

December 5, 1982

Analysis and reconstruction of the September 12, 1981 accident involving a 1975 Volkswagon driven by John J. Wargo and a 1978 Kawasaki motorcycle driven by Matthew S. Smilek on East Tallmadge Avenue at its intersection with Gorge Boulevard.

Submitted to: Mr. John J. Lynett
Olds, Olds & Lynett
The Equity Building
49 South Main Street
Akron, Ohio 44308

Materials and Information

1. State of Ohio Traffic Crash Report No. 38 prepared by the Akron Police Department and dated: September 12, 1981.
2. A scale drawing of the accident prepared by Officer Russell Murphy and dated: September 17, 1981.
3. Sixteen photographs of the Wargo Volkswagon and two photographs of the Smilek Kawasaki.
4. A visit to the accident scene on November 28, 1982 to make several measurements.
5. Specifications of a KZ1000 Kawasaki motorcycle from a KZ1000 owner's manual.
6. Weight and dimensions of a 1975 Volkswagon Rabbit from a N.A.D.A. Used Car Guide.
7. Coefficient of friction data from the "Traffic Accident Investigation Manual" by J. Stannard Baker (Northwestern University Traffic Institute) and "Highway Collision Analysis" by James C. Collins and Joe L. Morris.

Accident Description

The accident occurred at approximately 11:10 PM on September 12, 1981. The weather was clear and the pavement was

level, dry asphalt. Tallmadge Ave. has six lanes at the intersection with Gorge Blvd. Three are eastbound lanes and three are westbound lanes. Just to the west of the intersection with Gorge Blvd. on the north side of Tallmadge is the entrance ramp to the north expressway (S.R. #8). Mr. Wargo began a left turn from the left turn lane of Tallmadge Ave. eastbound onto the north expressway entrance ramp. When his 1975 Volkswagon was diagonally across the middle westbound lane of Tallmadge Ave. it was struck on the right side just forward of the rear wheel by the front of the 1978 Kawasaki motorcycle driven by Mr. Smilek. The Smilek vehicle left 31'8" of skidmarks prior to impact. The impact spun the rear of the Wargo Volkswagon around **approximately 122°** causing the rear wheels to slide **approximately 20' → 21'**. The rear of the Volkswagon ended up at the north curb of Tallmadge Ave. just west of the north expressway entrance ramp. After impact the motorcycle **slid on its side approximately 18'** at an angle **approximately 37°** north of the east-west direction of Tallmadge Ave.

Gregory Chambers was a passenger in the Wargo Volkswagon and Valerie Smilek was a passenger on the motorcycle. Apparently, both Mr. and Mrs. Smilek were thrown off the motorcycle at impact,

Objectives

1. To determine the speed of the Wargo Volkswagon at impact.
2. To determine the speed of the Smilek Kawasaki at the start of its pre-impact skid.

Analysis

The analysis of this accident may be divided into three parts. First, by considering the dissipation of notional energy available to each vehicle after impact as work done against the frictional forces with the pavement in their post-impact travel to a stop, the effective speed of each vehicle just after impact may be determined. The second step is to employ the principle of conservation of momentum to analyze the collision itself. Knowledge of the post-impact speeds of the vehicles, the weights of the vehicles and the directions of motion of both vehicles before and after impact allows one to compute the speeds of both vehicles just prior to impact. The third step involves calculating the speed of the Smilek motorcycle just prior to its pre-impact skid by considering the dissipation of some of its energy as work against the frictional force in its pre-impact skid.

- 1a) Post-impact speed of the Wargo Volkswagon.

Equation:
$$V_{1A}^2 = 2 \mu_1 g d_1 f_1$$

Attach all
summations -
other
angles -
look report
to do other
calculations
based on other
angles -

Attach
Police
report?
Expert's
calculations
based on
Police
report

V_{1A} = effective speed of the Wargo Volkswagen at the start of its post-impact slide to a stop

$\mu_1 = 0.6 \rightarrow 0.8$ (coefficient of friction range for tires sliding on dry asphalt from a speed less than 30 mph)

$$g = 32.2 \text{ ft/sec}^2$$

$d_1 = 20' \rightarrow 21'$ (distance traveled by the rear wheels in their post-impact slide to a stop)

Exact?

of
approach

$f_1 = 0.45$ (fraction of the Volkswagen's weight carried by its rear axle)

Result:

$$V_{1A} = 12.7 \rightarrow 15.0 \text{ mph}$$

Comment: This speed range ignores any sliding of the front wheels of the Volkswagen after impact.

b) Post-impact speed of the Smilek motorcycle.

Equation:

$$V_{2A}^2 = 2 \mu_2 g d_2$$

V_{2A} = speed of the Smilek motorcycle at the start of its post-impact slide to a stop.

