

# CALIFORNIA ASSOCIATION OF ACCIDENT RECONSTRUCTION SPECIALISTS

P O Box 53536, San Jose, CA 95153  
[CAARS@hotmail.com](mailto:CAARS@hotmail.com)



No. 22

Fall 2003

[Annual CAARS Training Conference for 2003:](#)



## CA²RS

VS.

## Bikes

And other in-line wheeled devices



Anaheim California  
October 15-17, 2003

Session Topics

*Excel Spreadsheets—Vehicle Codes*  
*Motorcycle Testing and Drag Factors*  
*Personal Mobility Devices*  
*Skateboard & Roller Blade Acceleration*  
*Biomechanical Injury Causation*  
*Accident Investigation Toolbox Roundtable*

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#### MEMBERSHIP SERVICES / INFORMATION

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e-mail: [kc2938pacbell.net](mailto:kc2938pacbell.net)

#### TRAINING COORDINATOR

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## Motorized Scooters

By Deputy Kent Boots

Orange County Sheriff's Department/ M.A.R.T.

IN PREPARATION FOR OUR UPCOMING FALL CONFERENCE I THOUGHT I WOULD GET EVERYONE UP TO DATE WITH THE LAWS REGARDING MOTORIZED SCOOTERS. IN RECENT YEARS MANUFACTURERS HAVE BEGUN EQUIPPING SKATEBOARDS AND SCOOTERS WITH MOTORS. THESE DEVICES ARE KNOWN BY SUCH BRAND NAMES AS GO-PED, BLATINO SCOOTER, ZIP ELECTRIC SCOOTER, AND MOTOBOARD TO NAME A FEW. THEY HAVE BEEN MARKETED FOR OUTDOOR RECREATION AS WELL AS FOR SHORT DISTANCE TRAVEL.

THERE ARE NO STATISTICS THAT I'M AWARE OF REGARDING TRAFFIC COLLISIONS INVOLVING MOTORIZED SCOOTERS BECAUSE THERE IS PRESENTLY NO WAY TO TRACK THEM. FOR THE PURPOSES OF A TRAFFIC COLLISION REPORT THEY ARE CONSIDERED VEHICLES. SOME OFFICERS HAVE INVESTIGATED INJURY TRAFFIC COLLISIONS WHERE THE MOTORIZED SCOOTER OPERATOR SUSTAINED INJURIES AS THE RESULT OF A FALL TO THE GROUND OR FROM STRIKING OTHER VEHICLES. THE SHERIFF'S DEPARTMENT MAJOR ACCIDENT RECONSTRUCTION TEAM HAS INVESTIGATED A COLLISION INVOLVING A "GO-PED" BEING RIDDEN BY A 14-YEAR-OLD WHO SUSTAINED LIFE-THREATENING INJURIES, AND A FATAL COLLISION INVOLVING AN ELECTRIC MOTORIZED

SCOOTER BEING RIDDEN BY A 5 YEAR OLD WHO WAS NOT WEARING A HELMET.

WITH THE INCREASE IN THE NUMBER OF THESE VEHICLES APPEARING ON THE ROADWAYS, SOME CONFUSION HAS RISEN REGARDING THEIR LEGAL STATUS. IN JANUARY OF 2000 THERE WERE NUMEROUS NEW LAWS ADDED TO THE VEHICLE CODE REGARDING MOTORIZED SCOOTERS. A "MOTORIZED SCOOTER" IS ANY TWO-WHEELED DEVICE THAT HAS HANDLEBARS, IS DESIGNED TO BE STOOD OR SAT UPON BY THE OPERATOR, AND IS POWERED BY AN ELECTRIC MOTOR OR OTHER SOURCE THAT IS CAPABLE OF PROPELLING THE DEVICE WITH OR WITHOUT HUMAN PROPULSION.<sup>1</sup> A DEVICE THAT IS POWERED BY A SOURCE OTHER THAN ELECTRICAL POWER SUCH AS A GASOLINE ENGINE IS ALSO A MOTORIZED SCOOTER. IN JANUARY OF 2003 THERE WAS A RELATED ADDITION AND AN AMENDMENT TO THE VEHICLE CODE REGARDING MOTORIZED DEVICES. THE ELECTRIC PERSONAL ASSISTIVE MOBILITY DEVICES (TWO-WHEELED SEGWAY TRANSPORTATION DEVICE) IS NOT A MOTOR VEHICLE AND CAN BE USED ON SIDEWALKS.<sup>2</sup> THESE TYPES OF DEVICES DO NOT MEET THE VEHICLE CODE'S DEFINITION OF A MOTORIZED SCOOTER.<sup>3</sup>

SOMEONE WHO OPERATES A MOTORIZED SCOOTER ON A ROADWAY HAS THE SAME RIGHTS AND IS SUBJECT TO ALL OF THE PROVISIONS OF THE VEHICLE CODE APPLICABLE TO THE DRIVER OF A VEHICLE<sup>4</sup>, INCLUDING DRIVING UNDER THE INFLUENCE OF ALCOHOL OR DRUGS.<sup>5</sup> THE EXCEPTION TO THIS IS THAT MOTORIZED SCOOTERS ARE NOT REQUIRED TO BE REGISTERED OR HAVE A LICENSE PLATE, NO PROOF OF INSURANCE IS REQUIRED,

<sup>1</sup> VC§ 407.5

<sup>2</sup> VC§ 313

<sup>3</sup> VC§ 407.5

<sup>4</sup> VC§ 21221

<sup>5</sup> VC§ 21221.5

**AND OPERATORS ARE NOT REQUIRED TO BE LICENSED.<sup>6</sup>**

The operator of a motorized scooter must be at least 16 years old, is required to wear a helmet regardless of age, and cannot carry passengers. They cannot be ridden on a roadway with a speed limit over 25 miles per hour unless they are ridden in a class II bicycle lane. They cannot be ridden on a sidewalk except to enter or leave property. They must be operated with at least one hand on the handlebars. They must be equipped with a brake that will allow the operator to make a braked wheel skid.<sup>7</sup>

