

## ACCIDENT ANALYSIS SERVICE



### Crash Facts: Scenario 2 - Run off Roadway Solution June 2006

#### Solution

#### This solution applies to a single vehicle fixed object collision only!

The issue in Scenario 2 was to determine the speed for a vehicle skidding three surfaces and impacting a tree. First, determine the energy equivalent speed for each surface skid using the formula examined in Scenario 1. I used the following drag factors for my calculations: wet asphalt = .65, wet gravel = .60, and wet grass = .40. You may have used slightly different drag factors

$$S1 = \sqrt{30 \cdot 25 \cdot .65} = 26.12 \text{ mph}$$

$$S2 = \sqrt{30 \cdot 15 \cdot .60} = 16.43 \text{ mph}$$

$$S3 = \sqrt{30 \cdot 60 \cdot .40} = 26.83 \text{ mph}$$

Energy equivalent speeds **cannot** be added together *arithmetically* but must be combined together *algebraically* using the Combining Speed Formula:

$$Cs = \sqrt{(S1^2 + S2^2 + S3^2 + Sn^2)}$$

Where:

Cs = Combined Speed (mph)

S1...Sn = individual speeds (mph)

$$\sqrt{26.12^2 + 16.43^2 + 26.83^2} = 40.9 \text{ mph}$$

If you used straight addition, the speed would be too high i.e. 69.39 mph.

The vehicle also skidded into a tree and the ACM recorded a Delta-V of 20.3 mph. A Delta-V is a *real* speed that is added *arithmetically* to the *combined speed*. A Delta-V is the same no matter where it occurs in the accident. A Delta-V of 20.3 mph represents the same speed loss regardless of the actual speed of the vehicle. Conversely, the speed loss skidding the *first* 30 feet will **always** be less

than the speed loss skidding the *last* 30 feet. This is the reason speed calculations from skidmarks **are not added arithmetically**.

In scenario 2, the vehicle skidded another 25 feet on wet grass before coming to rest:

$$S4 = \sqrt{30 \cdot 35 \cdot 0.40} = 20.49 \text{ mph}$$

The question now is do we add this speed arithmetically or algebraically to the Delta-V? Any speed loss after Delta-V is added arithmetically.

- The original speed is:

$$40.9 \text{ mph} + 20.3 + 20.5 = \mathbf{81.7 \text{ mph}}$$

- The original speed is well over the posted speed of 55 mph.

- The speed at impact with the tree was:

$$20.2 \text{ mph} + 20.5 \text{ mph} = \mathbf{40.7 \text{ mph}}$$

I hope that this exercise has helped you understand when to combined speeds algebraically and when to add speeds arithmetically.

## Crash Facts

### Weight v. Speed Accident Investigation Scenario 3

Let's switch gears and do some *qualitative analysis*. After all, this is a tool that you use everyday. Answer the following question:

At 50 mph, which vehicle will skid further with all tires skidding, one that weighs 5000-pounds or one that weighs 1500-pounds?

The first person to send me the correct answer and can explain why, will receive a Northwestern Traffic Institute Accident Investigator's Template.

You are invited to address any other issues that you feel are important and that you can support. Also, if you have any recommendations to make Crash Facts more relevant to you job, please let me know.

Email your answers to Don Webb at [donwebb@crashspeed.com](mailto:donwebb@crashspeed.com).