Module 2

- Crash Investigation—Site Inspection (cont'd) Examine Roadway Features
- Crash Investigation—The Vehicle

Examine Roadway Features

Roadway/Shoulder Discontinuities

- Examine road surface for potholes, edge of pavement drop-offs or soft shoulders that could contribute to loss-of-control.
- Examine curbs for tire or rim marks.
- Look for short-term or intermittent features that could affect pavement friction.

Intermittent Surface Conditions

Mud on Pavement

Rutted Pavement
(water in ruts is intermittent)

Acceleration Marks

Fatal Crash Attributable to Hump

Don’t Wait for Crashes to Occur
Be Proactive

Keep an Eye Out While
Riding the Roads

Reading the Road

Look for indications (roadway physical evidence we discussed) that road users may be having problems traveling a section of road.

Crash Debris

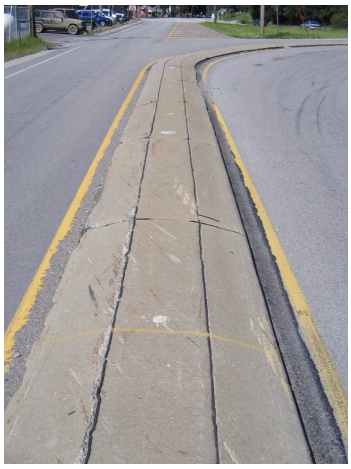
Locked Wheel Tire Marks

Yaw Marks

Tire Marks on Roadside

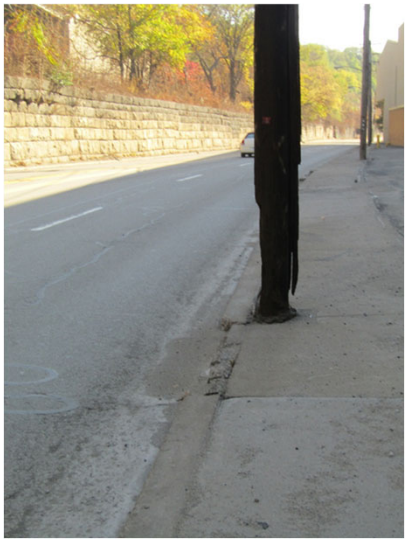
Gouges/Scrapes/Scratches on Pavement

Scratches/Scrapes on Roadside Features



Multiple Scars on Trees

Multiple Hits on Utility Pole



Multiple Sign Strikes

Example

Reading the road identifies gouge marks on top of curb. What's going on here?

Driver View Approaching Hillcrest

Informal Cues Override Formal Cues, Especially at Night

Read Cautiously—Should Be Multiple Indicators of a Problem

Questions?

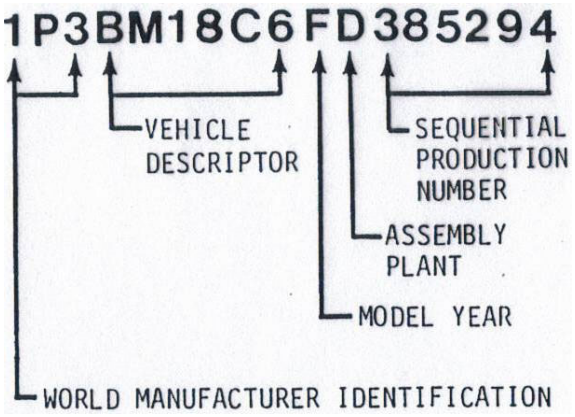
The Investigation Process

The Vehicle

Overview

- Vehicle ID Number
- Vehicle Damage
- Transfers
- Tires
- Glass
- Lamps

Vehicle ID Number (VIN)



Vehicle Identification Number (VIN)

- Confirms you are inspecting correct vehicle.
- Permits access to more specific information about vehicle characteristics.

