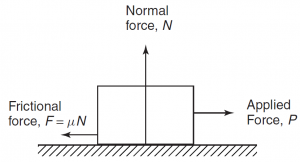
**Load measurements:**

****The aim of the experiment is to know the required force and hence the required torque to move the buggy from stationary and at constant speed. through the load experiment, the required force for any buggy mass is calculated from coefficient of static and rolling friction which are concluded form the results. The equation used is : **T = F.r**; T = Torque (Nm), F = Force(N), r =radius (m)

**[1]**

When the torque is known the gearbox can be chosen;

If the motors have a high Kt then a low current can be used to produce the torque needed and so we can choose a gearbox that reduces torque and raises speed at wheels but the torque needed needs to be known first. See gearbox section for the relation equations

[1] <https://me-mechanicalengineering.com/friction-coefficient-applications-advantages-disadvantages/>

* **Estimated Forces: flat**

**The estimated forces were calculated using average of the static and rolling coefficient of friction using results from 4 different weights:**

* + - Average static friction coefficient = 0.092
    - Average Rolling friction coefficient = 0.082

**Assuming the mass of the buggy is 1217 grams, the estimated needed forces are:**

* From stationary = 1.09N
* At constant speed = 0.978N

**NOTE:**

* This has been calculated using equation 1 of this section
* These coefficients of friction exhibit low standard error:
* Rolling coefficient of friction = 0.502%
* Static coefficient of friction = 0.609%
* Static friction is higher as for one weight measurement the static coefficient of friction was higher than rolling
* **Estimated forces: slopes**

The estimated forces were calculated using average of the static and rolling coefficient of friction using results from 4 different weights:

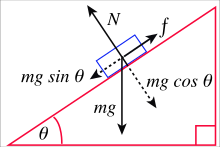
* Average static friction = 0.426
* Average rolling friction = 0.126

Since the coefficient of rolling friction of flat is close to rolling friction of ramp and the measurement of coefficient of friction is generally inaccurate the flat coefficient of friction will be used. However, the static friction coefficient will be used, more on that later.

**Using the average rolling of ramp and static coefficient friction of flat,** **again assuming the estimated mass is 1217 grams, the forces are:**

From stationary = 8.08N

At constant speed= 4.13N

**Equation used:**

**F = Cp.m.g.cos(theta) + m.g.sin(theta)**

**[2]**

**m = Mass (g)**

**g = gravitational constant (ms^-2)**

**Cp = coefficient of friction**

**Theta = angle (degrees)**

**[3]**

**NOTE:**

* Theta was recorded as 15.5 degrees

[3] https://en.wikipedia.org/wiki/Inclined\_plane

* **Required torque: flat and slopes**

**The required torque is now just a matter of using the relationship between the radius of the wheel and the force required;**

**T = F.r**

**[4]**

**T = Torque(Nm)**

**F = Force exerted at the radius of the wheels (N)**

**r = effective radius from the pivot point (m)**