$\mu_2 = 0.4$ (coefficient of friction for metal sliding on dry asphalt)

$$g = 32.2 \text{ ft/sec}^2$$

$d_2 = 18'$ (post-impact slide distance of the motorcycle)

Watch out in
calculating μ -coefficient
of friction... if it
forces up the
speed of
motorcycle for
ESP

Result: $V_{2A} = 14.7 \text{ mph}$

- 23 The speeds of both vehicles may be obtained by using the principle of conservation of momentum for the collision. Momentum is defined as mass times velocity. It turns out that the total north-south momentum of the two vehicles before impact equals the total north-south momentum of the two vehicles after impact. The same is true of the east-west momentum before and after impact. The result in **this** instance is two equations with two unknowns which are the pre-impact speeds of the two vehicles. Both may be determined.

Equation #1: north-south momentum conservation

$$m_1 V_{10} \sin 52^\circ = m_1 V_{1A} \sin (31^\circ \rightarrow 70^\circ) + m_2 V_{2A} \sin 37^\circ$$

$m_1 = 2100/32.2 \text{ slugs}$ (here the weight of the Volkswagen plus two people is approximately 2100 lbs)

$m_2 = 779/32.2 \text{ slugs}$ (here the weight of the motorcycle plus two people is approximately 779 lbs)

V_{10} = pre-impact speed of the Wengo Volkswagen

52° = angle which V_{10} makes with the east-west direction of Tallmadge Ave.

$V_{1A} = 12.7 \rightarrow 15.0 \text{ mph}$ (effective post-impact speed of the Volkswagen)

$V_{2A} = 14.7 \text{ mph}$ (post-impact speed of the motorcycle)

$31^\circ \leftrightarrow 70^\circ =$ possible range of angles V_{1A} makes with the east-west direction of Tallmudge Ave. This range of angles results because the initial direction of motion of the rear of the Volkswagen after impact is different from the angle which corresponds to the line connecting its center of gravity at impact with its center of gravity at final rest.

$37^\circ =$ angle V_{2A} makes with the east-west direction of Tallmudge Ave.

Cross X -
attention to
actual weight of
vehicles

Result:

$$V_{10} = 12 \leftrightarrow 22 \text{ mph}$$

Equation #2: east-west momentum conservation

$$m_2 V_{20} - m_1 V_{10} \cos 52^\circ = m_1 V_{1A} \cos (31^\circ \leftrightarrow 70^\circ) + m_2 V_{2A} \cos 37^\circ$$

$V_{20} =$ pre-impact speed of the Smilek motorcycle

Result:

$$V_{20} = 60 \leftrightarrow 62 \text{ mph}$$

Comment: The calculated pre-impact range of the Wargo Volkswagen is consistent with normal driving.

- 3) The speed of the Smilek motorcycle at the start of its pre-impact skid can be calculated by considering the energy of motion dissipated in the pre-impact slide and the amount of motional energy which the motorcycle possessed immediately prior to the impact.

- a) For full braking on both wheels of the motorcycle,

Equation: $V_{20}^2 = 2 \mu_3 g d_3 + V_{20}^2$

$V_{20} =$ speed of the Smilek motorcycle at the start of its pre-impact skid

$\mu_3 = 0.55 \leftrightarrow 0.70$ (coefficient of friction for tires on dry asphalt)

from a speed greater than 30 mph
 $g = 32.2 \text{ ft/sec}^2$
 $d_3 = 31'8''$ (pre-impact skid distance of
 the Smilek motorcycle)

$$V_{20} = 60 \leftrightarrow 62 \text{ mph}$$

Result: $V_{20} = 64 \leftrightarrow 67 \text{ mph}$

b) For braking only on the rear wheel of the motorcycle.

Equation: $V_{20}^2 = \mu_3 g d_3 + V_{20}^2$

Result: $V_{20} = 62 \leftrightarrow 64 \text{ mph}$

Comment: The speed of the Smilek Kawasaki at the start of its 31'8" pre-impact skid was, therefore, in the range 62 $\leftrightarrow$ 67 mph.

*Both skid
 skid accounted
 for?*

Conclusions

1. The speed of the Wargo Volkswagon at impact was between 12 and 22 mph.
2. The speed of the Smilek Kawasaki motorcycle at the start of its pre-impact skid was between 62 and 67 mph.

Submitted by:

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*What factor did
 account for coefficient
 of friction*

707 Berkeley Dr.
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Re: Smilek vs. Wargo
Your File No. 6814 JTT

Dear Mr. Lynett:

Enclosed you will find my report on the analysis and reconstruction of the Smilek-Wargo accident. I have also included a copy of my working scale diagram from which I measured the angles used in the analysis.

I have started to prepare a large scale drawing for presentation in court. I expect that I will have it completed within a day or two. Please let me know when you would like to get together and discuss my testimony and when you expect that you will be needing me in the courtroom. If you wish I can prepare a list of questions which you could use as a starting point for my testimony,

I will look forward to hearing from you.

Sincerely yours,



David E. Uhrich, Ph.D.
Professor of Physics
(Kent State University)