Sample Data Sheet

GENERAL MOTORS CORPORATION REF. NO. 8500030
1985 CHEVROLET
S-10 BLAZER 2-DOOR UTILITY VEHICLE FOUR-WHEEL DRIVE

	DATA
WIDTH	
W101 Tread Front	54.3
W102 Tread Rear	54.3
W103 Vehicle Width	65.4
W117 Body Width at SgRP Front	
W120 Vehicle Width-Front Doors Open	
W121 Vehicle Width-Rear Doors Open	
W106 Front Fender Width	
W107 Rear Fender Width	
LENGTH	
L101 Wheelbase	101.3
L103 Vehicle Length	170.0
L104 Overhang-Front	29.7
L105 Overhang-Rear	39.0
L123 Upper Structure Length	
L126 Front End Length	
L129 Rear End Length	
HEIGHT	
H101 Vehicle Height	65.4
H114 Cowl Point to Ground	
H138 Deck Point to Ground	
H111 Rocker Panel-Rear to Ground	
H112 Rocker Panel-Front to Ground	
H133 Bottom-Door Closed to Ground-Front	
H135 Bottom-Door Closed to Ground-Rear	
H122 Windshield Slope Angle	49.4
H121 Backlight Slope Angle	
GROUND CLEARANCE	
H102 Front Bumper (top) to Ground	24.9
H104 Rear Bumper (top) to Ground	24.9
H103 Front Bumper to Ground-Curb Weight	
H105 Rear Bumper to Ground-Curb Weight	
H106 Angle of Approach	
H107 Angle of Departure	
H147 Ramp Breakover Angle	
H153 Rear Axle Differential to Ground	
H156 Minimum Running Ground Clearance	
Location of Min. Ground Clearance	
WHEELS/TIRES	
Standard Tires	P195/15
Standard Wheels (rim size)	
Optional Tires	
Optional Wheels (rim size)	

VEHICLE CURB WEIGHT	FRONT	REAR	TOTAL
Chevrolet S-10 Blazer 2-Door Utl. 4x4	1858.5	1291.5	3150.0

OPTIONS DIFFERENTIAL WEIGHT

BRAKING DATA
60-0 mph (Hard pedal, no skid, dry pavement)
d = 139 ft; t = 3.2 sec.; a = -27.8 ft/sec/sec; G-force = -0.86

ACCELERATION DATA
0-30 mph: t = 4.4 sec. a = 10.0 ft/sec/sec; G-force = 0.31
0-60 mph: t = 11.3 sec., a = 7.8 ft/sec/sec; G-force = 0.24
45-65 mph: t = 9.6 sec.; a = 3.1 ft/sec/sec; G-force = 0.09

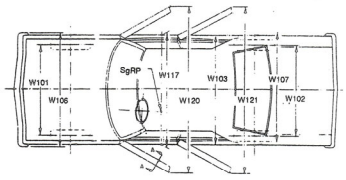
CENTER OF GRAVITY

Inches Behind Front Axle	41.2
Inches in Front of Rear Axle	59.6
Inches From Side	27.0
Inches from Ground	26.0
Inches From Front Corner	76.3
Inches From Rear Corner	102.2
Inches From Front Bumper	71.4
Inches From Rear Bumper	98.6

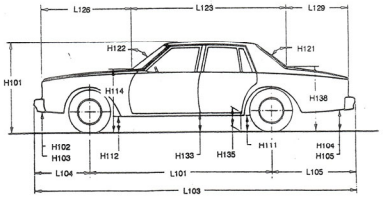
MOMENTS OF INERTIA
Yaw Moment of Inertia = 2038.50 lb-ft-sec^2
Pitch Moment of Inertia = 1969.50 lb-ft-sec^2
Roll Moment of Inertia = 417.00 lb-ft-sec^2

