RECONSTRUCTION: The Language

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Western New England University

Remember: This is not *your* jury pool.

Email from Nebraska TSRP:

John,

I just finished preparing my Trooper for his testimony, and if he talks like that to the jury they won't understand anything he's saying.

Why is it difficult to explain collision reconstruction in "*plain speak*"?

Your instructor trained you

how to do it!

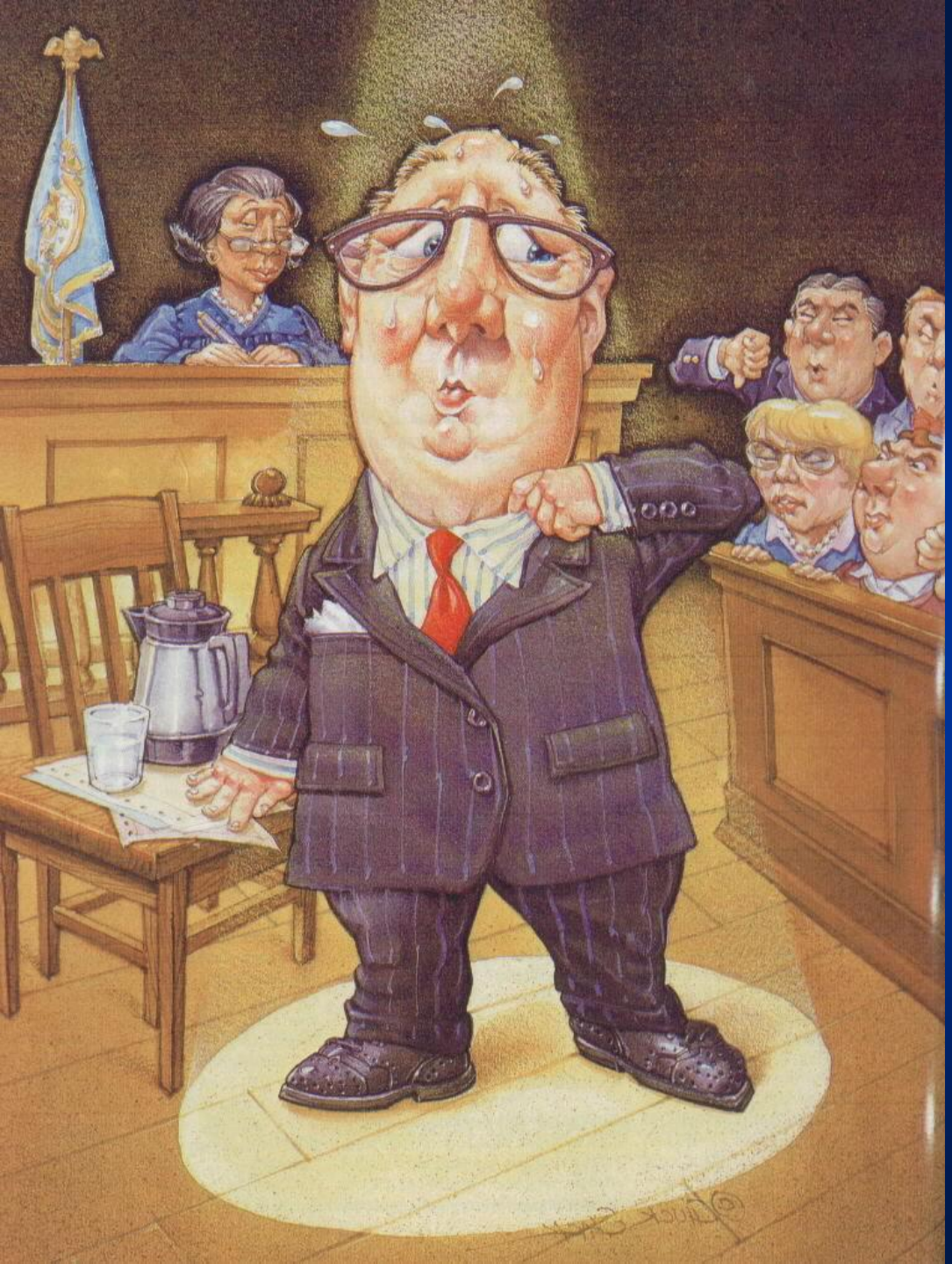
The jury just wants to know

what it is *about*!

WHEN YOU TESTIFY, YOU

ARE A **STORYTELLER**

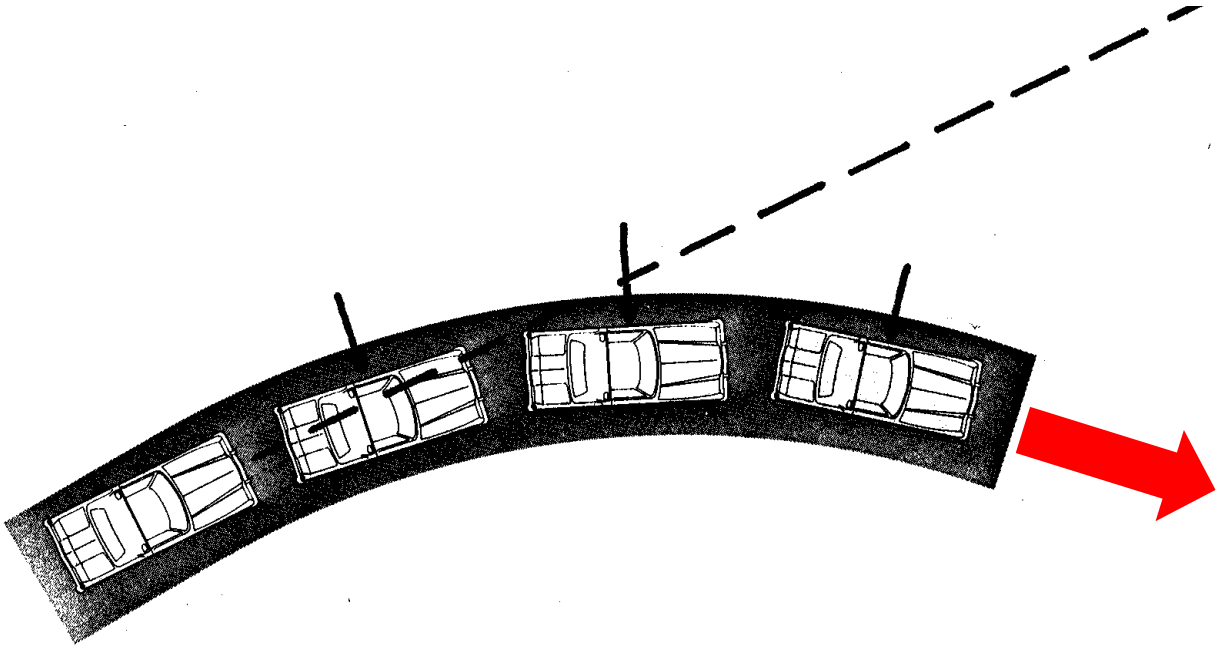
NOT AN INSTRUCTOR



“If I had been good at math…”

You don’t have to be good at math, but…. you must understand the expert’s vocabulary.

