

# 1 Environment

This system models the environment of the motorcycle is riding in.

Force directions are defined as longitudinal(long), lateral(lat), and normal(n). Longitudinal is along the direction of the motorcycle (when moving straight). Lateral is orthogonal to Longitudinal axis. Normal 3-D orthogonal to lateral and longitudinal, in general the axis to the road on no incline.

## 1.1 Inputs and outputs

### 1.1.1 Inputs

Input	Symbol	Unit
Distance Travel	$d$	m

### 1.1.2 Outputs

Output	Symbol	Unit
Environment Forces on Tire[3]	$F_t$	N[3]
Road Gradient	$\theta_r$	rad
Ambient Temperature	$T_{amb}$	K
Air Pressure	$P$	Pa
Air Density	$\rho$	$kg/m^3$

### 1.1.3 Background, rationale, modeling strategy

The Environment only models air density, air temperature, and road gradient.

$$\theta_r = \frac{d}{dd}h(d) \quad (1)$$

$$T_{amb} = T_0 - Lh(d) \quad (2)$$

$$P = P_0 \left( 1 - \frac{Lh(d)}{T_0} \right)^{\frac{gM}{RL}} \quad (3)$$

$$\rho = \frac{PM}{1000RT} \quad (4)$$

### 1.1.4 Variables

Output	Symbol	Unit
Temperature Lapse	$L$	$K/m$
Initial Pressure	$P_0$	$Pa$
Initial Temperature	$T_0$	K
Gravity	$g$	$m/s^2$
Molar mass of Dry Air	$M$	kg/mol
Ideal Gas Constant	$R$	$\frac{J}{mol*K}$

### 1.1.5 Look up Table

$h(d)$

Type	Description	Symbol	Unit
Input	Distance Travel	$d$	m
Output	height	n/a	m

### 1.1.6 Assumptions

- The air is dry
- Temperature lapse rate right is correct (no inversion)