No one shall operate a motorized scooter at a speed in excess of 15 miles per hour.<sup>8</sup> The operator must stay as close as practical to the right hand curb or roadway edge. If the operator wishes to make a turn he/she must pull to the right hand curb, get off of the scooter and complete the turn by walking the scooter across the street.<sup>9</sup> A scooter may be operated on a bike lane, path, or trail unless prohibited by a local ordinance.<sup>10</sup>

Every scooter operated during darkness is required to be equipped with a headlamp visible 300 feet from the front and sides, a red reflector on the rear that is visible from 500 feet, and a yellow or white reflector on each side visible 200 feet from the front or rear.<sup>11</sup>

Local authorities may regulate the registration of, parking of, and the operation of motorized scooters on bicycle and pedestrian facilities as long as the ordinances are not in conflict with the state laws.<sup>12</sup>

## **ACTAR Schedule of Accreditation Examinations**

### **ACTAR Update**

BY RUDY DEGGER, ACTAR, 447

Here's a quick update regarding ACTAR. Currently, there are 830 people accredited by ACTAR. There are several long-term examinations scheduled in the upcoming months:

<b>Date</b>	<b>Location</b>
October 14, 2003	Anaheim, Ca

CAARS members are encouraged to apply and register for one of the upcoming long-term examinations. Remember, CAARS will host an examination at our next conference in October 2003. You may contact Al Baxter, ACTAR Administrator, at the location listed below.

P. O. Box 5436,  
Hudson, FL 34974  
<http://www.actar.org>  
800.809.3818

### **Hotel Information:**

#### **Sheraton Anaheim**

900 South Disneyland Drive  
Anaheim, CA 92802-1844

**RESERVATIONS: (714) 778-1700**

*Inform the operator you are with the CA<sup>2</sup>RS Conference.  
Please make reservations prior to September 20, 2003  
to insure conference rate.*

#### **Standard Room**

Single Rate \$ 89.00\*      Double Rate \$ 89.00\*  
Triple Rate \$109.00\*      Quad Rate \$129.00\*

*Room rates are good 3 days before and after the conference.*

*\*Rates are subject to applicable state and local  
occupancy currently at 15%.*

**Complimentary Parking provided by the Sheraton Anaheim**

<sup>6</sup> VC§ 21224

<sup>7</sup> VC§ 21235

<sup>8</sup> VC§ 22411

<sup>9</sup> VC§ 21228

<sup>10</sup> VC§ 21230

<sup>11</sup> VC§ 21223

<sup>12</sup> VC§ 21225

## Blurbs from the Board



Gordon Gray  
Chair



Kent Boots  
Vice Chair



Benn Karne  
Director



William Jones  
Director



Bill Focha  
Director



Karen Haverkamp  
Director

### Blurbs from the Board for Fall 2003

Dear CAARS Members,

As is typical, I'd like to start off this blurb by thanking those persons responsible for our last pair of quarterly training meetings. Board member Benn Karne (Karne Engineering) arranged the presenters, Charles Barton and Rudy Degger did a great job presenting Computers in Accident Reconstruction including use of AutoSketch with and use of PowerPoint. Other Board members, Karen Haverkamp (Riverside PD) and Benn did their usual great jobs at arranging facilities for the meetings. I wasn't able to attend either myself, but I've heard positive comments from many of the members who enjoyed something out of the norm for traffic investigation training.

Speaking of Board members, have you ever dreamed of going in to politics? Does the idea of having a "say" in how things are done and representing your voting members sound appealing? Then it's not too early to start thinking about the Board member elections that will take place at the Fall Conference in October. Let this be your stepping-stone to higher office!

There are four Board positions up for election this year, the Board seats of **William Focha**, **William Jones** and **Benn Karne** as well as the Vice-Chairman position of **Kent Boots**. I'd like to encourage anyone who feels they can contribute to the growth and direction of the association to put their name on the ballot. Talk to your Board members and see what's involved. You can make many worthwhile contacts and have the opportunity to help organize training for your fellow members. If you'd like to put a "candidate's statement" into the Skidmark prior to the election, it can be arranged.

It's hard to believe its August already. Time flies while you're having fun. We are in full gear planning for our Annual Conference. This year's topic is **Bikes and Other In-Line Wheeled Devices**. We have three great days of Training, Testing, Vendors, and Information to include: Vehicle Familiarization, Motorcycles and drag factors, Bicycles vs. Vehicles, Acceleration/Deceleration Testing.

Exhibitor Displays & Reception: \* Continental Breakfasts \* Catered Lunches \* Evening Reception  
Conference Discounts: \* CAARS Member discounts for the ACTAR exam fee \* Preferred rates at Sheraton Anaheim Hotel \* Discounted Disneyland resort tickets. ACTAR Exam October 14, 2003.

I hope you will come to Southern California, attend the conference, and experience some of the most update training offered with the craze of use with these types of vehicles. Our Featured Speakers are Bruno Schmidt, Sean Shimada, Jerry Eubanks, Tom Fugger, Kerry Berg, Kent Boots, and Tim Reust.

Congratulations to our Conference Registration Fee giveaway drawing winners!!!! These five lucky members have the opportunity to attend the Conference simply from paying their yearly dues early. Michael Briggs – Danville PD, Randy Pope - Oakland PD, Jennifer Colunga – RDA & Assoc., Gary Hughes – Accident Analysis & Consulting, and Kevin Corvin – Milpitas PD. Hope to see everyone at the conference! These lucky members will be receiving more info in the mail.

Lastly, I'd like to once again encourage anyone who has ideas for future training meetings to contact one of the Board members and pass it on. We're also looking for meeting places in both Northern and Southern California area. In considering a meeting place, we take into account the number of members in the area and the ease of commuting to the location at the time the training is offered. In this way we can be assured of maximum attendance.

As always, the Board welcomes any suggestions regarding future training topics or how to improve the organization.

*Gordon*

CHAIR	Gordon Gray - Stockton Police Department
VICE CHAIR	Kent Boots – Orange County Sheriff's Department
DIRECTORS AT LARGE	Benn Karne – Karne Engineering William Focha – Sonoma County Sheriff's Department William Jones – Mr. Truck Accident Investigation and Reconstruction Karen Haverkamp – Riverside Police Department James Holder – Garden Grove Police Department
Membership Committee	Kevin Cassidy – San Jose Police Department
ACTAR Representative	Rudy Degger – Rudy Degger & Assoc., Inc.

