

MarinPowerOnFlat

In this worksheet we calculate power input required to maintain a certain speed on flat level ground

Universal constants

Gravity constant, g	9.81 ms ⁻²
Pi	3.142
Miles per km	0.6214

Inputs

Crossbar drop	20 mm
Recorded terminal speed	14 mph

Weight

Bike+rider+luggage mass	112.0 kg
Downforce (weight)	1098.7 N

Calculate crossbar tilt on level

Spirit level length	203 mm
Crossbar drop on level ground	17 mm
Sine of tilt angle	0.084
Crossbar tilt angle on level ground	0.084 radians
Crossbar tilt angle on level ground	4.804 degrees

Calculate crossbar tilt on hill

Crossbar drop	20 mm
Sine of tilt angle	0.099
Crossbar tilt angle on hill	0.099 radians
Crossbar tilt angle on hill	5.654 degrees
Tilt angle of hill	0.850 degrees
Tilt angle of hill	0.015 radians
Tread of hill	67.4 'one in X'

Calculate speed and power down hill

Recorded terminal speed	14 mph
Metric speed	22.5 kph
Metric speed	6.26 ms ⁻¹
Distance moved along slope per second	6.26 m
Height drop per second	0.093 m
Potential energy loss per second	102.0 Joules
Rate of power input	102.0 Watts

Marin bike power tests:

Fri 25 Aug 06 on a windless morning

All up weight (kg): 112
 length of spirit level (mm): 203
 Crossbar drop on flat (mm): 17

Hill name: GG
 Crossbar drop readings (mm): 28
 terminal speed (mph): 27

Hill name: GW
 Crossbar drop readings (mm): lp20 sp19 tr19
 terminal speed (mph): 14

Inputs are in red

Outputs are in blue

Results (generated by hand)	
Speed on the flat (mph)	Reqd. input power (W)
14	~70 to 100
27	~700

HillClimbing

In this worksheet we calculate 'climbing' power required (to increase potential energy) going up a slope at a given speed

Note that the *total* input power required will be the sum of this power and the power needed to maintain that speed on the flat

Hill tread	10 'One in X'
Hill inclination angle	0.10 radians
Hill inclination angle	5.71 degrees
Speed along the slope	10 mph
Metric speed along the slope	16.09 kph
Metric speed along the slope	4.47 ms ⁻¹
Distance along slope per second	4.47 m
Height climbed per second	0.44 m
Potential energy increase per second	488.73 Joules
Required (additional) power input	488.73 Watts

Results (generated by hand)		
Hill Tread ('one in X')	Speed along slope (mph)	Reqd. input power (W)
20	20	491
15	15	491
10	10	489
8	8	487
7	7	486
6	6	484
5	5	481

Inputs are in red

Outputs are in blue