Typical Exterior Dimensions Available

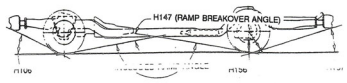
Exterior Width



Exterior Length & Height



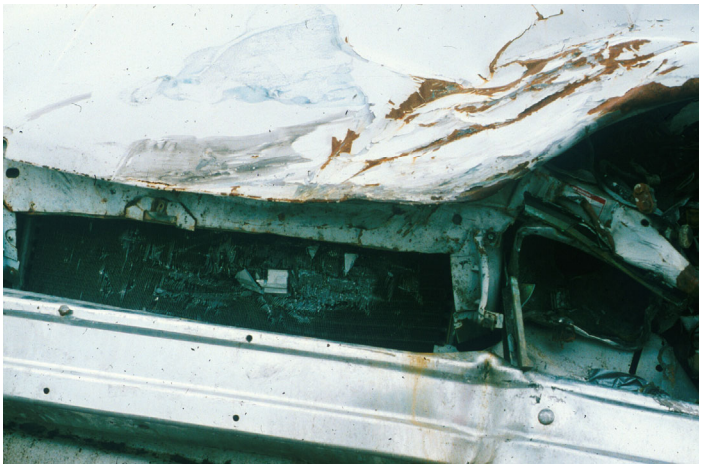
Exterior Ground Clearance



Exterior Details
to Be Noted and Recorded

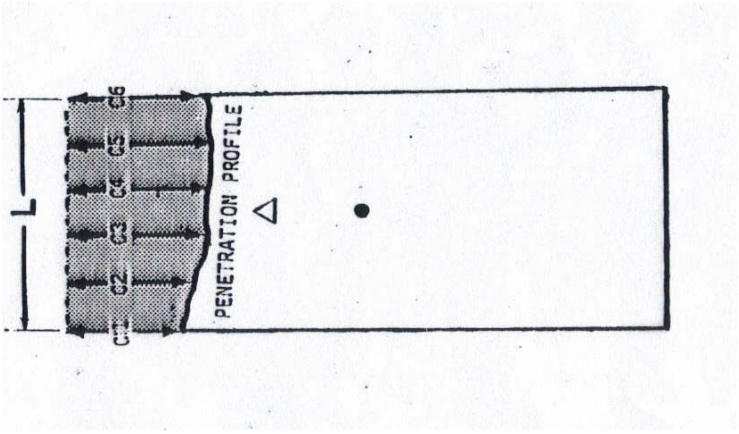
Contact vs Induced Damage

Contact Damage

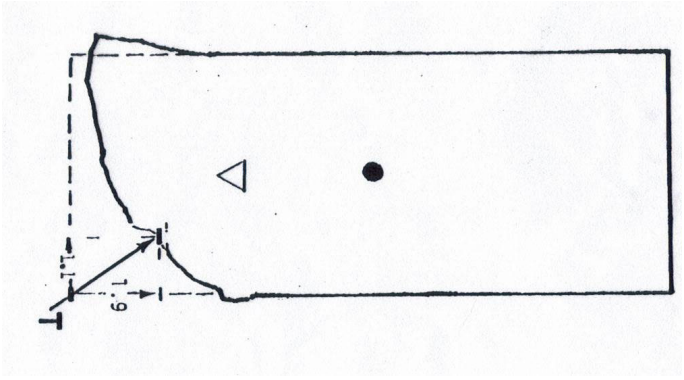


Induced Damage

Typical Vehicle Damage Measurements



Documenting Damage and Direction of Thrust



Contact Damage

- Metal Folds
- Imprints
- Transfers
- Scrapes, Gouges and Scratches

Metal Folds

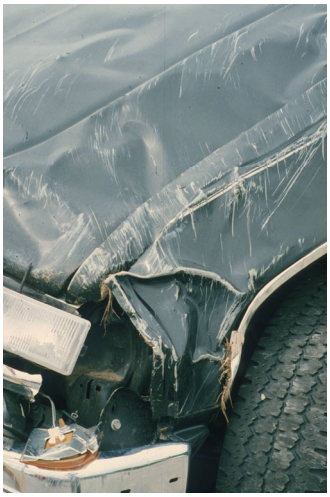
- Occur at impact when one portion of metal is pushed over or under another portion.
- Can be metal folds in many different directions on the same vehicle, indicating the vehicle underwent more than one impact.
- Look at other evidence to determine how they occurred.

Examples of Metal Folds

Metal Folds (2)

- Also useful in determining when a vehicle has rolled over and in what direction and possibly how long it stayed in that position.
- Number (and direction) of road abrasions on the metal is an indicator of this.
- The deeper the abrasion, the longer the slide time in that position.

Note Different Directions of Scratches



Imprints

- Dents pressed into body parts by some stronger object that clearly show its shape.
- Usually made in areas which are damaged or collapsed so may be difficult to recognize.
- They fix the position of one vehicle with respect to another (or to an object) during collision.

