S.A.C.

Students Against Crashes
Instructor's Guide - Session One

PPT 1	**Introduction:** Instructors and assitants should introduce themselves and tell why they are offering this course; to promote safe driving to students and other inexperienced drivers. • Explain the purpose, goals, and objectives for this program. Any class rules and housekeeping rules should be given. • Explain what the three sessions will involve, and all class materials should be distributed.
2- **Video Clip- 35 mph crash**	You are about to see a live crash that occurred just as a TV news crew was doing a segment on a dangerous intersection. Look at how they come together, at what speed, and where they stop at final rest.
3- **Crash Definition**	The key point to the definition is the word "**unintended**". It would not be called an accident if it were an intentional act. A criminal ramming a poice cruiser with his car would not be an accident, by definition. Neither would a suicide by automobile or damage caused by a hurricane or tornado.
4- **Investigation definition**	A rational, fair, and objective investigation and conclusion as to how the crash occurred. There is only one government agency working 24/7 and is charged with the responsibility to investigate vehicle crashes.
5- **Why investigate**	Stress the tremendous personal, social, and economic loss to society because of vehicle crashes. Photos from this "155 mph crash" file and a very interesting history of that crash are included in CD addendum file.
6- **Why investigate**	As many victims die in car crashes **each year** as died during the entire Vietnam War which lasted over 10 years. The average fatality or serious crash costs over one million dollars.
7- **Why investigate**	Explain why the public must have a fair, impartial investigation; that justice cries out for clear causes of fault and fair compensation for pain, suffering, and property loss. The police agencies are charged with this task as they are the only round-the-clock agency representing government and ensuring public safety.
8- **Investigation process**	Most accidents are caused by one or more of the three key components: the **road**, the **vehicle**, the **driver**. Officers examine all three. **Question to class**- "If the witness statements contradict the physical evidence, which would you tend to favor?" **Answer**- the physical evidence, because it doesn't lie and doesn't change its mind under duress, peer pressure, or the passage of time. The investigator finds the scene as it ends up, and must work backwards to "reconstruct" how the vehicles came together.
9- **Responsibilities**	These bullet points are other factors the investigator must consider in the accident. We will touch upon a few of these during this session. We will make the connection between accident causes and the bad driving habits that

	lead up to them.
10- **Critically Examine**	Each of these items tells a story and is a clue to how the accident occurred. At times, the cause is quite clear with little evidence. At other times, too many clues cause complications. These four bullet points are key physical evidence features the officere examines. Each tells a story, is a piece of the puzzle that explains how the accident happened.
11- **Damage**	There are four classifications of vehicle damage in most state vehicle crash reports: **Slight**- is only cosmetic damage and does not affect driving or car performance. **Moderate**- may require some body work or other repair for the car to be safe for the highway and pass road inspection (lights or turn signals out, flat tire, etc). **Severe**- car will require extensive repairs or may be totalled (by legal definition) and must be towed from the scene. **Demolished**- car is ready for the 'crusher'.
12- **Classification**	Various types of evidence are classified as to how long they will last. Obviously the investigator photographs, measures, and documents the temporary and short-lived evidence first. **Temporary evidence:** liquids, debris, tire prints, tire shadow marks, bodies, and vehicles on travelled portions of highway. **Short-lived evidence:** skidmark smears, gouges or scrapes in the road, oil and blood stains, damage to fixed objects, vehicles off the travelled portion of the highway. **Permanent evidence:** much more long-lasting and can be examined in the future. These include lane and road width, trees, utility poles, vegatation, curbs, street addresses, road contours and elevation.
13- **Review the clip again**	Ask the class to examine the video clip looking for the evidence you just identified and reviewed such as temporary, short lived, and permanent items. Ask them to listen to the sounds involved in the crash. Was there braking before the crash? What about skid marks, debris, car parts, etc?
14- **Video Clip- 35 mph crash**	• Point out the whooshing sound as the tire blows out. • Point out car parts flying in the air and on the roadway from both vehicles. Point out the final rest of both vehicles and skidmarks leading up to them. Will a car skid farther on blacktop or on grass? • Mention the term momentum (speed combined with weight) of the pickup truck. • Explain why that caused both vehicles to spin in the direction of the path of the pickup truck. • Ask for and allow questions and comments from the class. • Ask the question, "was this crash caused by the **roadway,** the **vehicle,** or the **driver?**"

