CAN YOU STOP YOUR CAR IN TIME?

Of all the things an operator has to think about, stopping the car to prevent an accident should be high on the list. This article will discuss braking, distance and time required in stopping, not the cause of the emergency that requires the braking action.

We all know from driving that braking involves speed, time and distance. When operating trolleys speed becomes somewhat of a problem: how do you judge speed when there is no speedometer? There is a simple way to convert MPH to speed in feet per second (FPS). Take the speed in MPH; add one-half of it and the result is FPS. Thus 10 MPH equates to 10 + 5 = 15 FPS. This computation is not completely accurate but is good enough for the slower speeds. We now have a concept of speed in small units that will make stopping distances more understandable.

In an emergency the car must be stopped as quickly as possible. The distance "X" depends on a number of variables including perception time, reaction time and braking time. While perception and reaction times are nearly universal for all vehicles, braking time is not. Let us first look at perception and reaction times before examining braking.

Perception is the time to recognize the need to brake. For an alert operator this takes one-half second. At 20 MPH (30 FPS) the car will travel 15 feet as you become aware of the need to stop. If you are not alert, and are distracted for 3 seconds the car has traveled an additional 90 feet! That could be the difference between a safe stop and an accident!

Reaction is the time required for you to move your foot to and press the brake pedal, or to move the brake handle to the apply position with your hand. Again, for an alert operator, this requires one-half second. At 30 FPS the car will travel another 15 feet. If your hand is not on the brake handle, or your foot poised over the brake pedal, the car will move even farther. That is why it is important to keep your hand on the brake valve handle of hand-controlled cars at all times when the car is in motion, or your foot resting lightly on the brake pedal of PCC cars when not using power. Operators should always be alert and in position for the immediate application of the brakes.

Perception and reaction time distances are in addition to the actual distance traveled during braking that brings the vehicle to a stop.

Braking rate, or deceleration, is the reduction of speed over a period of time, normally expressed in feet per second per second. By knowing the braking rate and the distance, the time to stop can be computed. By knowing the braking rate and the time, the distance to stop can be computed. Each of these is dependent on the braking rate that can vary widely for a rail vehicle. The best braking is achieved with dry rail and all wheels rolling with maximum friction. Locking the wheels, so they slide, decrease friction and increase braking distance.

Wet, greasy and black rail reduce braking rates. Poorly adjusted brake shoes or inadequate air pressure also reduce braking rates. The actual braking rate is also affected by weight, force, and type of brake shoes, temperature, construction and other items. A fully loaded car will not stop as fast as an empty one. The maximum braking rate for hand-controlled streetcars has been computed at about six feet per second per second. This number is hard to understand until used to determine actual distance in feet for various speeds.

STOPPING DISTANCE
HAND-CONTROLLED CARS, IDEAL CONDITIONS

MPH	FPS	P & R Distance Feet	Stopping Distance Feet	Total Distance Feet	Car Lengths
5	7.5	7.5	5	12.5	0.3
10	15	15	19	34	0.8
15	22.5	22.5	42	64.5	1.6
20	30	30	75	105	2.6
25	37.5	37.5	117	154.5	3.8
30	45	45	168	213	5.3
35	52.5	52.5	210	262.5	6.5
40	60	60	300	360	9.0

Perception and reaction times are one-half second each.