DEFENSE EXPERT TESTIMONY:



"The vehicle maintained
a constant speed of 35 mph
as it accelerated through the turn."

What does acceleration mean ?

Speeding up
Slowing down
Changing direction

The mathematical definition of acceleration:

$$\vec{a} = \Delta\vec{V} / \Delta t$$

Satchel Paige

"It's not what you don't know that will get you in trouble – it's what you do know that ain't so."

Why do we even need collision reconstruction ?

How good are

you as a witness ?

State of WY v. Mitton

1. What part of the vehicle struck the utility pole?

____ left front
____ right front
____ center of front

1. What part of the vehicle struck the utility pole?

_√__ left front
____ right front
____ center of front

2. Which side of the vehicle came up first during the rolling motion?

___ driver's side
____ passenger's side
____ don't know

2. Which side of the vehicle came up first during the rolling motion?

_ √ _ driver's side

_____ passenger's side

_____ don't know

3. How far was it from the impact with the utility pole to the start of the rollover?

_____ ft

3. How far was it from the impact with the utility pole to the start of the rollover?

__45__ ft

4. Did you at any time during the collision see the driver ejected from the vehicle?

_____ YES
_____ NO

4. Did you at any time during the collision see the driver ejected from the vehicle?

_____ YES

__ √ __ NO

5. In what position was the vehicle when it came to its final rest?

____ on its wheels
____ on its roof
____ on the driver's side
____ on the passenger's side

5. In what position was the vehicle when it came to its final rest?

____ on its wheels
_ √ _ on its roof
____ on the driver's side
____ on the passenger's side

6. What part of the vehicle was facing you when it came to rest?

____ front
____ rear
____ driver's side
____ passenger's side

6. What part of the vehicle was facing you when it came to rest?

____ front
____ rear
____ driver's side
_ √ _ passenger's side

7. What was the distance from the utility pole to the final rest of the vehicle?

_____ ft

7. What was the distance from the utility pole to the final rest of the vehicle?

__80_ ft

8. What was the speed of the vehicle when it hit the pole?

_____ mph

8. What was the speed of the vehicle when it hit the pole?

__45_ mph

9. How many times did the vehicle roll over?

____ less than one
____ one
____ more than one
____ more than two

9. How many times did the vehicle roll over?

_ √ _ less than one

____ one

____ more than one

____ more than two

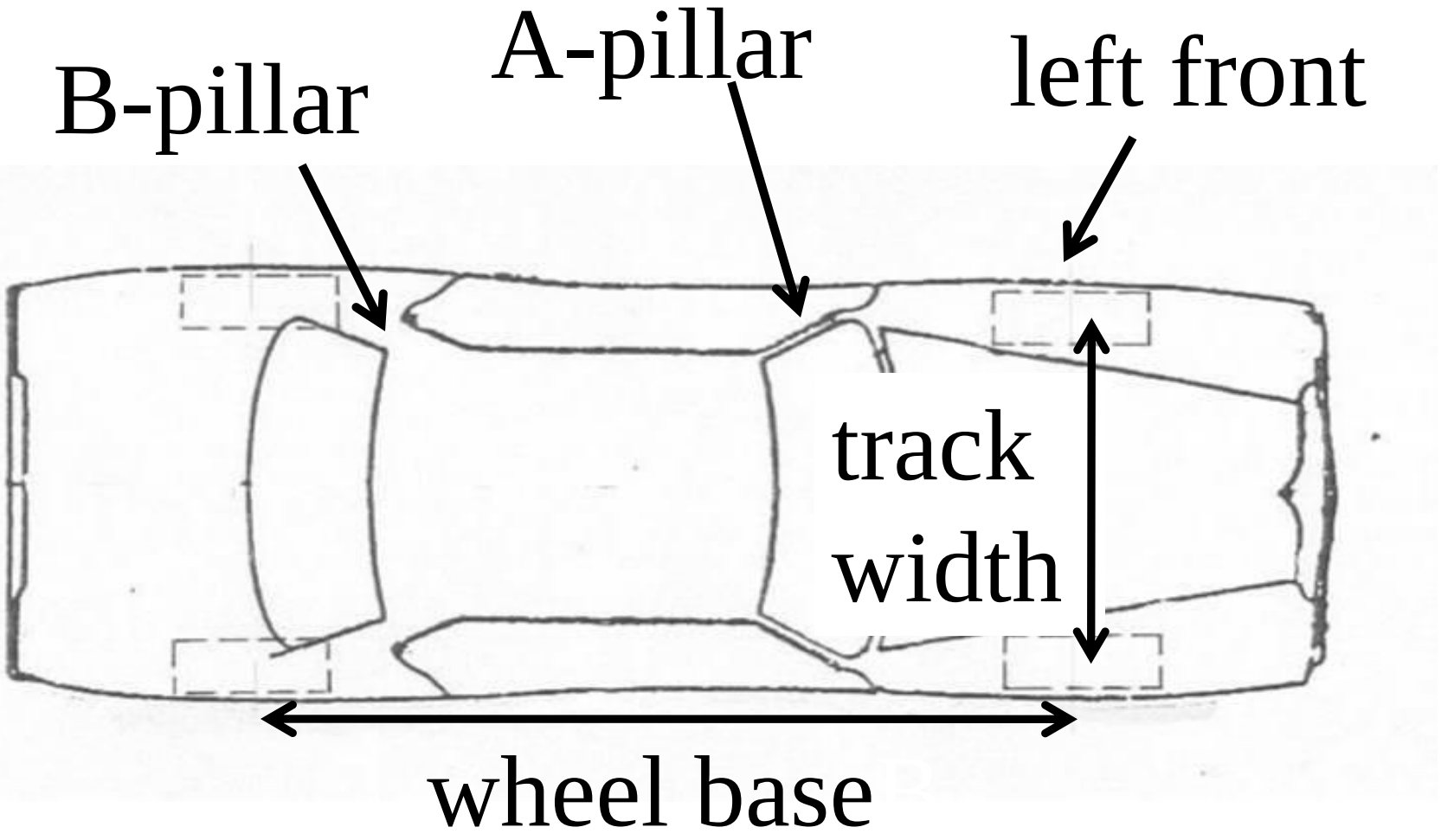
10. What color was the vehicle?