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### CA<sup>2</sup>RS ADMINISTRATIVE CONTACTS

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E-mail: [CAARS@hotmail.com](mailto:CAARS@hotmail.com)

### CA<sup>2</sup>RS NEWSLETTER EDITOR

William M Jones  
(see contacts above)

## Just a reminder...

If there is any information you would like changed, added, or deleted from your mailing address, please contact CA<sup>2</sup>RS Headquarters immediately. If you would like information to appear in our newsletters you must submit your materials to William. For deadlines please call (925) 625-4994 or e-mail at [william@mrtruckar.com](mailto:william@mrtruckar.com)



# ACTAR Accredited CA<sup>2</sup>RS Members



Michael Allision	Benn Karne	<p>If you are accredited by ACTAR and do not see your name on the list, contact CA<sup>2</sup>RS Headquarters so that you may be recognized for this important achievement. If you would like your ACTAR number listed by your name, please let us know.</p> <p>If you do not see your colleague's name on this list, their membership with CA<sup>2</sup>RS may not be current. If you know of anybody who mistakenly missed their CA<sup>2</sup>Rs renewal, please remind him or her to contact CA<sup>2</sup>RS so that we can renew their membership and continue to recognize them for their achievement.</p>
Paul Arnold, Jr.	Chris Kauderer	
Donald Basham	Daniel Mahoney	
David Beals	Michael Mahoney	
Stephen Benanti	Robert Mahoney	
Kerry Berg	Patrick Moore	
Kent Boots #1170	Terry Morris #1150	
Glen Callaway #1229	John Muse	
Rochelle Carlton	George Ogilvie	
Kevin Cassidy	Karl Pringle	
Clark Corbin	Timothy Reust	
Rudy Degger #447	Charles Ritchie, D.C.	
Michael Frain, PE	Pat Stadler #1117	
Dennis Green #672	Daniel Trudell	
Steven Guderian	Eugene Vanderpol	
Jeffrey Guyer	Daniel W. Vomhoff, PhD #483	
Stephen Haverkamp	Paul Wade	
Kenneth Heichman	Scott Wagner #1238	
David Johnson	Mark Winter	
Stephen Neumann	Michael Clare	
Toby Gloekler	Gregory Taylor # 1227	
James Holder #1322	Wesley Van Diver # 1324	

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## Test your skills - Bicycles

1. A bicycle skids 17 feet on a level asphalt roadway before going off the roadway and into a ditch. The bicycle travels a horizontal distance of 12 feet and drops 5 feet vertically. The roadway coefficient of friction is 0.26. What was the speed of the bicycle when it first began to skid?
2. Assume that a bicycle can lean at a 20-degree angle before saddlebags straddling the rear tire come into contact with the pavement. If the bicyclist is traveling at 25 mph, what radius turn can the bicycle execute before the saddlebags strike the pavement?
3. A bicyclist coasts down a 6% grade from an initial speed of zero. The bicycle travels to the bottom of the grade over a distance of 100 feet. What is the speed of the bicycle at the bottom of the grade? Note: the actual speed would be less due to wind resistance.
4. A bicyclist leans at 15 degrees while executing a 35-foot radius turn. What is the speed of the bicycle, given these conditions?

5. You conduct an inspection on a bicycle and determine the following information:
- The chainwheel has 52 teeth
  - The freewheel has 16 teeth
  - The wheel size is 26.5 inches in diameter
- Assuming your bicyclist had a pedaling speed of 70 rpm, how fast could the bicyclist have been traveling?

## Measuring the Paint Film Thickness

Ken Zion

Why would you want to measure the paint thickness on a car body or frame?

If you can non-destructively measure the thickness of a painted surface, you can determine what, if anything, has happened to the metal directly under the paint. For example, paint measurements can assist you in determining if a VIN number has been ground / altered, or if a fender has been replaced in an attempt to hide a repairs related to an accident.

There are several different devices available on the market today, which can measure the thickness of paint and repair materials over the base metal. Some of the more exotic equipment can even determine the thickness of paint over a plastic surface.

Overall, there are numerous advantages of being able to non-destructively test the thickness of the paint / material on a vehicle body. Specific applications for a mil film thickness gauge include:

1. How thick the paint is and whether or not the vehicle should be repainted.
2. How many times the individual part has been painted.
3. How many times the entire car has been painted.
4. If new or used parts were installed on the car.
5. Determination of a hidden factory seam in a body panel.
6. Determination if a door skin (repair panel) has been replaced.
7. If the paint on a door, fender or hood has been blended.
8. Determination of the location of plastic filler / repaired areas.
9. Where a ¼ panel or similar welded part was spliced into the car body.
10. Determine if stamped VIN numbers have been altered.

Currently, there are several different types of mil film thickness gauges available to choose from. Dependent on the type of gauge, the thickness of a variety of different materials can be measured including: paint, plastic, rubber, enamel, electroplating, hard chrome and galvanizing.

The primary types of mil film thickness gauges are:

1. Magnetic
2. Electronic
3. Ultrasonic

The Magnetic gauge is the least expensive of the gauges currently available (under \$50). A common example of a magnetic gauge utilizes a spring-loaded magnet within a hollow tube. The gauge works off the basic principle of a magnet's ability to be attracted to ferrous materials. The magnetic end of the gauge is held 90° to a clean surface. Slowly the gauge is pulled away from the surface and the magnet releases from the surface, a scale on the side of the gauge depicts the material thickness. The process is usually repeated several times. The overall accuracy of the magnetic gauge is suspect and can vary significantly with different operators. An example of a magnetic gauge is shown in Figure # 1.

