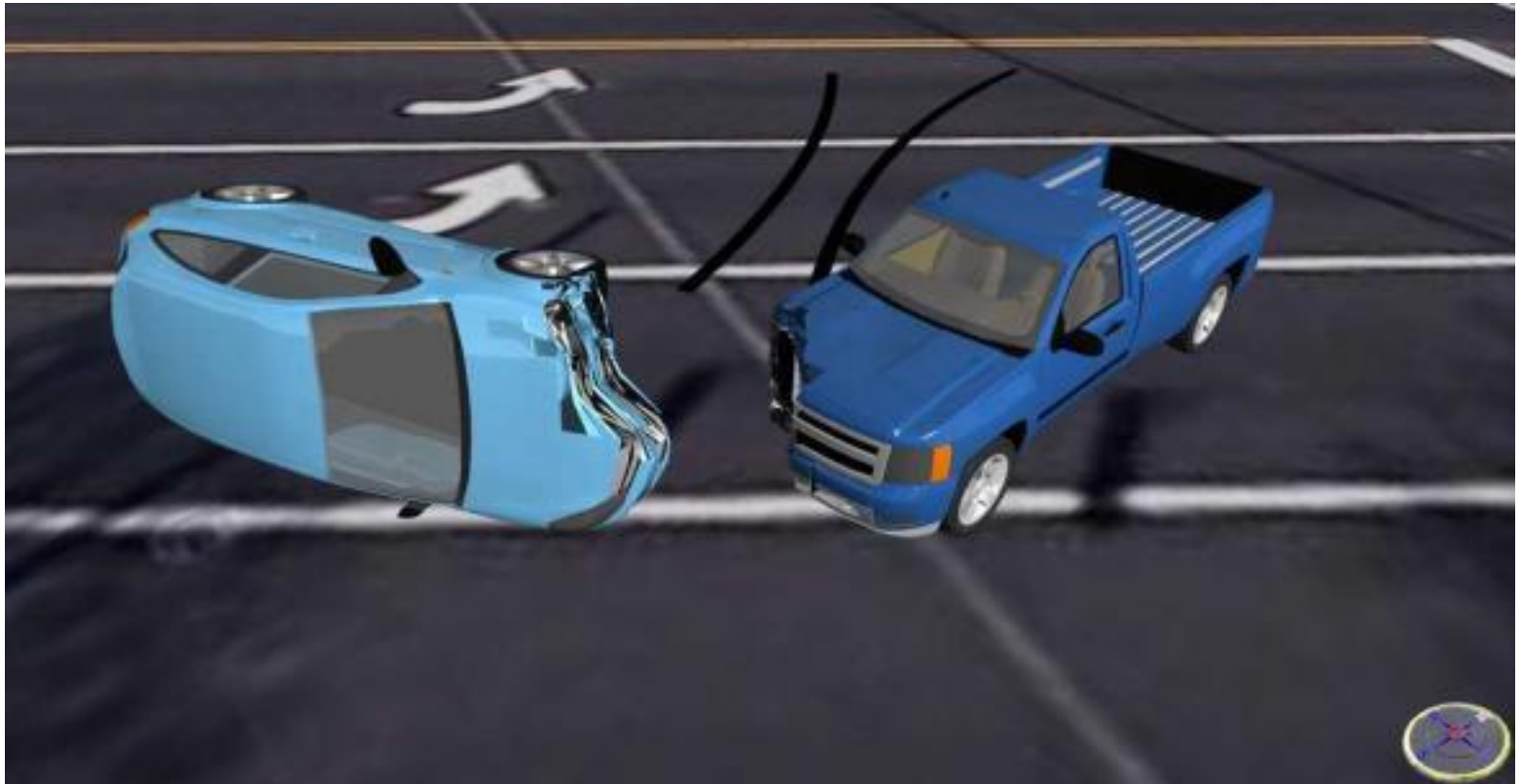
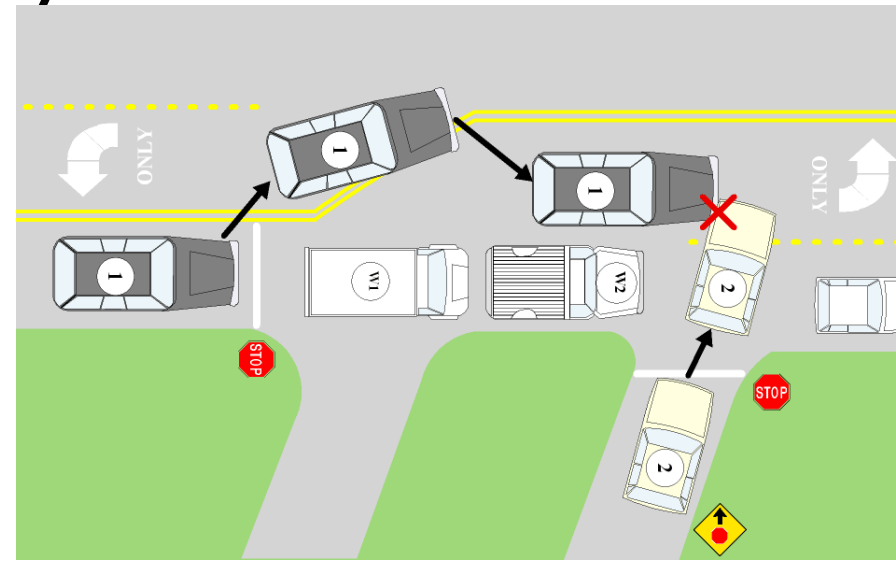