____ black
____ red
____ blue
____ green
____ white

10. What color was the vehicle?

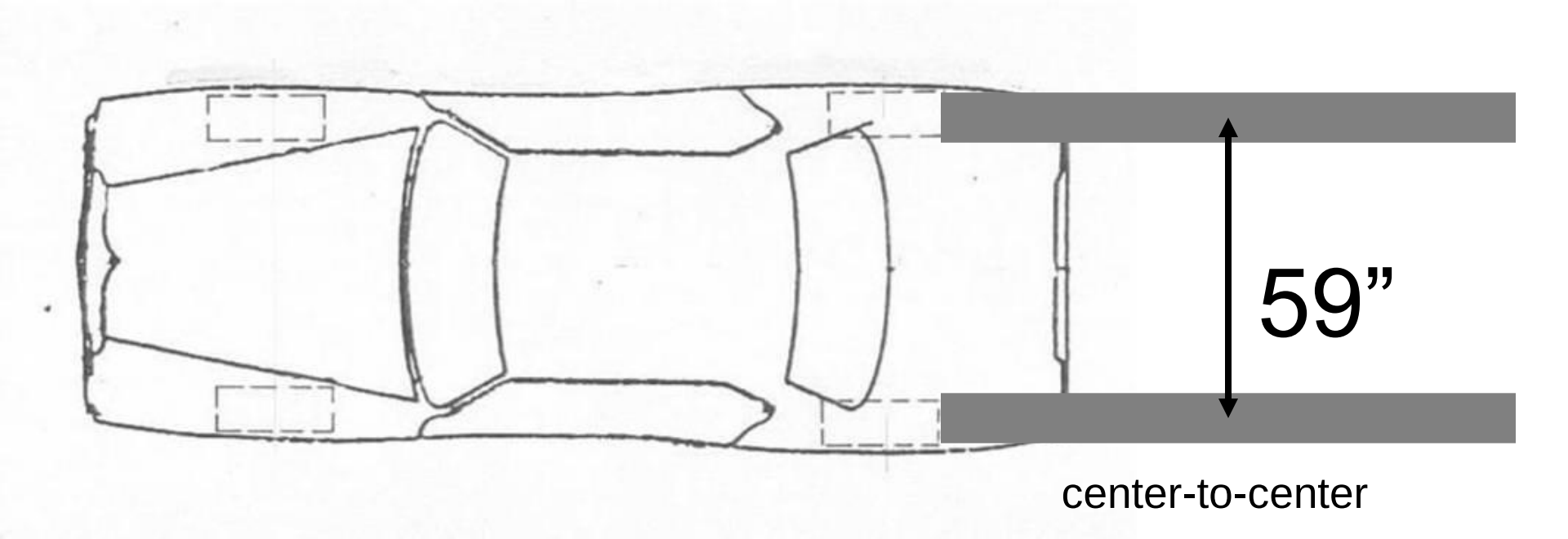
____ black
____ red
____ blue
_ √ _ green
____ white

VOCABULARY

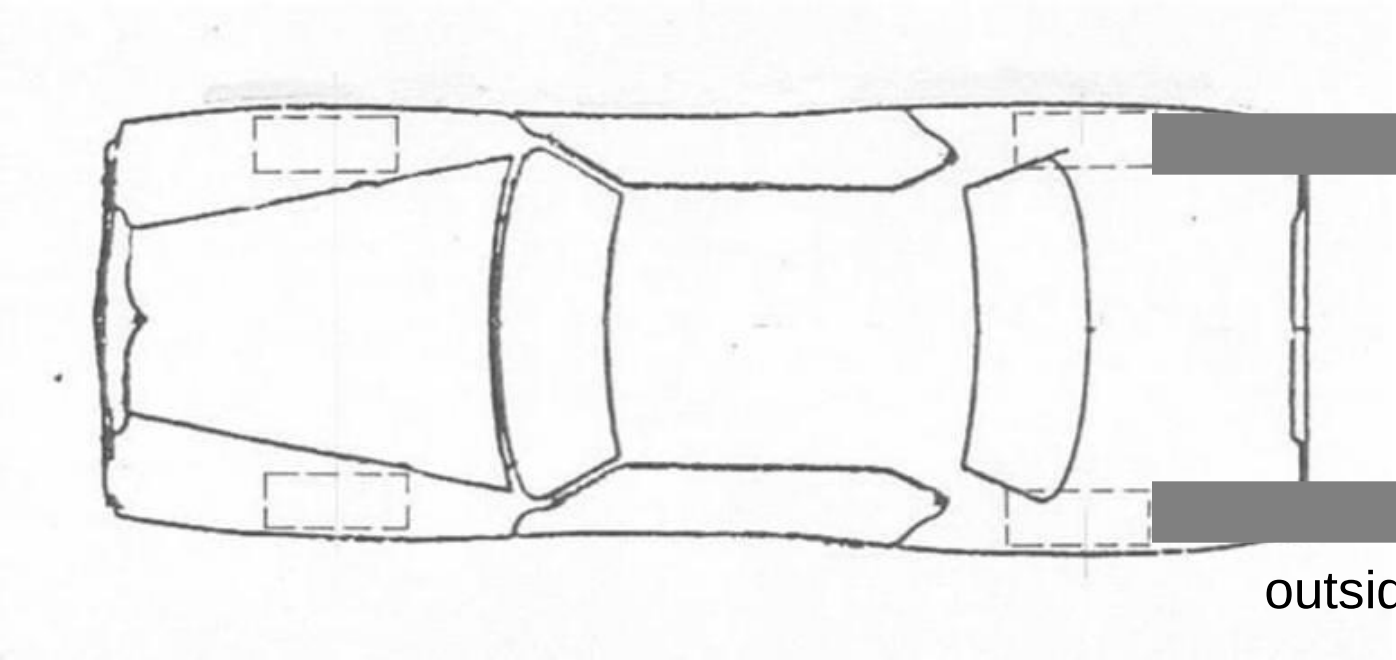

B-pillar
A-pillar
left front
track
width
wheel base

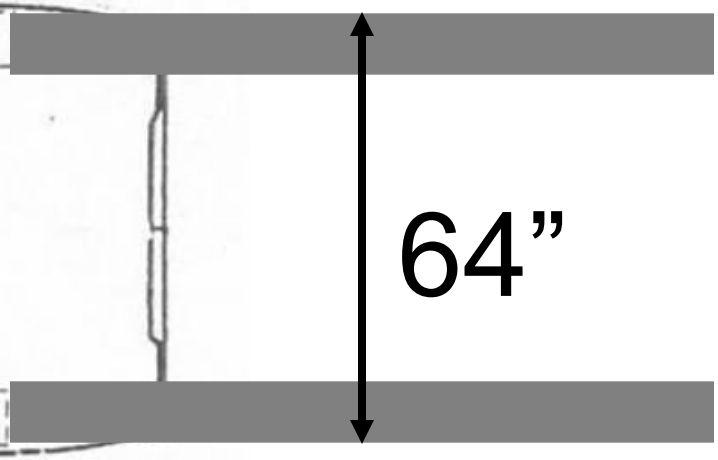

FL v. Farrall
track
width

Track Width Specification for Farrall's vehicle



Measurement by FHP





outside-to-outside

Are speed and velocity the same?

What's the difference between speed and velocity ?

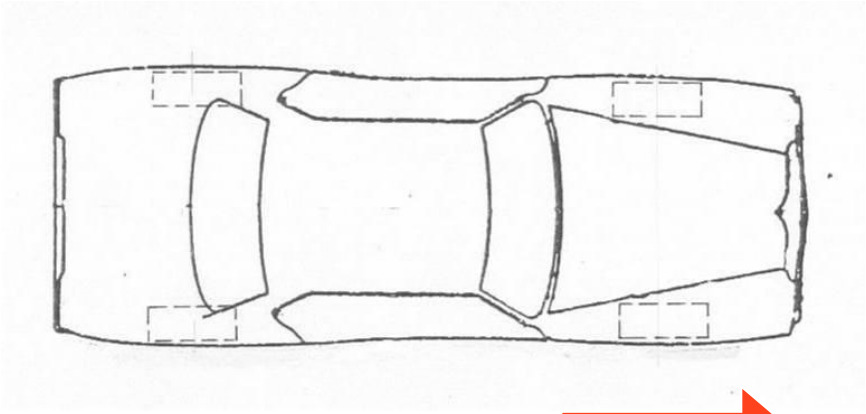
SCALAR

(quantity only)

What's the difference between speed and velocity ?