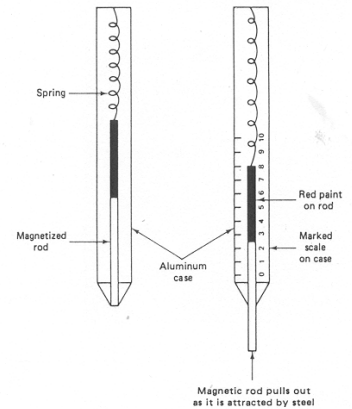


Figure # 1

The Electronic mil film thickness gauges are normally priced between \$500 to \$1,000, dependent upon accessories. As the name implies, the gauge uses batteries to generate an electrical field when the gauge is held against a car body. The thickness of the material over the metal surface increases or decreases the resistance of the field and thus provides a related reading of the paint thickness. Electronic gauges can test paint thickness over a variety of bases including ferrous / non-ferrous materials. Field calibration for an electronic gauge usually includes plastic foils or shims placed over a metal surface. Most gauges have the capability to interface with a computer for data transfer. The general accuracy of an electronic gauge is  $\pm 3\%$ . An example of an electronic gauge is shown in Figure # 2.



Figure # 2

The Ultrasonic mil film thickness gauges are normally priced between \$4,000 to \$8,000, dependent upon accessories. Sonar, the technique of sending sound waves through water and observing the returning echoes to characterize submerged objects, has been used prior to World War II. As early as 1929, the use of ultrasonic waves have been used to detect metal objects. In 1931, a patent obtained for using ultrasonic waves, using two [transducers](#) to detect flaws in solids. As its name implies, the Ultrasonic gauge utilizes an ultrasonic sound to measure the thickness of a substance over almost any base material including plastics, wood, ceramics, ferrous and non-ferrous metals and concrete. Frequently, the sensor information from the gauge is sent to a microprocessor and the results are shown on the instrument display.

## How to interpret measurements provided by a mil film thickness gauge

Most modern vehicles have an exterior paint film thickness of 2 to 4 mils (or thousandths). On the some vehicles, it is not uncommon to have 1.0 mil or less on the interior jambs or underside of the hood.

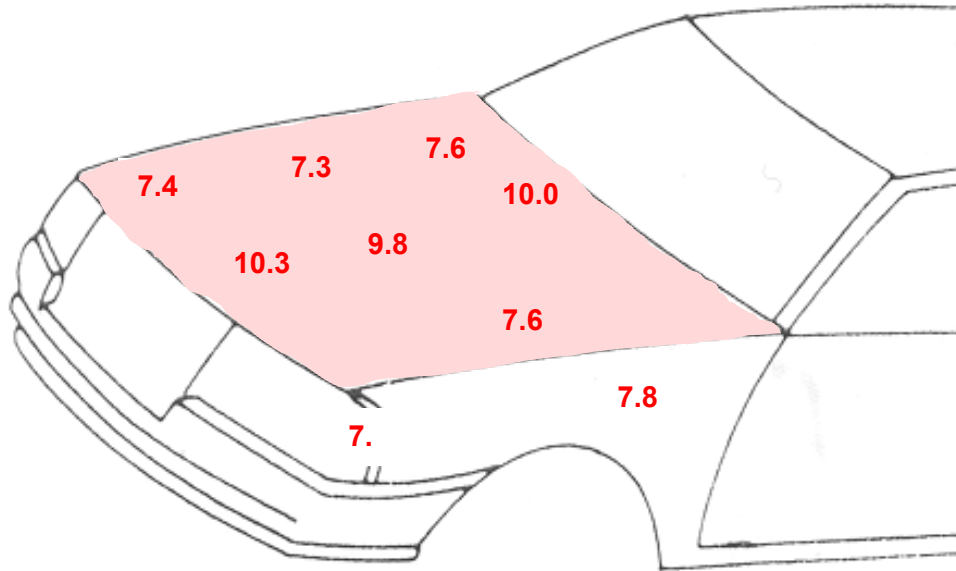
A general rule of thumb states every repaint adds 4 –5 mils of paint thickness. Most paint experts agree a paint film thickness should not exceed 12 mils or paint failure can occur.



Looking at the numbers that means most vehicles can be repainted twice, not to exceed 12mils. Examples of various readings are provided below:

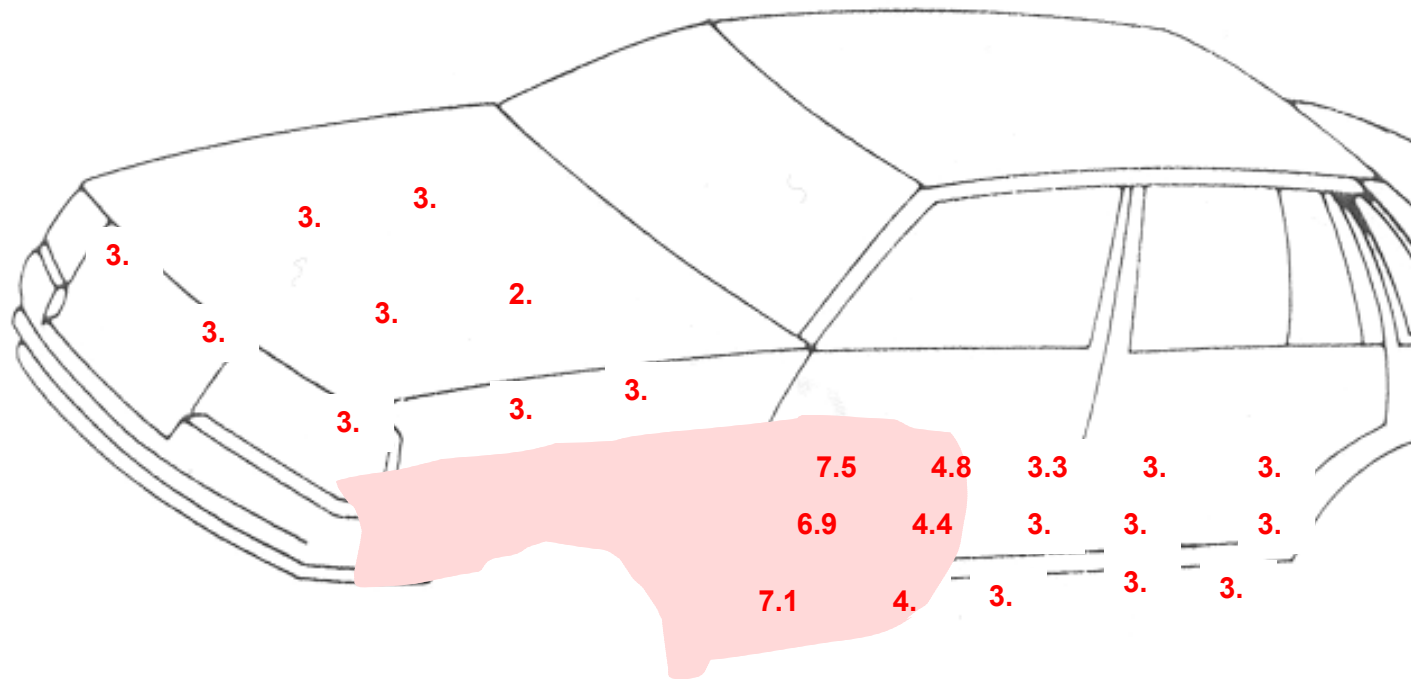
Hood repaint:

A hood is typically too large for a painter's arm to reach all the way across. As a result, the painter will start on one side of the hood and move toward the middle, then stop, move to the other side of the vehicle and continue painting. This process always results in slightly higher readings in the center of the hood. As shown below.





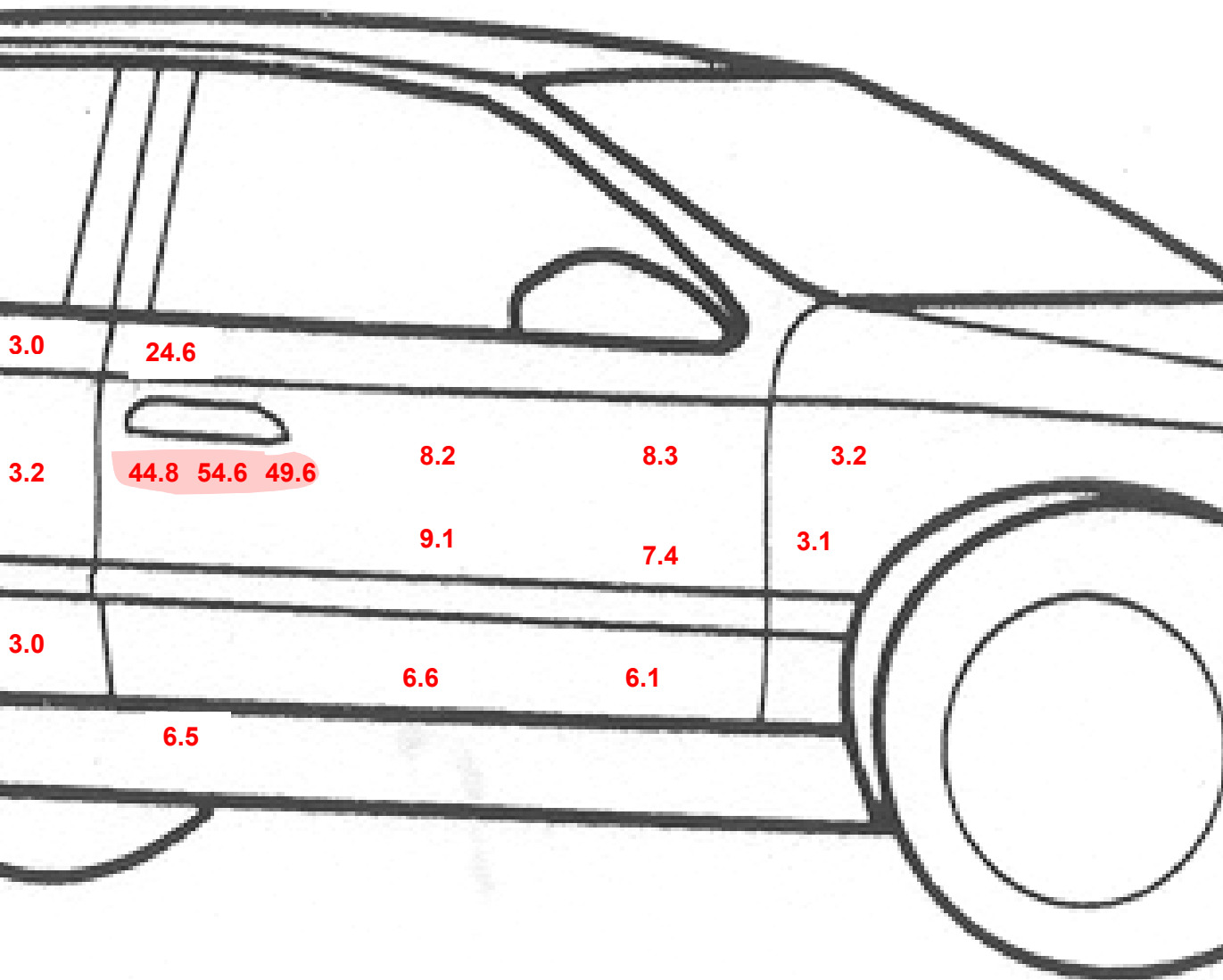
Blending the left front fender into the drivers door:



As shown above, the left fender has been repaired and refinished. The paint has been blended in to the existing door paint. Note the mil film thickness measurements on the door decrease as the paint is blended into the door. Measurements of the adjacent left rear door and hood should be very similar to each other.