	• You may want to back up the slide and have the class view the crash a second time. • This is the first time many of the students have seen an entire, live, unrehearsed crash sequence. • Explain that often we see the aftermath of a crash and wonder how the cars got there. • Here is a chance to see how cars come together in a frequent intersection type crash and how they end up where they do.
15- **Speed estimates**	Now transition to the investigating phase of the power point. Here we determine speed based upon scientific study and mathematical formulas.
16- **How do we determine speed**	Explain skidmark data is the most often used method of determining speed by applying accepted math formulas. Technical accident reconstructionists can also determine impact speed by vehicle crush analysis.
17- **Speed definition**	This is a straight forward definition.
18- **Speed from skidmarks**	The "slide to stop" formula is listed in this slide with definitions of the letters used in the formula. Once you know the drag factor of the roadway, you can determini minimum "initial" speed before braking, by measuring the skidmarks the vehicle laid down on the roadway
19- **The "D" in the formula**	The most importand piece of evidence is the skidmark measurement. The other items are not as critical as the total skidmark lengh of the vehicle. It is vital to have an accurate measurement of the skidmarks.
20- **Skid distance**	This slide tells how to obtain accurate skidmark data. Depending on time available, you may expand or contract this slide as needed.
21- **Skid shadows**	Explain that impending skids (skid shadows) are the precursers to the deep, dark skids we associate with a panic stop. They are part of the skid length and most often overlooked in measurements. These skids help determine maximum braking before the driver loses control of steering in non-ABS vehicles. Explain that anti-lock brakes (ABS) lock and release the brakes several times a second, allowing the driver to maintain steering control. ABS also stops vehicles in up to a 30% shorter disance.
22- **Skidmarks**	The next two slides explain various types of skids the class observed on the highway. Expand as time permits. Gap skids and skip skids are described.
23- **Skidmarks**	Spin skids and skids on various surfaces are explained. There is a "combined speed formula" that technical analysts use for skids on two or more different surfaces.
24- **What is drag factor?**	Explain that drag factor is the friction or grip that tires have on the road. The better the grip, the higher the drag factor number and the shorter the stopping distance. Examples of drag factor numbers are given for concrete, asphalt, and other surfaces. Explain that water or ice make the drag factor very low and take much longer to stop the vehicle.
25- **Influences on drag factor**	Materials on the roadway including liquids, dust, debris, or other materials on the surface (snow, water, ice, mud, car parts, or other items) can cause the drag factor to be lower and require more distance to stop the vehicle.
26- **Tire composition**	Items on tires affect the drag factor, such as tire compostion, tread, tire chains or studs, and tire defects. The amount of tread on a tire does not generally affect its stopping power on dry surfaces, however, more tread enables better stopping power on wet surfaces. Items attached to the tire, such as chains or studs, can affect the drag factor dramatically in heavy snow and slush (better

	stopping power). Conversly, chains and studs have just the opposite effect on dry pavement. They lessen the surface contact area of tire to roadway lowering the effective drag factor and dramatically increasing safe stopping distances.
27- **Length of skid**	The length of the skidmark is the key measurement in the drag factor formula. This determines the drag factor for that road surface. Other factors such as road elevation and percentage of braking play a lesser role in determining drag factor. Ask the class what advantage chains or studded tires have. Over what surfaces are they effective? How do chains or studs affect drag factor on dry roads? *(lower the drag factor and require more stopping distance.)*
28- **Drag factor tests**	Drag factor may be determined in various ways. Four methods are listed in the slide. **Test skids:** have been the standard of the ages. Their lengths are plugged into the drag factor formula. **Drag sled:** although more technical, has been around a long time. It is a tread with a weight on it of known amount dragged over a surface with a known force (gauged by an instrument). Those numbers are put into the formula for the drag factor. **Coefficient of friction table:** lists high and low ranges of drag factors for know surfaces. When unable to determine drag factor from road tests, this table allows the investigator to bracket high and low speed ranges of the vehicle in question. **Accelerometer:** is a more modern electronic device that is suction-cupped to the windshield. Variations in the vehicle's G-forces activate this device. It gives an instant readout of skid distance, speed, the stopping time, and the drag factor. Police departments are using these type instruments more often as it quickly and accurately determines speed, braking distance, elapsed time, and roadway drag factor.
29- **Drag factor formula**	The unknown variable is isolated on the left side of the equation. You know the speed and distance. This formula reveals the drag factor. This is a basic math formula that can be worked on any standard calculator.
30- **Test skids**	This slide lists rules for performing test skids and for determining the drag factor for a crash area. Test skids are ideally done in the same direction of the crash. It is easier to track and measure skids on a vehicle without anti-lock brakes (ABS). Officers doing the skidmark demonstration in session two may consider removing the fuse from the ABS plug, allowing the cruiser to lay down black measureable skid marks. It is usually best to do at least two test skids and average the skid distance of the two. If results are dramatically different for the two skids, a third is usually performed.
31- **Other formulas**	To convert miles per hour (mph) to feet per second (fps), divide the number of seconds in an hour (3,600) into the number of feet in a mile (5,280). This equals 1.46, which rounds to 1.5 for this project. This formula is useful when doing a time-distance study in reconstructing an accident.

	Perception-reaction time involves a driver perceiving a danger and then reacting to it. Numerous studies conclude this takes about one and a half seconds before braking begins. In session three, more time is spent with this concept and these two formulas. This session clearly demonstrates there is so much more to an accident scene than merely the skidmarks left on the roadway.
32- "**Driving Dance"**	The video "driving dance" is a series of slow-motion vehicle crashes set to music. It has humor, pathos, and shows a variety of crash types. Introduce the clip by asking the class to observe the various approach angles of cars before a crash and how they "bounce" off each other. Observe how broken glass flies in the direction the vehicle is travelling
33- **Session 2**	This slide outlines what will be covered in session two. During this is the "hands-on" session, students will see what police do at an accident scene to "reconstruct" what happened and how it happened. Students will observe a "test-skid" and measure it's length and will look for "skid shadows" at the beginning of the skid pattern. The students will compare the measurements with data from an accelerometer (if available). Then they will record their measurements for session three. During session three, the students will use the drag factor formula. Then the class will discuss other factors that may affect the drag factor of the roadway and how they affect a vehicle's handling on that surface.
34- **Session 3**	Returning to the classroom, students will apply the test-skid data to the drag factor formula. The same "teams" that took measurements together will compute the data together. They will then be given accident scenarios with new skidmark data. Next, the groups will determine the minimum initial speed of vehicles before the crash using the slide-to-stop formula that incorporates the drag factor you just determined. After that the students will back up even farther in the crash sequence by factoring in the perception-reaction time. By the end of session three, the students will have a truer understanding of the many factors at work in vehicle crashes. They will better understand why speed and following too closely are the primary causes in accidents involving young drivers.