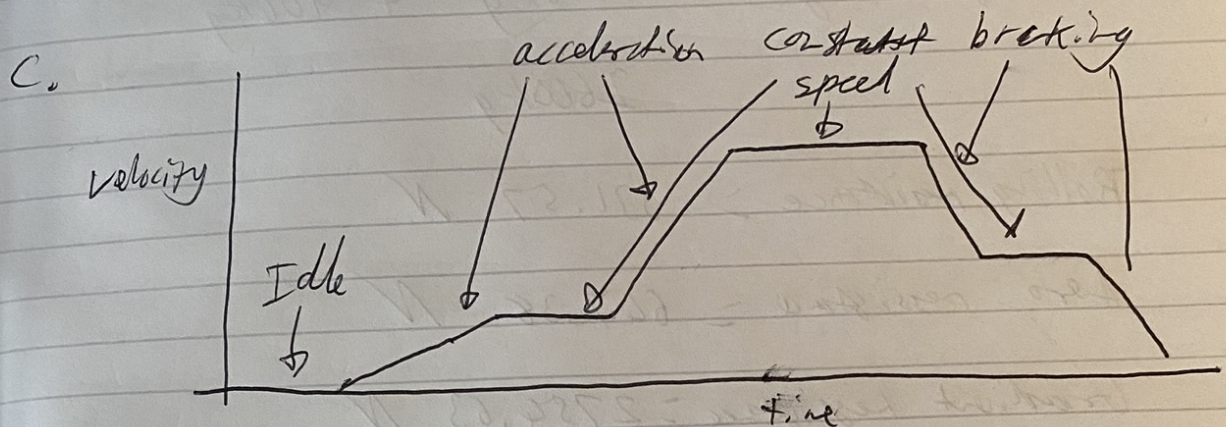


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M6X02209

13.00pm 14/5/20



Drive cycle is a series of data points that shows speed of the vehicle over time. An example of this is above (fig 2) which shows the vehicle speed at different points. This can be used to identify vehicle idle, acceleration, speed, braking. This can also be used to identify if energy can be recovered.

AS 4000 0.002

M6X0220d

$$d. \text{ Max weight} = 1600 \text{ kg} + 900 \text{ kg} \\ 2500 \text{ kg}$$

$$\text{Rolling resistance} = 331.57 \text{ N}$$

$$\text{Aero resistance} = 647.38 \text{ N}$$

$$\text{Gradient resistance} = 2784.63 \text{ N}$$

$$\text{Tractive effort} = 3733.54 \text{ N}$$

$$\text{Power needed} = 100,134.9 \text{ W} \\ = 100.1349 \text{ kW}$$

Assumptions

gradient: 6.2° (Max gradient on swansea
tine resistance: 0.013 constabution L571)

Area: 3 m^2

velocity: 60 mph, 26.86 m/s

100.134 kW at the wheel

typical drivetrain efficiency 80%

$$100.134 \times 0.2 = 20.0268$$

+

$$100.134$$

$$= 120.1608 \text{ kW}$$

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MEX0220a

120.168 kW battery is needed for the
whole system

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Q1.d. Rolling resistance = $\text{cof} \times M \times G$

$$rr = 0.013 \times 1500 \times 9.81$$

$$rr = \underline{191.295 \text{ N}}$$

$$\text{Aero resistance} = \frac{1}{2} \times \text{Den of air} \times \text{Drag} \times A \times V^2$$

$$70 \text{ kph to m/s} = \underline{19.44 \text{ m/s}}$$

$$Ar = \frac{1}{2} \times 1.2 \times 0.8 \times 3 \times 19.44^2$$

$$Ar = \underline{340.122}$$

$$\text{Tractive Effort} = rr + Ar$$

$$= 191.295 + 340.122$$

$$= \underline{531.41 \text{ N}}$$

$$\text{Tractive power} = \text{force} \times \text{velocity}$$

$$= 531.41 \times 19.44$$

$$= \underline{10330.75 \text{ W}}$$

$$10.33 \text{ kW}$$

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b. Tractive power = 5 kW (at wheel)