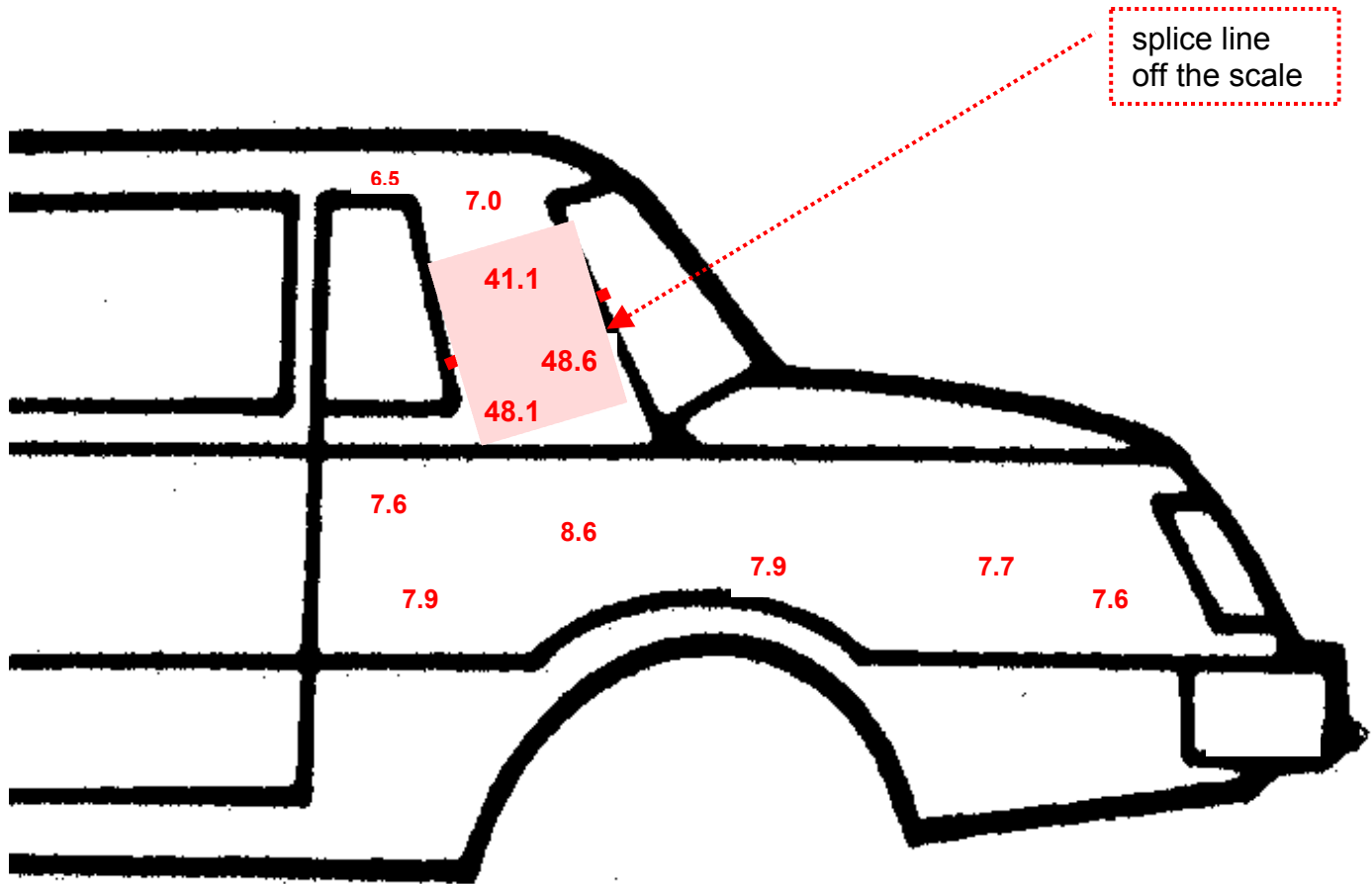
Suspected prior theft:

If measurements surrounding a door handle are unusually high, suspect a possible prior theft. A screwdriver can be used to punch out the metal surrounding a door handle and thus allow access to the lock mechanism. Repairs to the door will include plastic body filler, hence the higher readings. An example is provided below.



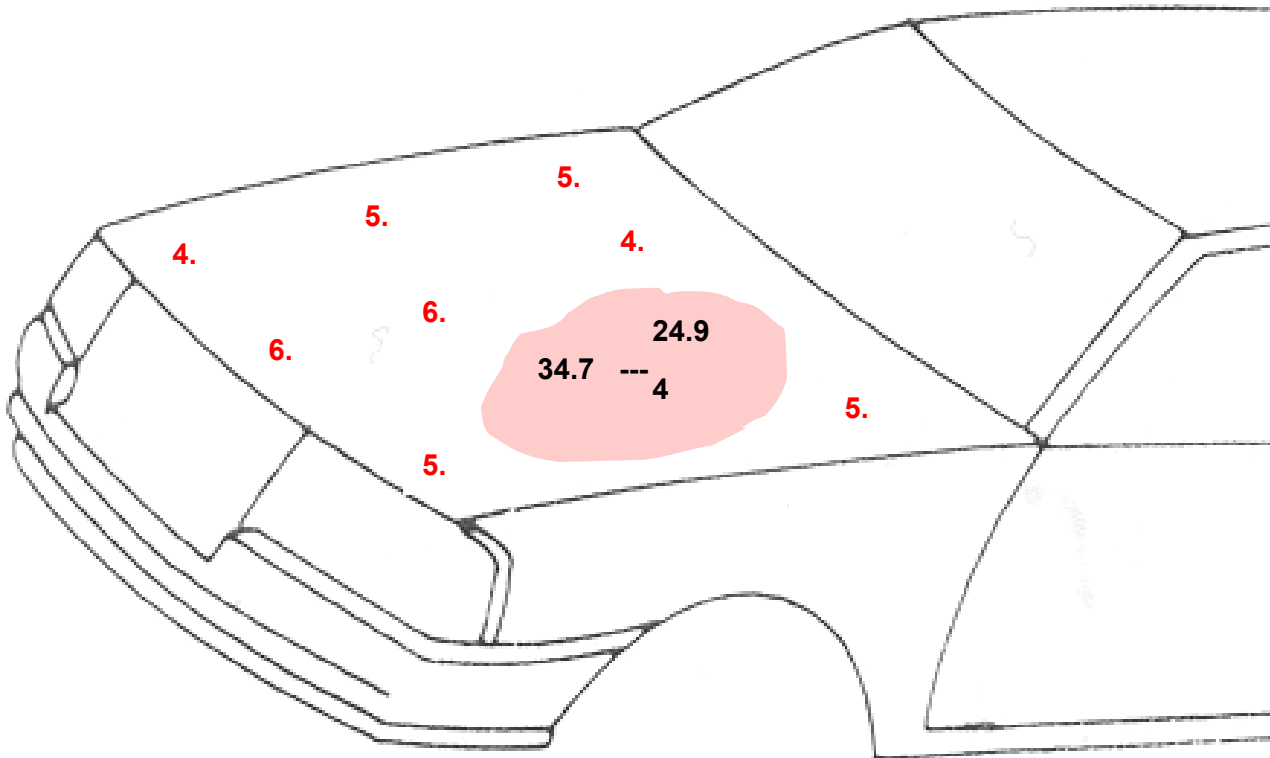
¼ panel sectioning

A typical ¼ panel replacement operation will involve cutting and welding into the sail panel. The welding operation will result in a very small area, the width of the sail panel, which will contain very high measurements and, in most cases, measurements off the scale.