Accident Investigation



5 Levels of Accident Investigation

- Level 1: Reporting
- Level 2: At-the-scene investigation
- Level 3: Technical Follow-up
- Level 4: Accident reconstruction
- Level 5: Cause Analysis



Level I: Reporting

- All accidents should be reported
 - No matter how minor
- Basic Information
 - Names, vehicles, time, location, witnesses, damage, injuries
- Most traffic accidents only require level I
 - Usually only require beyond level I if serious injuries or fatalities result

Level 2: At the Scene Investigation

- Requires extra data collection
 - Photos, measurements of tire and skid marks, field sobriety test, final positions of vehicles/persons
- After the data are assessed, investigators will determine whether a criminal act occurred
 - If so, investigators will move on to level 3.



Speed of a Vehicle

- Use skid marks to calculate speed
- Only applies to vehicles stopping and moving in a **straight line**
- Temperature and mass of vehicle are NOT factors
- Formula: $s = \sqrt{30df}$
 - s = speed in miles per hour (mph)
 - d = distance in feet
 - f = coefficient of friction

Skid Marks



Coefficient of Friction

- Determined through experimentation
 - Using an exemplar vehicle on varying surfaces
- Measures the roughness of a surface
- No friction = 0

Cement: 0.55 to 1.20

Asphalt: 0.50 to 0.90

Gravel: 0.40 to 0.80

Ice: 0.10 to 0.25

Snow: 0.10 to 0.55

Example

- Investigators discovered skid marks on an asphalt road that were 45 feet long. The coefficient of friction was calculated to be 0.73.

$$S = \sqrt{(30)(45)(0.73)}$$

$s = 31.4$ mph when the brakes were applied

Yaw Marks

- Vehicles don't always skid in a straight line
—sometimes will skid in a curved path

- **Formula:**

$$S = 3.86\sqrt{rf}$$

S = speed in miles per hour (mph)

