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Analysis of the 5 October 1979 accident involving a Bicycle ridden oy Forrest Henning and a 1976 Honda driven by Mrs. Lucy Zazo.

Submitted to:

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Materials and Information

1. State of Ohio Traffic Crash Report describing the Henning - Zazo sccident on 5 October 1979.
2. Engineering Drawing of the Glenwood Ave. - Dayton St. intersection where the accident occurred.
3. Deposition of Mrs. Lucy A. Zazo; dated 11 September 1980.
4. Weight of a 1976 Honda 2 door sedan from Rick Case Honda Inc., Akron, Ohio : 2000 pounds.
5. Approximate weight of Forrest Henning at the time of the accident: 165 pounds.
6. Approximate weight of Mrs. Lucy Zazo: 115 pounds.
7. Coefficients of friction for rubber tires skidding on dry asphalt were taken from the Traffic Accident Investigation Manual, by J. Stannard Baker, Northwestern University Traffic Institute.

Objectives

1. To determine tne speed of the Honda driven by Mrs. Zazo at the beginning of its pre-impact skid.
2. To deternine whether or not Mrs. Zazo could have stopped prior to impact if she had been traveling at the 25 mph speed limit or at a lower speed.

Analysis

I. Determination of the speed of the Zazo vehicle at the start of its pre-impact skid.

The police report; gives the following skidmark data: right front - 27 ft and left rear - 85 ft. *The* skid as shown on the police report diagram is relatively straight and there is no evidence of defective brakes. The brakes on all four wheels, therefore, must 'nave Seen nearly equal in effectiveness in slowing the vehicle for the entire length of the 85 ft skid.

A. First, we will conpute the pre-skid speed assuming no impact. Here, the energy of motion prior to the skid is dissipated as work is done against the frictional force between the tires and the dry traveled asphalt for a locked wheel and against the brakes for a wheel which is not locked.

Equation: $v_o^2 = 2 \mu g d$

v_o = pre-skid speed range
μ = 0.55 ↔ 0.70 (coefficient of friction range for tires skidding on dry traveled asphalt from speeds greater than *30* mph)
g = 32.2 ft/sec²
d = 85 ft

Result: Pre-skid speed range is 37 to 42 mph.

Comment: This result is a *true* minimum speed range because the slowing of the Zazo vehicle due to the impact has not been. tsken into account.

B. The position of the point of impact relstive to the start of the 85 ft skid is not clear. The police report diagram indicates that it occurred approximately three-fourths the way along the 85 ft skid. The deposition. of Mrs. Zazo, however, states that the car stopped et impact. We shall consider each possibility.

1. Case 1: Skid of 65 ft to impact and then a 20 ft skid *to* a stop. Mrs. Zazo's deposition states that Mr. Benning was carried dong by the car after impact.

The energy of motion just after impact was dissipated by doing work agaist the frictions1 forces.

Equation: $v_2^2 = 2 \mu g d_1$

V_2 = speed range just after impact
μ = 0.55 <-> 0.70
g = 32.2 ft/sec^2
d_1 = 23 ft

Result: V_2 = 18.1 <-> 20.5 mph

Momentum is conserved at impact.
Equation: $m_H V_b = (m_H + m_{B+H}) V_2$

m_H = 2115 lbs (weight of Zazo vehicle including the driver)
m_{B+H} = 180 lbs (weight of Forrest Henning and his bicycle)
V_b = speed range of Zazo vehicle just prior to impact.

Result: V_b = 19.7 <-> 22.2 mph

The energy of notion at the beginning of the pre-impact skid of 65 ft was partially dissipated as work against the frictional forces and tire remainder provided the pre-impact speed (V_b).

Equation: $V_0^2 = 2 \mu g d_2 + V_b^2$

V_0 = pre-skid speed range
μ = 0.55 <-> 0.70
g = 32.2 ft/sec^2
d_2 = 65 ft
V_b = 19.7 <-> 22.2 mph

Result: Pre-skid speed range is 38 to 43 mph

2. Case 2 : The second possibility is that the Zazo vehicle stopped almost at impact. Consider an 82 ft skid to impact and then a 3 ft skid to a stop. We will repeat the calculation for case 1 in what follows for case 2.

Post-impact skid of 3 ft.
Equation: $V_2^2 = 2 \mu g d_3$

d_3 = 3 ft

Result: V_2 = 7.0 <-> 7.9 mph

Impact

Equation: $m_H V_b = (m_H + m_{B+H}) V_2$

Result: V_b = 7.7 <-> 8.6 mph

Pre-impact 82 ft skid.

Equation: $v_o^2 = 2\mu g d_4 + v_b^2$

$d_4 = 82$ ft

Result: Pre-skid speed range is 38 to 42 mph.

II. Determination of the stopping distance from a speed of 25 mph.

The police report gives the speed limit as 25mph. The stopping distance (once the brakes are applied) may be computed by considering the energy of motion at 25 mph being dissipated as work against the frictional force in a skid to a stop.

Equation: $v_o^2 = 2\mu g d_5$

v_o = 25 mph
μ = 0.60 - 0.80 (coefficient of friction for tires on dry traveled asphalt from speeds less than 30 mph)
d_5 = range of stopping distances from 25 mph

Result: The range of possible stopping distances from 25 mph after the brakes have been applied is between 26 and 35 ft.

Conclusions

1. The speed of the Zazo vehicle at the beginning of its skid was in the range of 37 to 43 mph. Therefore, the Zazo vehicle was traveling at least 12 mph more than the speed limit.

2. If the Zazo vehicle had been traveling at 25 mph at the time the 85 ft skid began, it would have come to a stop at least 30 ft prior to where the impact occurred and the accident would have been avoided.

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