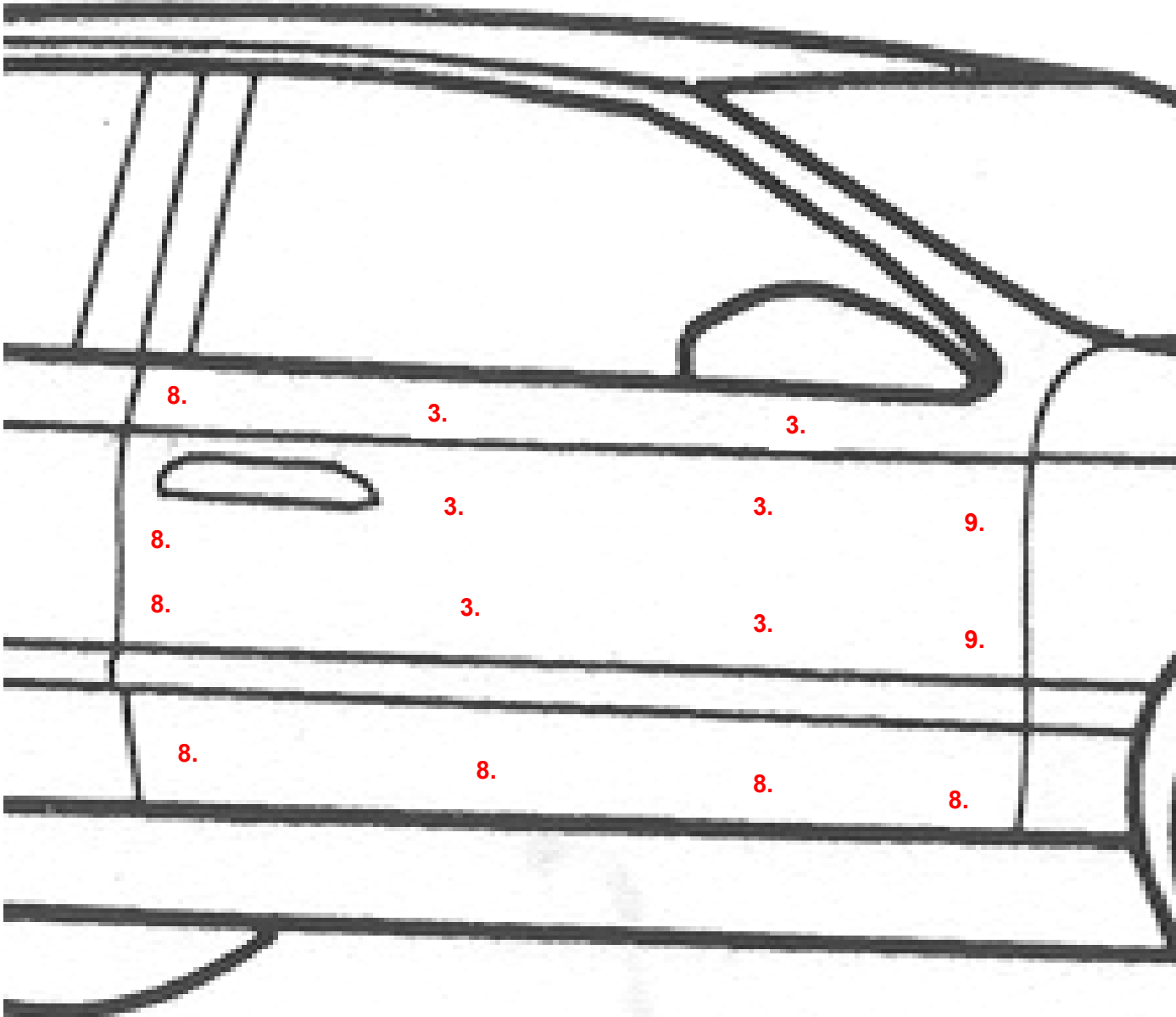
Repairs / plastic filler

As shown below, the red areas depict sheetmetal repairs (plastic filler) under the paint. Measurements of the red areas can provide an outline the prior repairs. The “ -- “ marks in the middle of the repaired area represent measurements which were off the scale, indicating the thickest part of the plastic filler.