VECTOR

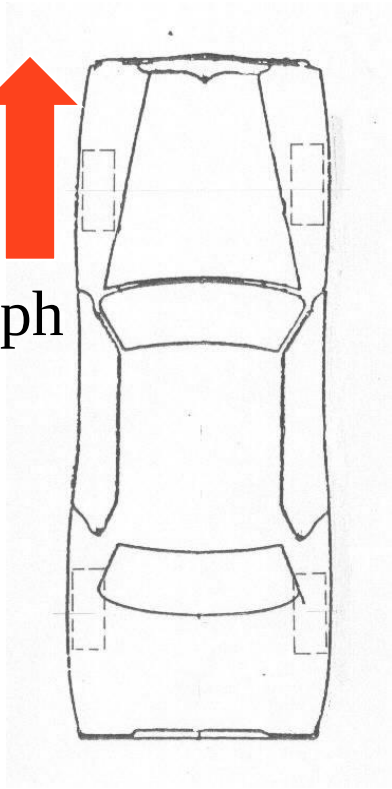
(quantity and direction)



Eastbound

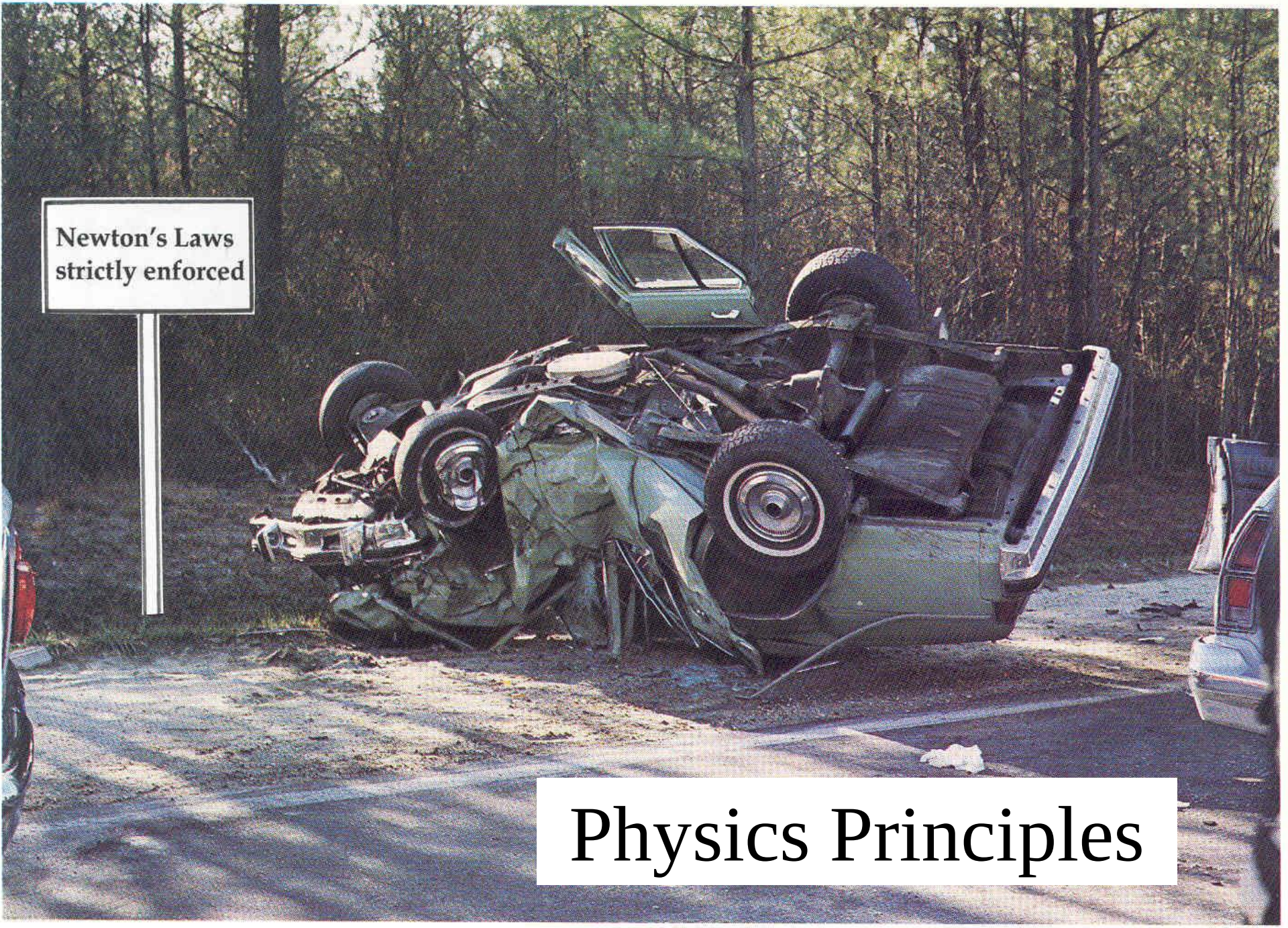
30 mph

30 mph



Northbound

same speeds,
different velocities



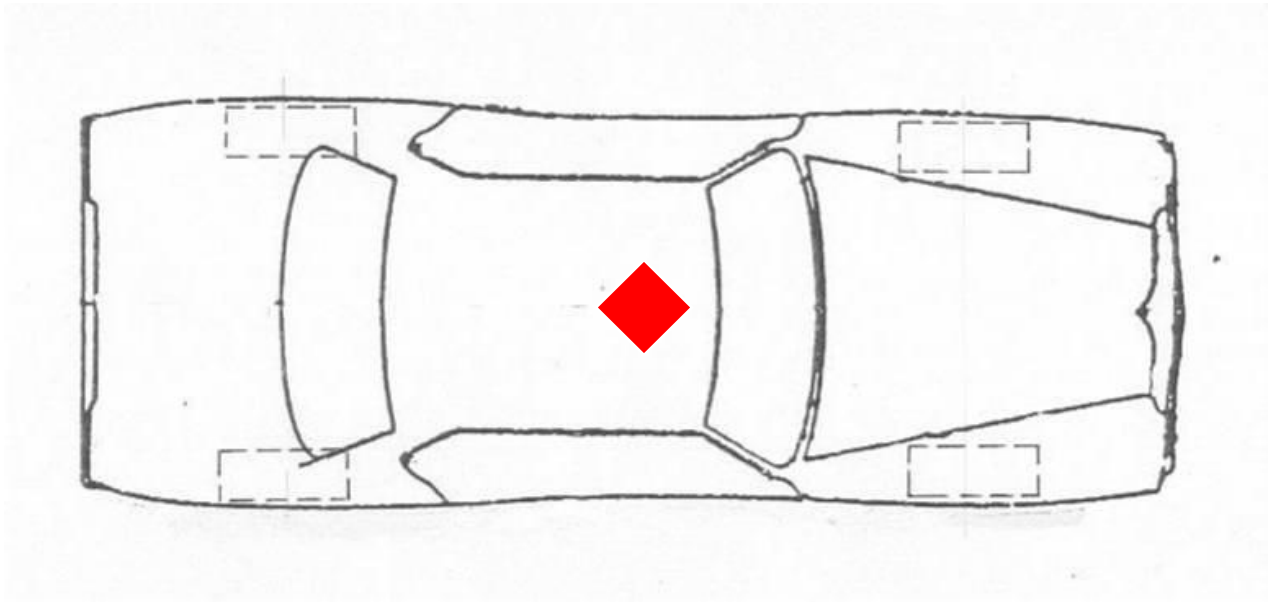
Physics Principles