$$B_{sfc} = 200 \text{ g/kWh}$$

$$\text{Transmission efficiency} = 80\%$$

$$\text{Time} = 1 \text{ hr}$$

$$\text{power at engine} = 5000 \times 0.20$$

$$= 1000$$

$$= 1000 + 5000 =$$

$$= 6000 \text{ W}$$

$$= 6 \text{ kW}$$

$$\text{Energy} = \text{power} \times \text{time}$$

$$= 6000 \text{ W} \times 60$$

$$= 360000 \text{ Joule}$$

$$= \underline{1 \text{ kWh}}$$

$$\text{mass ~~volume~~ of fuel used} = \underline{200 \text{ g}}$$

$$\text{Density of gasoline} = 0.755 \text{ kg/liter}$$

$$= 755 \text{ g} / 1000 \text{ mL}$$

$$= \frac{1000}{755}$$

$$= 1.325 \text{ mL/g}$$

$$\text{Vol of fuel} = 1.325 \times 200$$

$$= 265 \text{ mL}$$

$$= \underline{0.265 \text{ Litres}}$$

2P

5/20

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$$C. \text{ ~~flawed energy~~ } = 1.2 \text{ Mjoles}$$

$$= 1,200,000$$

$$\text{Ice power} = 55 \text{ kW}$$

$$\text{car used} = 10.33 \text{ kW}$$

$$\text{Ice} - \text{car power used} = 55 - 10.33$$

$$\text{flawed} = 44.67 \text{ kW}$$

$$d. \text{ Time} = \text{energy} / \text{power}$$

$$= \frac{1,200 \text{ kJ}}{44.67 \text{ kW}}$$

$$= 26.86 \text{ sec}$$

$$e. \text{ Resistive power} = 44.67 \text{ kW}$$

$$\text{potential energy} = 1,200 \text{ kJ}$$

$$p_e = R_p \times \text{Time}$$

$$\text{Time} = \frac{p_e}{R_p}$$

$$= \frac{1,200}{26.86}$$

$$= 44.67 \text{ Secs}$$

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g. start : 1g

power : 55

Time : $26.86 \times 2 = 53.72 \text{ secs}$

bstc : 285 g/kwh

energy = power $\times$ time

$$= 55 \times 53.72$$

$$= 1477.3 \text{ kWs}$$

$$\text{bstc to seconds} = \frac{285}{60}$$

$$= 4.25 \text{ g/kWs}$$

$$1477.3 \times 4.25 = 6278.52 \text{ g}$$

$$\text{Total} = 1\text{g} + 6278.52$$

$$= 6279.52 \text{ g}$$

h

4p

7/20

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M6X0220d

13.00pm 1/5/20

3.a. electric.

Electric vehicles Compose of a electric motor, speed controller, battery and charger. This system can ~~be~~ replace the existing drivetrain or can be used with existing drivetrain. If the electric motor is used with the existing drivetrain, then the speed and torque requirements are maintained or broadened. This system is below (fig 1)

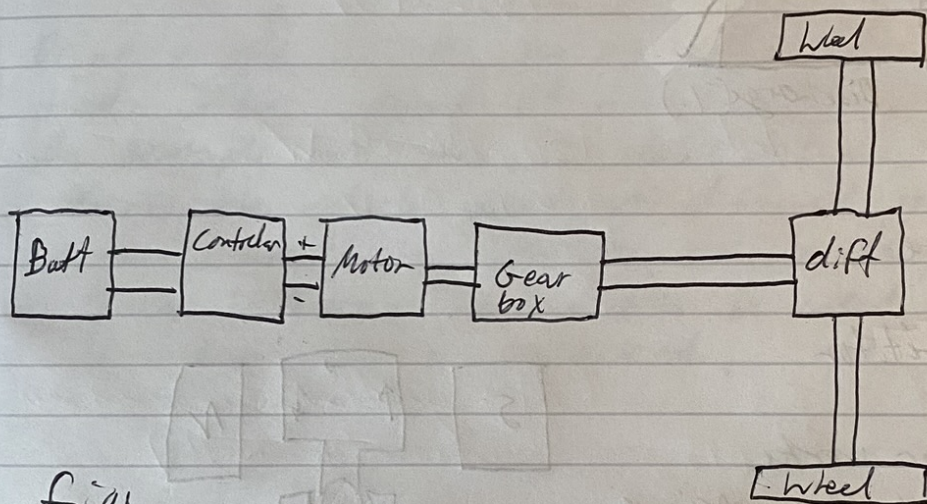


fig 1.

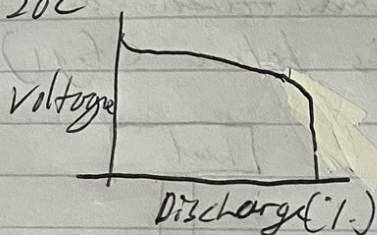
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b. Energy Storage

Lithium Ion battery

- energy density: 200 - 603 Wh/L
- power density: 300 - 1500 W/kg
- Number of cycles: 400 - 1200
- SOC



Drive

DC Motor

A DC motor works by having two permanent magnets on each side. A stator which composes of coil windings which is energized to create an electromagnet which opposes the permanent magnets to rotate the stator.