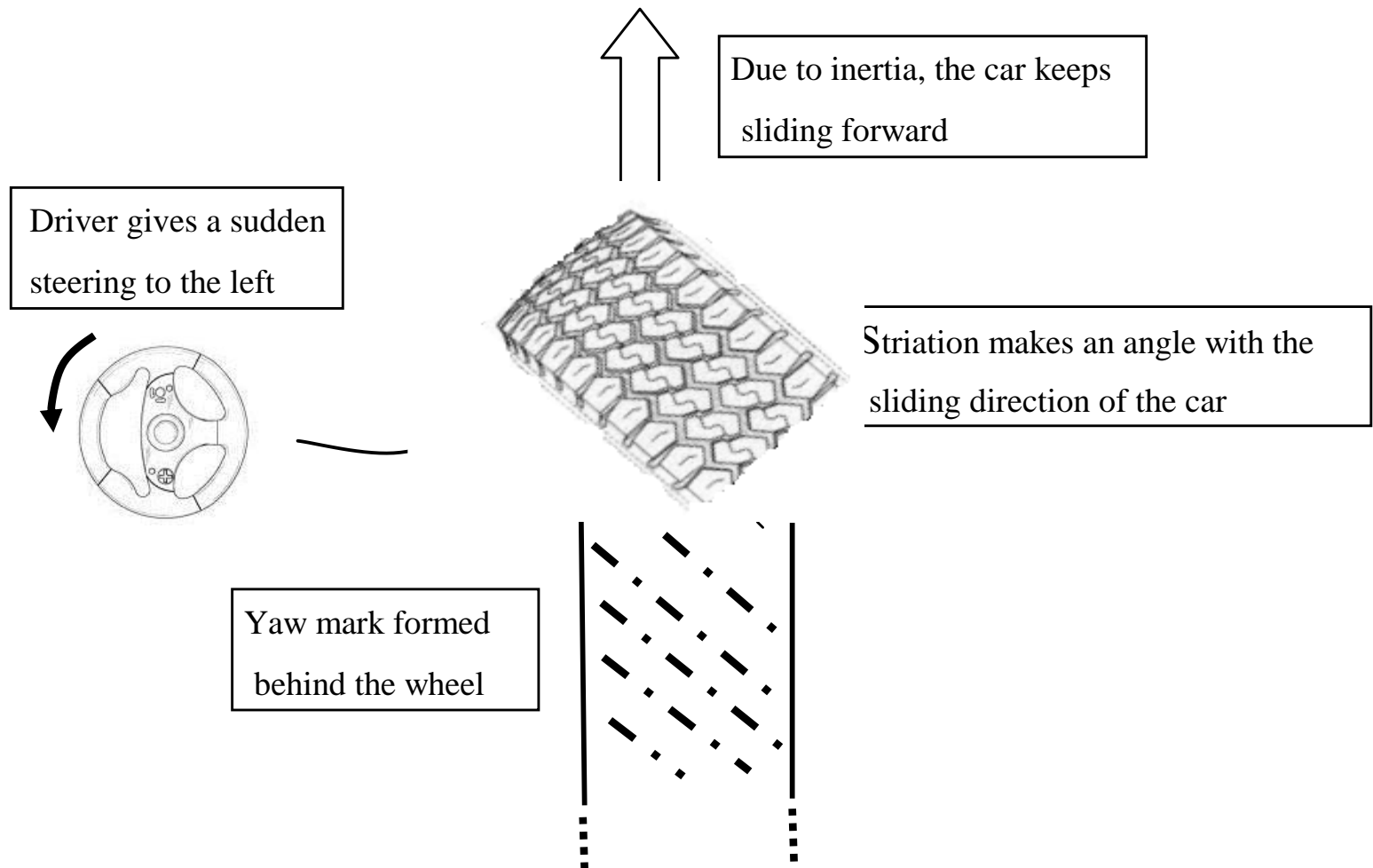
r = radius of the yaw mark (determined by drawing an imaginary line to complete the circle)

f = coefficient of friction

Yaw Marks



- Yaw mark indicates rotation of a vehicle, as would occur when a vehicle “spins out”. Yaw marks are generally curved, and the striations are at an angle to the marks.



Example

- Yaw marks were made on a flat, gravel surface with a coefficient of friction of 0.60, during an accident. The radius of the yaw marks was measured to be 102 feet. What speed was the car traveling?

$$S = 3.86\sqrt{(102)(.60)}$$

S = 30.1 mph when the brakes were applied

Level 3: Technical follow-up

- Only when a crime has been committed
- Investigators complete level 1, level 2 also
- Includes involvement of specialists
 - Paint analysis
 - Pathologists (if a fatality)
 - Toxicologists
 - Reconstructionists

Accident Reconstruction

- Motorcycle accident
- Truck accident
- Various Vantage Points

Level 4: Accident Reconstruction

- Law of Conservation of Energy
 - Energy is not created or destroyed, but can be converted from one form to another
 - When cars collide, one of the cars will move the other one
 - Some of the energy is converted to heat when the brakes are applied



Law of Conservation of Momentum

- Momentum = mass x velocity
- Momentum of a system remains unchanged unless a force acts upon it

Newton's Laws of Motion

- First Law

- An object at rest will remain at rest and an object in motion will stay in motion unless some external force acts on the object

- Second Law

- Acceleration = force / mass
- $a = \frac{F}{m}$

- Third Law

- For every action there is an equal and opposite reaction
- Example: car hits a tree – action force will probably cause damage to the tree and reaction force – tree is likely to damage vehicle

Level 5: Cause Analysis

- Investigators try to determine the indirect cause or conditions that resulted in an accident
- Based on facts and research
- Causes fall under 3 categories:
 - Environmental conditions
 - Rain, snow, ice, fog, sun glare, heavy winds
 - Human error
 - Speeding, under the influence of drugs/alcohol, fatigue, distracted, aggressive driving, inexperience
 - Vehicle equipment malfunction
 - Brakes not working, old/worn tires