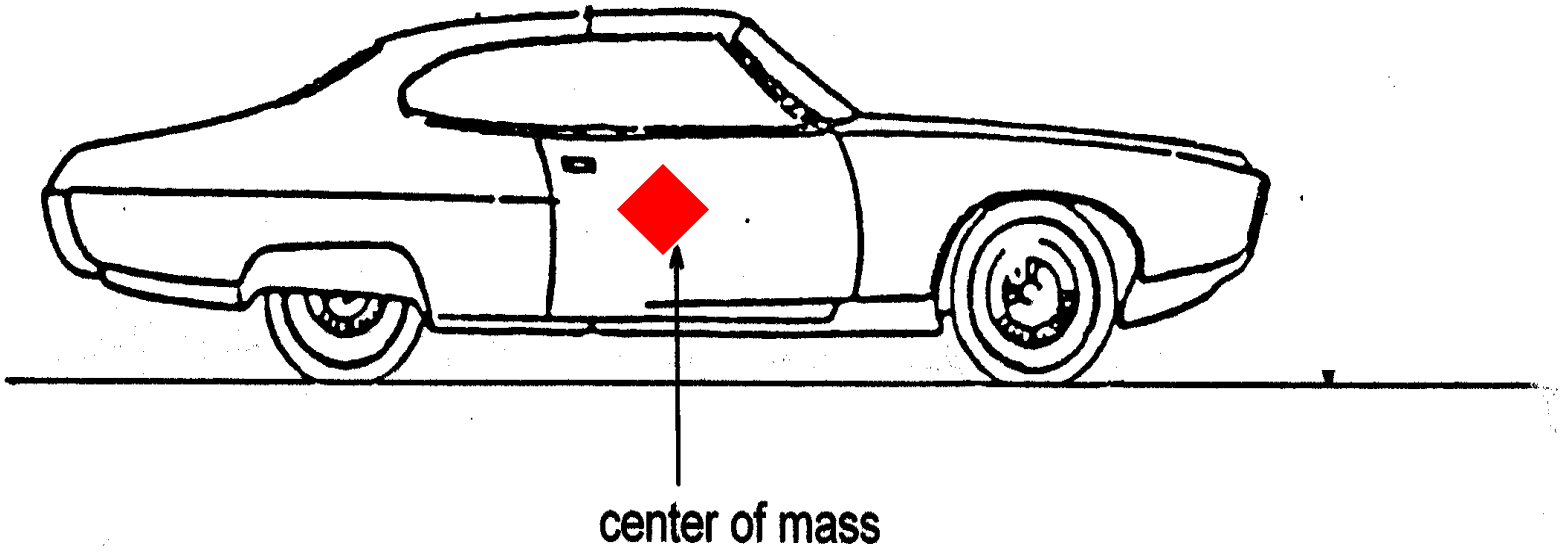
CENTER OF MASS

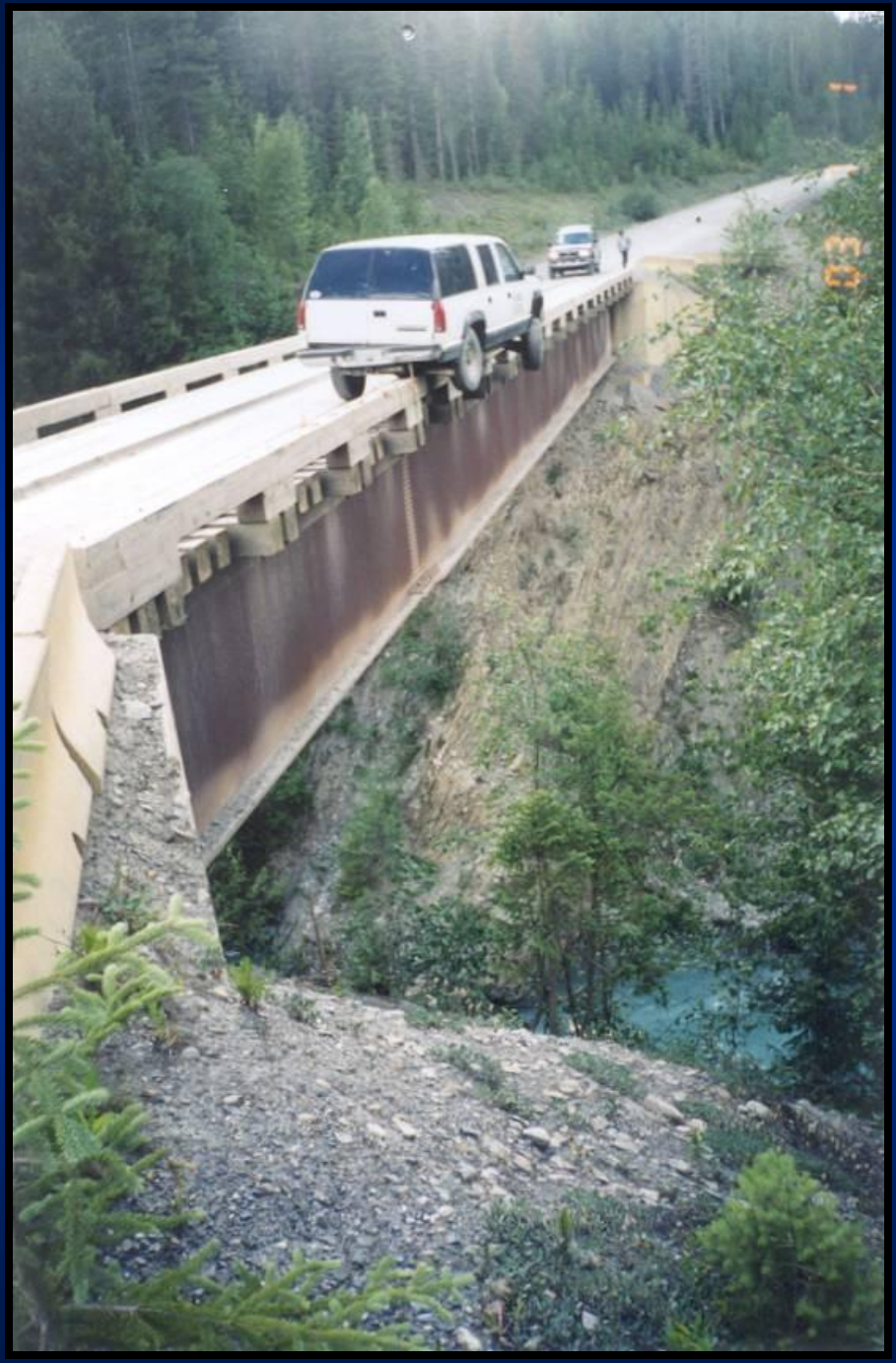
(center of gravity)

THE POINT WHERE THE WEIGHT SEEMS TO BE CENTERED

THE “BALANCE POINT”




center of mass



FACT:

The location of the center of mass is seldom used in the calculations !