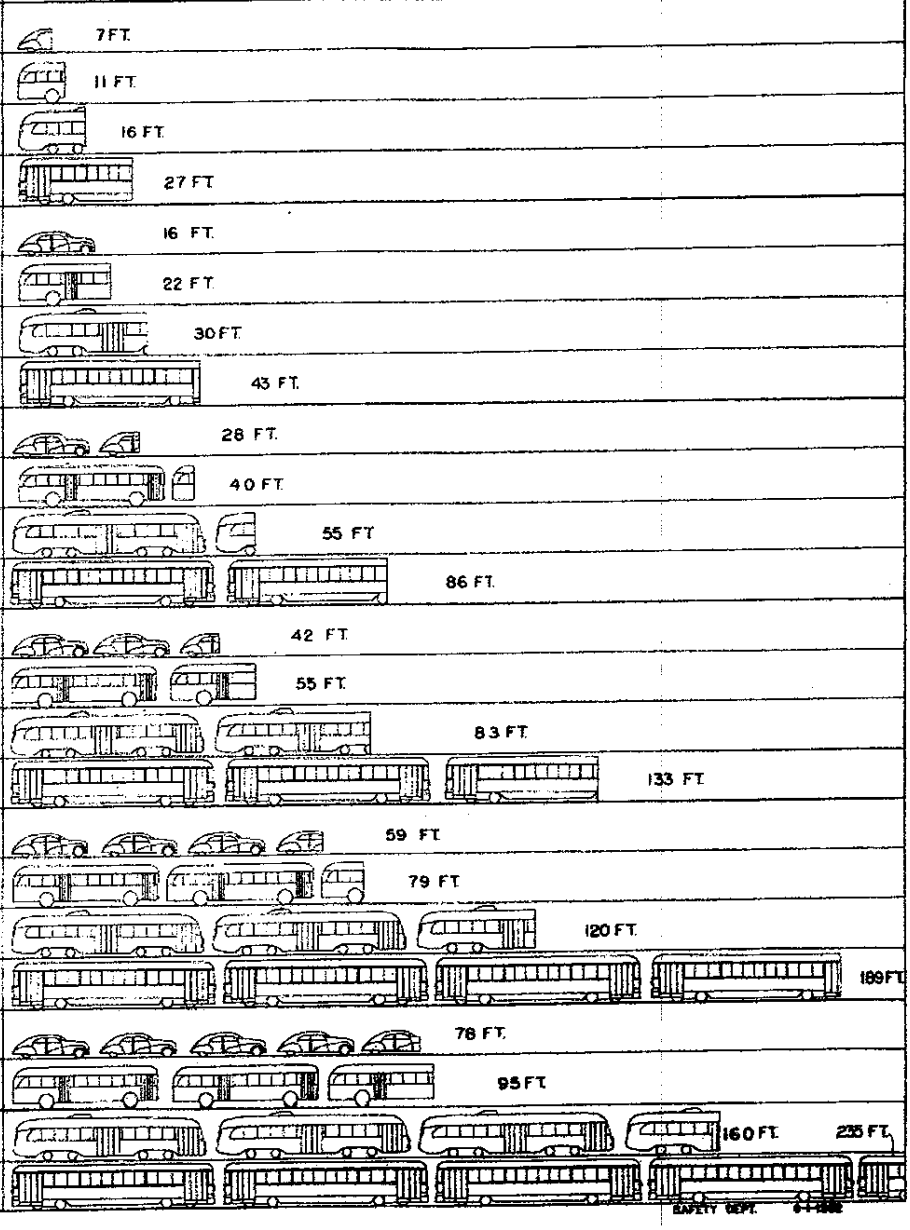
Please review the above numbers. They tell us to be alert, to anticipate problems and adjust speed accordingly, to know the condition of the car and rail. Remember under ideal conditions when car speed doubles, the stopping distance increases four-fold.

Safety is of the First Importance in the Discharge of Duty!

LOS ANGELES TRANSIT LINES.

CHART OF STOPPING DISTANCES

VEHICLE	MILES PER HOUR	FEET PER SECOND	.75 SEC. REACTION TIME DISTANCE	LEVEL, DRY STREET/TRACK BRAKING DISTANCE FEET	TOTAL DISTANCE REQUIRED FOR EMERGENCY STOP
AUTO	5	7.3	6	1	7 FT.
COACH				5	11 FT.
P.C.C.				10	16 FT.
OTHER ST. CARS				21	27 FT.
AUTO	10	14.6	11	5	16 FT.
COACH				11	22 FT.
P.C.C.				19	30 FT.
OTHER ST. CARS				32	43 FT.
AUTO	15	22	17	11	28 FT.
COACH				23	40 FT.
P.C.C.				38	55 FT.
OTHER ST. CARS				69	86 FT.
AUTO	20	29.3	22	20	42 FT.
COACH				33	55 FT.
P.C.C.				61	83 FT.
OTHER ST. CARS				111	133 FT.
AUTO	25	36.6	28	31	59 FT.
COACH				51	79 FT.
P.C.C.				92	120 FT.
OTHER ST. CARS				161	189 FT.
AUTO	30	44	33	45	78 FT.
COACH				62	95 FT.
P.C.C.				127	160 FT. 235 FT.
OTHER ST. CARS				202	



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