Example of an Imprint

Transfers

- Material is transferred from one object to another during the impact phase of crash.
- Examples include:
  -- paint
  -- wood fibers from trees or utility poles
  -- dirt/grass
  -- tire rubber

Examples of Transfers

Tire Rubber Transfer

Transfer from Vehicle to Guardrail

Transfer of Pedestrian's Clothing

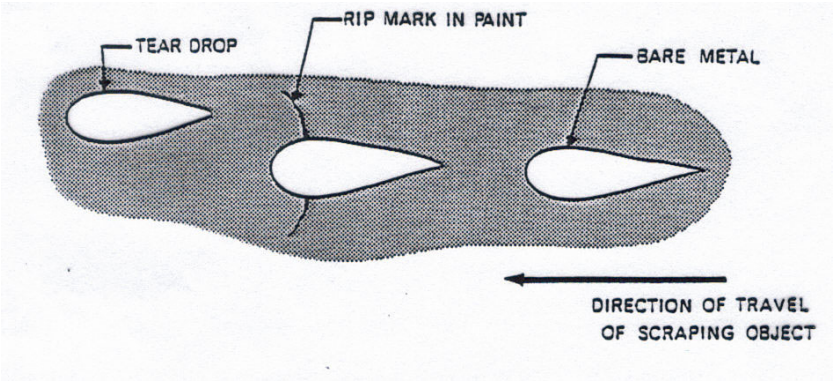
Paint Transfers

- Starts as a small, thin line and increases in width and thickness along the direction of the transfer.
- End is usually abrupt with a full width and thickness.

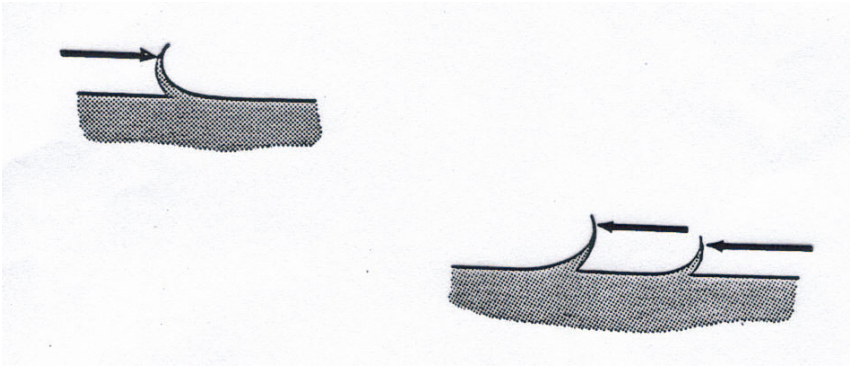
Scrapes, Scratches and Gouges

- Scrapes can be due to impact or can occur during a rollover and subsequent sliding of the vehicle along a hard surface.
- Gouges are usually of the puncture or ripping type. Rough edges of U-shaped sign supports can cause a ripping or tearing of vehicle sheet metal.

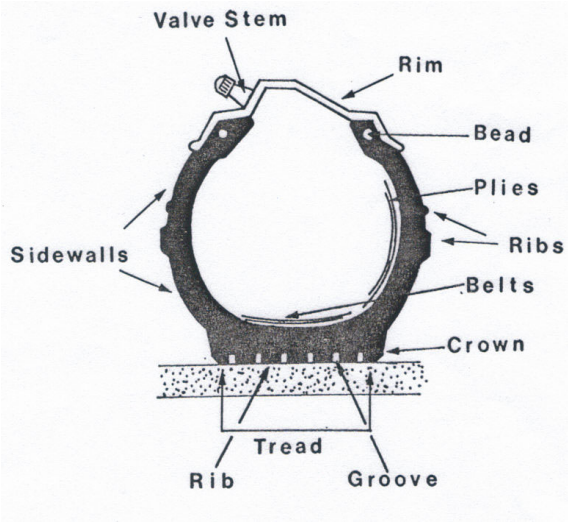
Scrape Marks in Body Paint



Gouge Mark Showing Upturned Metal Chips



Tires (and Terminology)



For Each Tire, Indicate:

- Position on vehicle
- If flat
- If hole present
- If bead unseated
- If rim is bent
- Whether wheel could be rotated

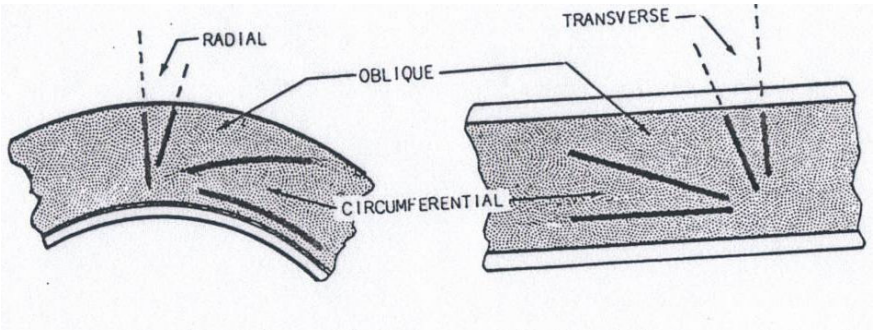
For Each Tire (continued)

- Laceration
- Wear
- Abrasions
- Heat deterioration
- Separation

Tire Abnormalities

- Small Hole
- Cut
- Impact Break
- Tear or Rip

Describing Alignment of Abnormalities



Document Tire Tread Wear/Depth

Spares

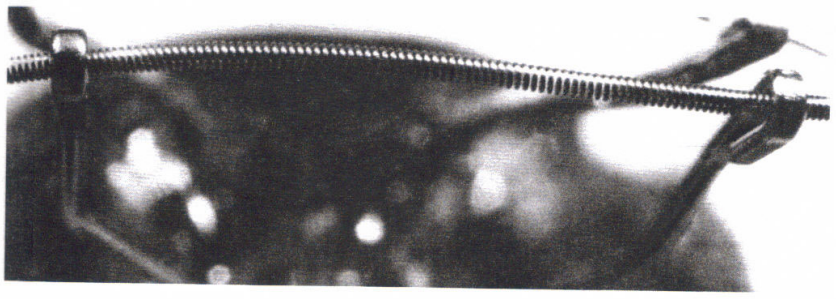
Headlights, Taillights and Side Marker Lights

- Note: Minor disassembly may be needed, e.g., taking off front headlights, rear taillight lenses and side marker lenses to analyze and photograph the conditions of the filament of the light bulbs.

Headlights, Taillights and Side Marker Lights (2)

- Motor vehicles use light bulbs in a 12-volt system that serves as main power source.
- Filaments inside the bulb glow a dull red when electricity is applied to them.
- Consequently, filament wire is much softer than when no electricity is applied.

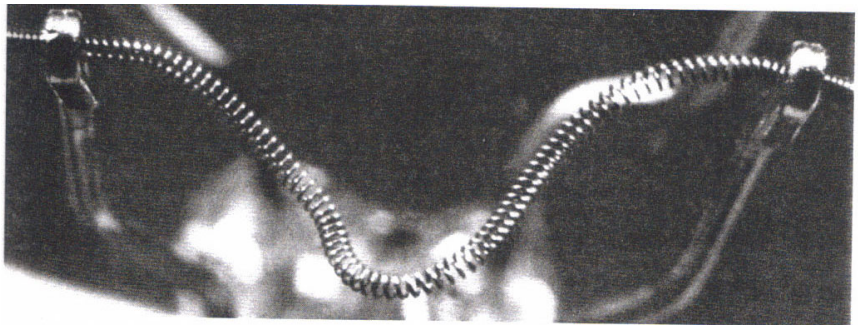
Normal (Undamaged) Filament



Filament Analysis

- During a collision, the filament stretches in the direction that the accident occurred if lights were on prior to the collision.
- Be careful when using this method to determine if lights were on since the point of collision must be very close to the lights for significant stretching to occur.

Filament Suffering “Hot Shock”



Cold Fracture vs. Hot Shock

- Sometimes a cold filament will fracture during a collision.
- Cold filament fracture has sharp edges and ends.
- Heated filament fracture has a rounded globular-like end.
- Difficult to determine if bulb had cold fracture prior to a crash.