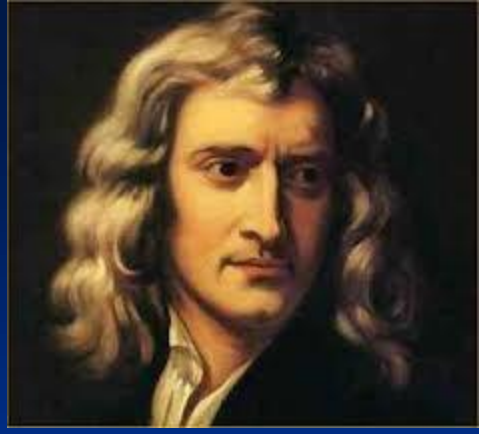
But ... beware of the defense!

T/F In a rear-end collision whiplash injury may occur because the head is suddenly pushed backwards by the force of the impact.

T/F In a rear-end collision whiplash injury may occur because the head is suddenly pushed backwards by the force of the impact.

FALSE

NEWTON'S FIRST LAW:



OBJECTS AT REST REMAIN AT REST, UNLESS UNBALANCED EXTERNAL FORCES ACT ON THE OBJECT TO CHANGE ITS MOTION.

NEWTON'S FIRST LAW:

OBJECTS AT REST REMAIN AT REST

STOPPED VEHICLE, STRUCK FROM REAR

VEHICLE moves forward, HEAD stays in place

NEWTON'S FIRST LAW:

OBJECTS IN MOTION MAINTAIN THEIR MOTION, UNLESS UNBALANCED EXTERNAL FORCES ACT ON THE OBJECT TO CHANGE ITS MOTION.

NEWTON'S FIRST LAW:

OBJECTS IN MOTION MAINTAIN THEIR MOTION …

FL v. Farrall

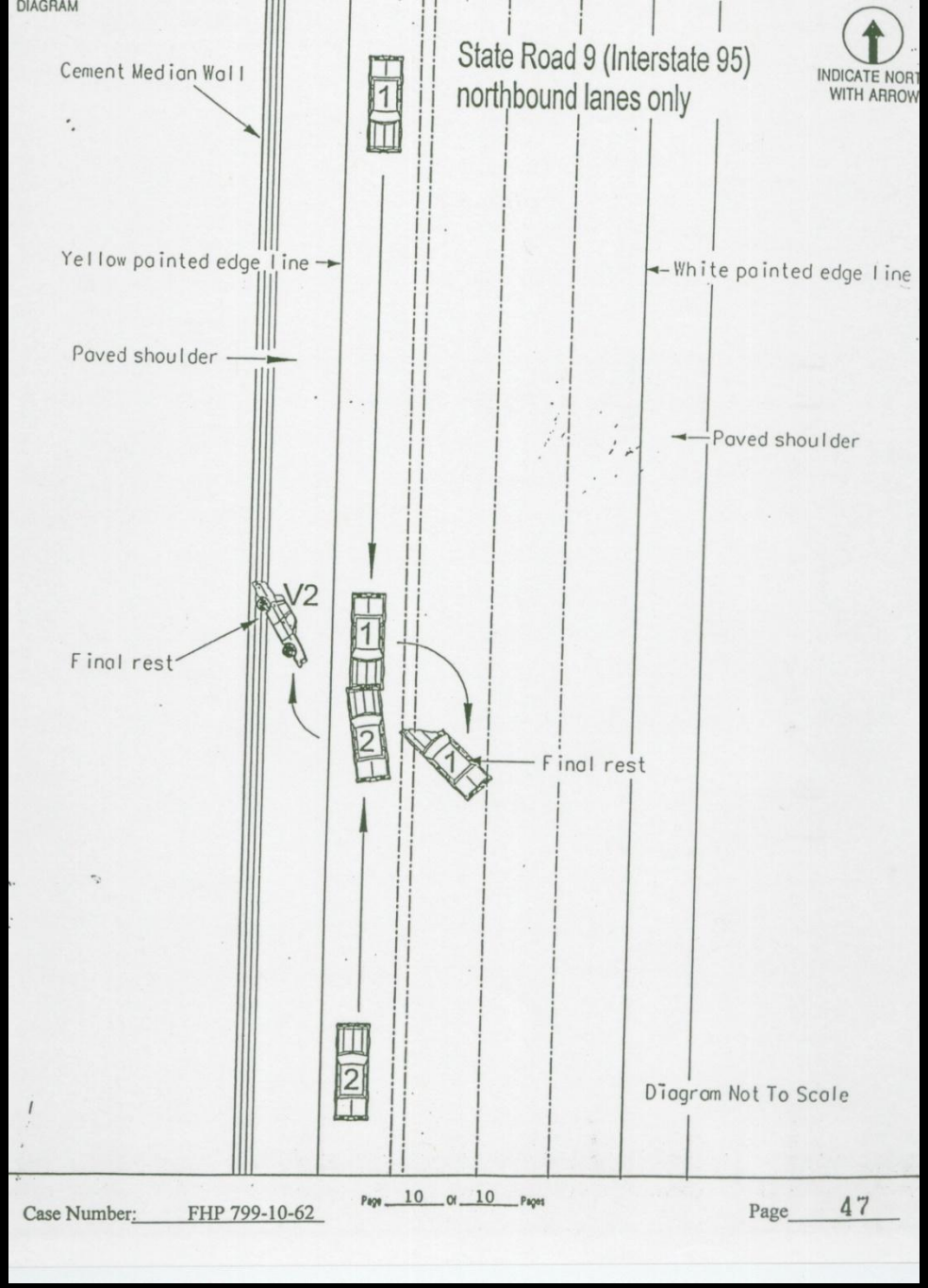
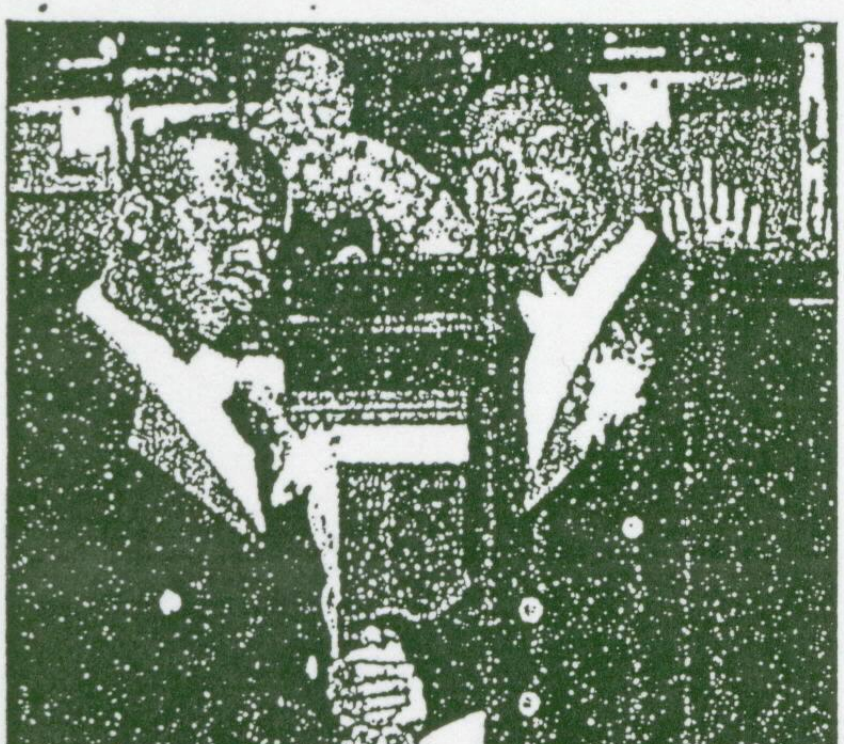