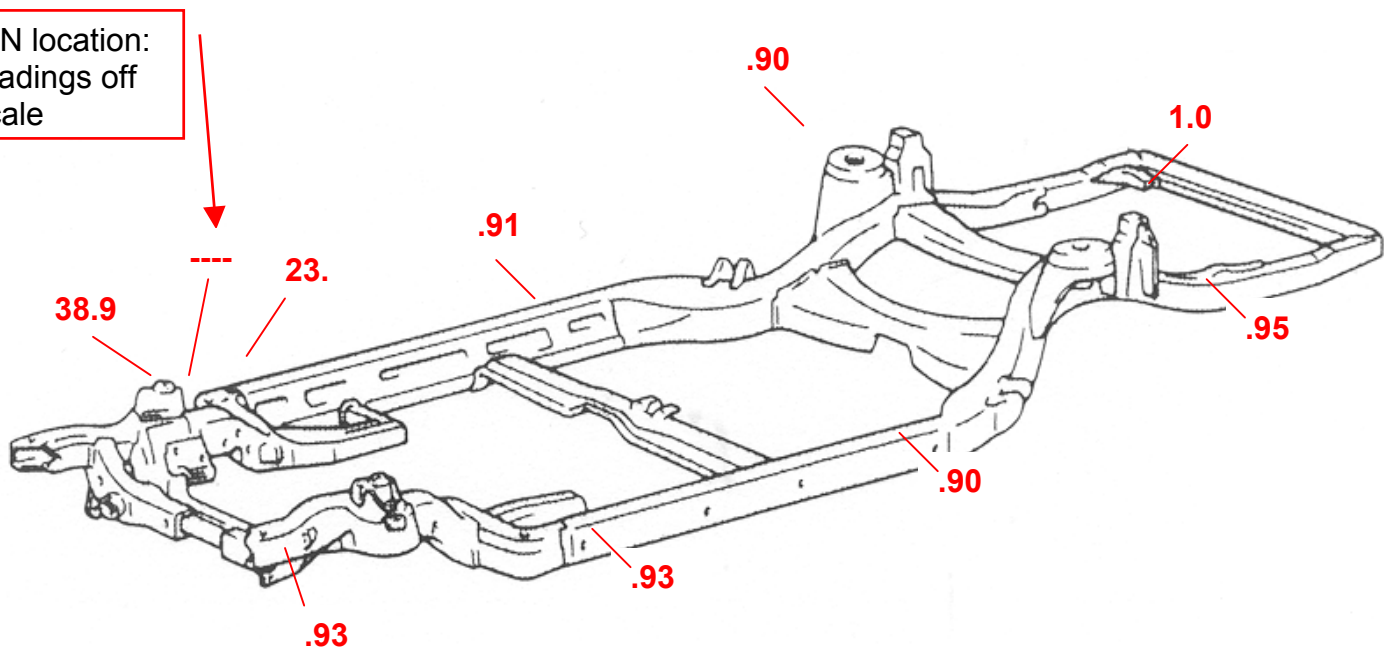
Door skin / repair panel replaced

Usually door skin replacements result in higher measurements around the left, right and bottom perimeter of the door. The top of the door (under the door glass) will be consistent with the middle of the door.



## Measuring a frame for possible VIN alteration

Measure multiple areas to establish what the mil film thickness should be. Typical measurements are .90 → 1.2 mils. Roadway grease, dirt and undercoat materials can produce higher readings. With the surrounding frame members measured, measure the VIN and the immediate adjacent area.



## *Truckin' with CA<sup>2</sup>RS Conference CD*

The CD contains all of the data from the 16 crash tests and off-tracking tests that was collected from the 2002 Heavy Vehicle Conference. It also contains notebook material, classroom presentations, photographs, and some videos.

Price: Non-members \$25.00

Members \$15.00

For more information or ordering information send an e-mail to [caars@hotmail.com](mailto:caars@hotmail.com)





# CA<sup>2</sup>RS Versus Bikes

Schedule of Events		
Tuesday, October 14 <sup>th</sup>	8:00 am – 5:00 pm	ACTAR test
Wednesday, October 15 <sup>th</sup> Continental Breakfast 7:30 am – 8:30 am	8:00 am – 8:30 am	Opening Remarks
	8:30 am – 9:45 am	Applicable Vehicle Code Laws <b>Kent E. Boots</b> <b>Orange Co. Sheriff's Dept.</b>
	9:45 am – 10:00 am	Morning Break
	10:00 am – 12:00 pm	Razor Scooters <b>Tim Reust</b> <b>Accident Science</b>
	12:00 pm – 1:00 pm	Buffet Lunch (provided)
	1:00 pm – 3:00 pm	Bicycles <b>Tim Reust</b> <b>Accident Science</b>
	3:00 pm – 3:15 pm	Afternoon Break
	3:15 pm – 5:00 pm	Excel Spreadsheet Basics <b>Bruno Schmidt</b> <b>Southwest Missouri State University</b>
Thursday, October 16 <sup>th</sup> Continental Breakfast 7:30 am – 8:30 am	8:00 am – 10:00 am	Excel Spreadsheet Applications <b>Bruno Schmidt</b> <b>Southwest Missouri State University</b>
	10:00 am – 10:15 am	Morning Break
	10:15 am – 12:00 pm	Personal Mobility Devices <b>Tom Fugger</b> <b>Accident Research &amp; Biomechanics, Inc.</b>
	12:00 pm – 1:00 pm	Buffet Lunch (provided)
	1:00 pm – 2:45 pm	Personal Mobility Devices (continued) <b>Tom Fugger</b> <b>Accident Research &amp; Biomechanics, Inc.</b>
	2:45 pm – 3:00 pm	Afternoon Break
	3:00 pm – 5:00 pm	Collision Investigation Case Studies - Lead By: Kerry Berg, Jerry Eubanks, Sean Shimada, Dr. Federico Vaca, TBA Followed by: Q & A open discussion
5:00 pm – 7:00 pm	Exhibitors Event No-Host bar and appetizers	
Friday, October 17 <sup>th</sup> Continental Breakfast 7:30 am – 8:30 am	8:00 am – 10:00 am	Excel Features for Accident Recon. <b>Bruno Schmidt</b> <b>Southwest Missouri State University</b>
	10:00 am – 10:15 am	Morning Break
	10:15 am – 12:15 pm	Skateboard/ Rollerblade Speeds <b>Jerry Eubanks</b> <b>Automobile Collision Cause Analysis</b>
	12:15 pm – 1:15 pm	Buffet Lunch (provided)
	1:15 pm – 2:45 pm	Biomechanical Injury Causation <b>Sean Shimada</b> <b>Biomechanical Consultants of California</b>
	2:45 pm – 3:00 pm	Afternoon Break
	3:00 pm – 4:00 pm	Medical Field /Collision Investigation Efforts <b>Dr. Federico E. Vaca, M.D., M.P.H., F.A.C.E.P</b> <b>UCI Medical Center</b>
4:00 pm – 5:00 pm	Q & A Closing Remarks	



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### Test Your Skill Answers:

Answers:

1. 18.63 mph
2. 114.81 feet
3. 57.54 fps or 39.23 mph
4. 17.37 fps or 11.84 mph
5. 26.29 fps or 17.92 mph

For detailed solutions, contact Kent E. Boots. E-mail: [kboots@ocsd.org](mailto:kboots@ocsd.org)