

pedthrow.xls
8/10/2012

Analysis of Pedestrian Throw Distance from Initial Conditions

ver 3.0

NOTATION, COORDINATES, UNITS & VARIABLES:

x - coordinate parallel to ground
y - coordinate perpendicular to ground

Brach Engineering
VCRwareTM
Vehicle Crash Reconstruction Software
www.brachengineering.com

UNIT
CONVERSION

US

SOLVER INSTRUCTIONS

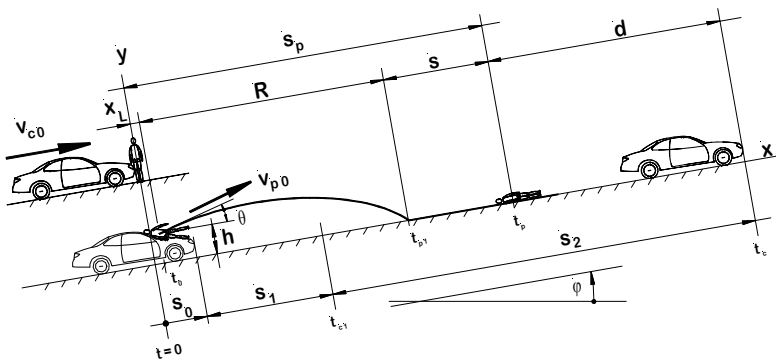
Enter all cell references as an absolute reference w/o equal sign: \$C\$5.
To Maximize: put a 1 in cell \$L\$10, a 0 in cell \$N\$10 and 0.000 in cell \$P\$10.
To Minimize: put a 0 in cell \$L\$10, a 1 in cell \$N\$10 and 0.000 in cell \$P\$10.
To optimize to a Value: put a 0 in cell \$L\$10, a 0 in cell \$N\$10, and the numerical value to optimize to in cell \$P\$10.
Enter Multiple Change Cells separated by a comma: \$C\$3, \$D\$5
Constraint Relation can be only: >=, =, or <=.

INPUT INFORMATION (KNOWN):

a_2	0.90	deceleration of vehicle over distance s_2 , g's
f_p	0.80	drag resistance coefficient of pedestrian over distance s
g	32.17	ft/s ² acceleration of gravity
h	4.00	ft height of pedestrian center of gravity at launch, h_0
s_1	0.00	ft distance of travel of vehicle at uniform speed
v_{c0}	44.00	ft/s initial speed of vehicle
	30.0	mph initial speed of vehicle
x_L	2.00	ft x-distance of pedestrian from initial contact to launch
α	1.00	ratio of pedestrian speed to vehicle speed at time of launch
θ	5.00	deg angle of launch of pedestrian relative to x axis
ϕ	0.00	deg road grade angle
μ	0.80	impulse ratio for pedestrian-ground impact
m_c	93.24	lb-s ² /ft mass of vehicle, weight / g
m_p	5.44	lb-s ² /ft mass of pedestrian, weight / g

OUTPUT INFORMATION (UNKNOWN):

v_{c0}	41.57	ft/s velocity of vehicle after impact with pedestrian
v_{p0}	41.57	ft/s initial speed of pedestrian
R	25.84	ft range of pedestrian throw, launch to ground impact
t_{p1}	0.72	s time from impact to pedestrian initial contact with ground
s	15.51	ft pedestrian ground contact distance, impact to rest
s_p	43.35	ft throw distance; total distance from initial contact to pedestrian rest
t_p	1.82	s total time of travel of pedestrian, initial contact to rest
t_{c1}	0.09	s time of travel of vehicle to travel from initial contact to $s_0 + s_1$
s_0	4.10	ft distance of travel of vehicle with pedestrian contact
s_2	29.85	ft distance of travel of vehicle with uniform deceleration, s_2
$s_0+s_1+s_2$	33.94	ft total distance of travel of vehicle
t_c	1.53	s vehicle travel time, initial contact to rest
d	-9.40	ft distance between rest positions of vehicle and pedestrian



Solver Block

Target Cell:	\$M\$30			
Equal to:	Max:	0	Min:	1
Value of:				0.00
By changing cells:	\$B\$13,\$B\$17			
Subject to constraints:	Left Side	Relation	Right Side	
Constraint #1:	\$B\$17	<=	8.0	
Constraint #2:	\$B\$17	>=	0.0	
Constraint #3:				
Constraint #4:				
Constraint #5:				
Constraint #6:				
Constraint #7:				
Constraint #8:				
Constraint #9:				
Constraint #10:				