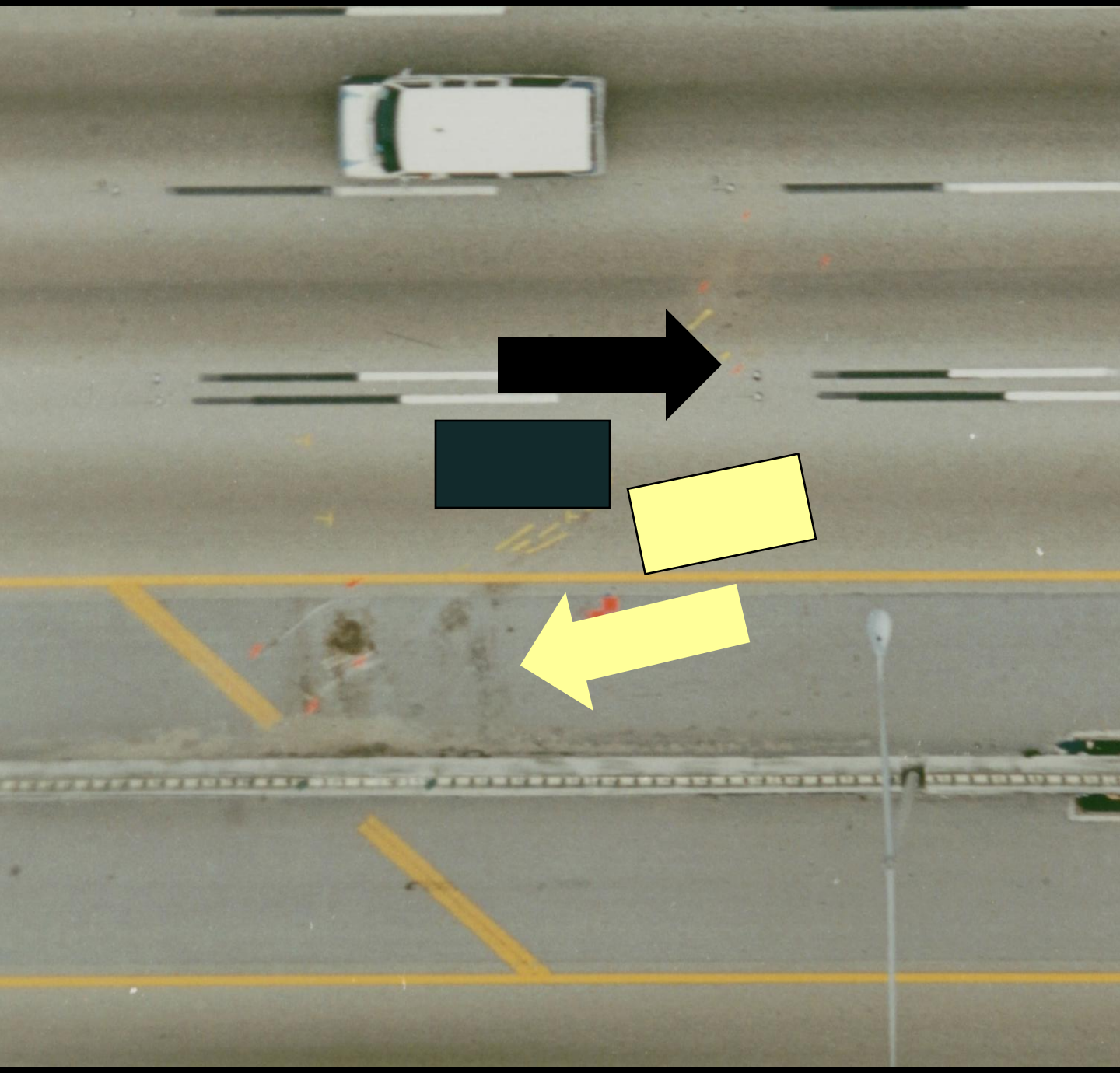
DIAGRAM
Cement Median Wall
State Road 9 (Interstate 95)
northbound lanes only
INDICATE NORT
WITH ARROW
Yellow painted edge line
White painted edge line
Paved shoulder
Paved shoulder
V2
Final rest
Final rest
Diagram Not To Scale
Case Number: FHP 799-10-62
Page 10 Of 10 Pages
Page 47