Vehicle Interiors

- Provides information to investigator about components that occupants struck during the second collision.
- Information may allow a biomechanics expert to match occupant injuries with interior damage.
- Investigator needs to locate, classify, manage and report each piece of evidence.

Witness Marks Left on Interior Features

- Smudges from human skin
- Dings (including bent/broken knobs)
- Dents
- Blood spatter
- Strands of human hair caught in cracks
- Shoe polish smears
- Clothing transfers
- Cracked glass

Vehicle Interior (1/2)

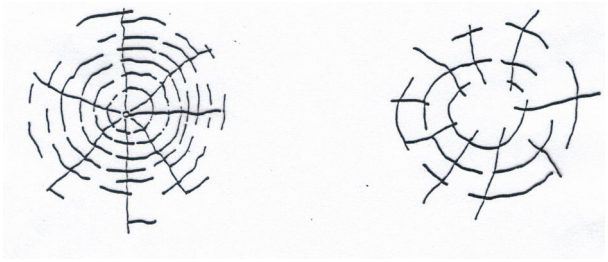
Vehicle Interior (2/2)

Glass

- Laminated – layers of glass that are bonded together. Used for windshields.
- Tempered – single layer of glass that has been heat-tempered to give it a toughened inner and outer surface. Shatters into many tiny pieces that produce only small lacerations to human tissue. Used for side windows.

Laminated Glass

Spiderweb Pattern in Windshield Glass



Breakage of Side and Rear Windows

- If side and rear windows have been broken by foreign objects thrown from outside vehicle, then glass fragments are inside the vehicle.
- If glass was broken from inside, the fragments are outside of the vehicle.

Tempered Glass, Side Window

Event Data Recorders

- Historically, travel speeds of crash-involved vehicles were reconstructed based on physical evidence such as location of impact, point of final rest and crush damage.
- Energy dissipated during and following collision was determined to compute vehicle speed.

Event Data Recorders (2)

- With introduction of electronic air bag systems, auto makers began to record certain information in event of collision.
- Over time, the ACM included recording of certain pre-crash data in collisions where air bags deployed and when they did not.

Event Data Recorders (3)

- Format and data stored by ACM was standardized by NHTSA in model year 2011.
- All vehicles produced after 2011 have onboard event data recorder (EDR) which is typically the ACM.
- Data on operation of vehicle is provided to the ACM via powertrain control module (PCM) continuously and is recorded whenever a collision occurs.

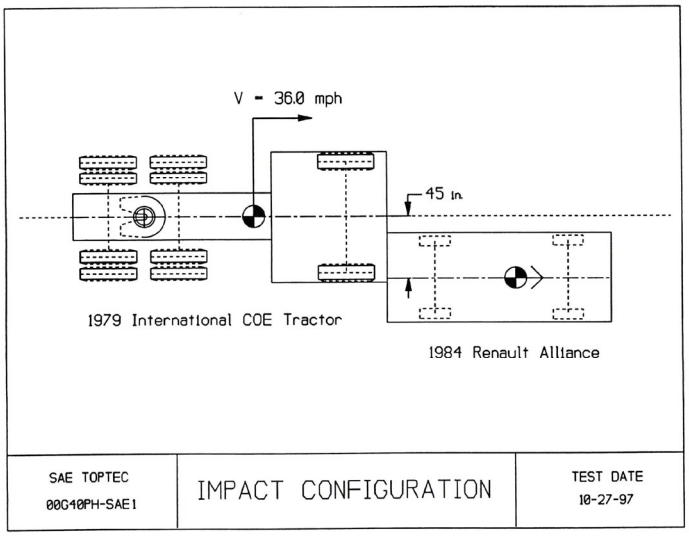
High-Speed Rear-Impact Crash Test

- In the video, will see the crash from a variety of perspectives, at both full speed and slow-motion.
- Especially look for crush damage, debris patterns and road surface marks.

High-Speed Rear-Impact Crash Test (2)

- Crash test is <u>not</u> intended to model a typical vehicle crash.
- Example of a high-energy, significant intrusion, non-survivable, rear-end crash.
- Note the seat back failure.

High-Speed Rear-Impact Crash Test (3)



Questions?