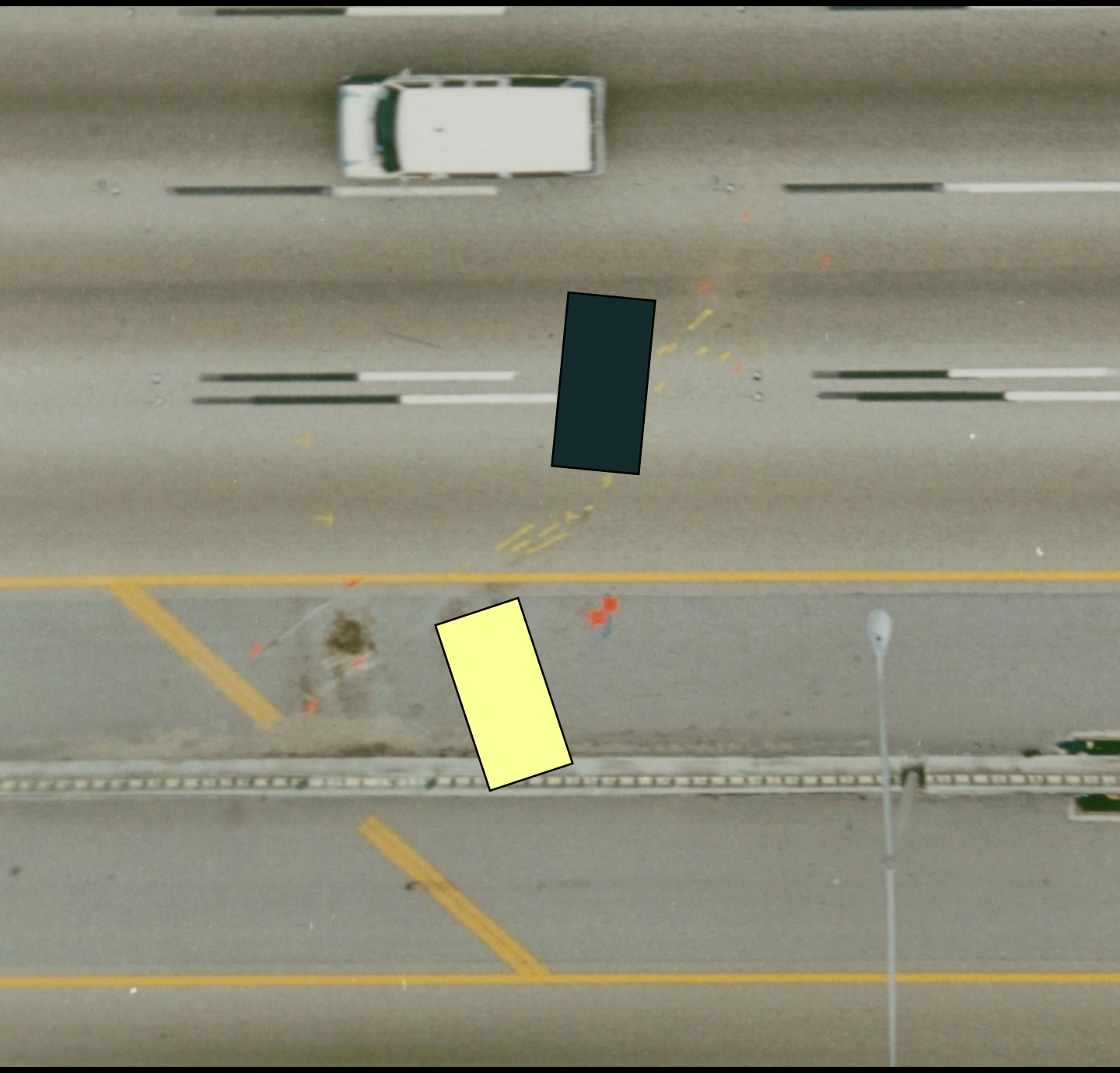


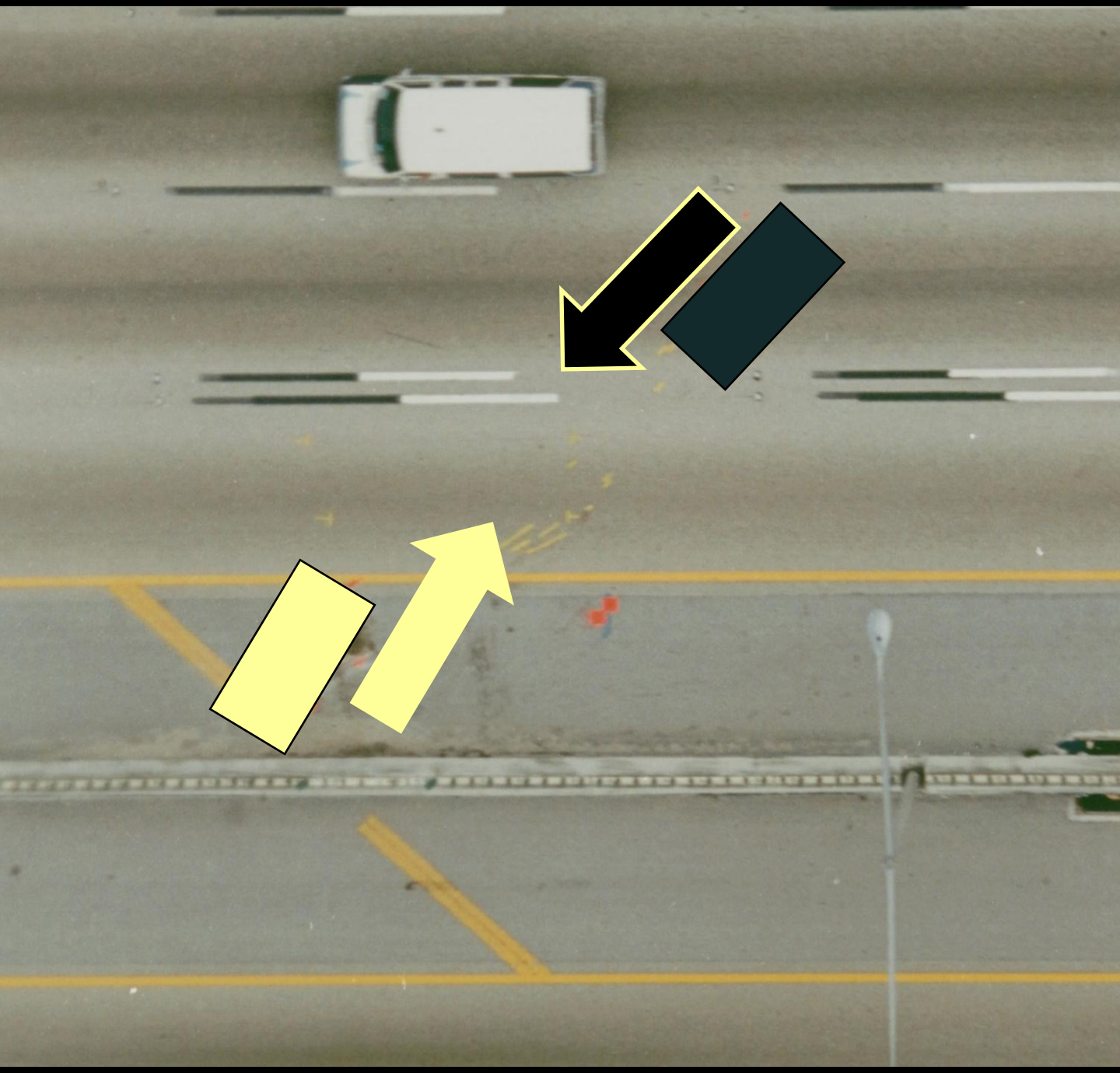
BROTHERS: Only days before their deaths in a head-on collision with an FBI agent on I-95, Maurice Williams, 23, left, and Craig Chambers, 19, attended a friend's wedding.

WRONG WAY TO DIE

On Nov. 23, two cars heading in opposite directions in the northbound lanes of Interstate 95 collided, killing two brothers. How it happened and who is to blame remain a mystery.





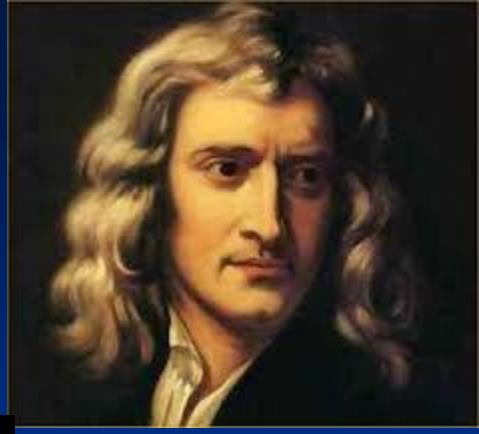


T/F In a pedestrian crash the height of the bumper should match the location of the impact injury on the pedestrian.

FALSE

T/F In a pedestrian crash the height of the bumper should match the location of the impact injury on the pedestrian.

1st Law example:



CSI

"pitching"
or "bumper dive"

WEIGHT SHIFTS TO THE FRONT

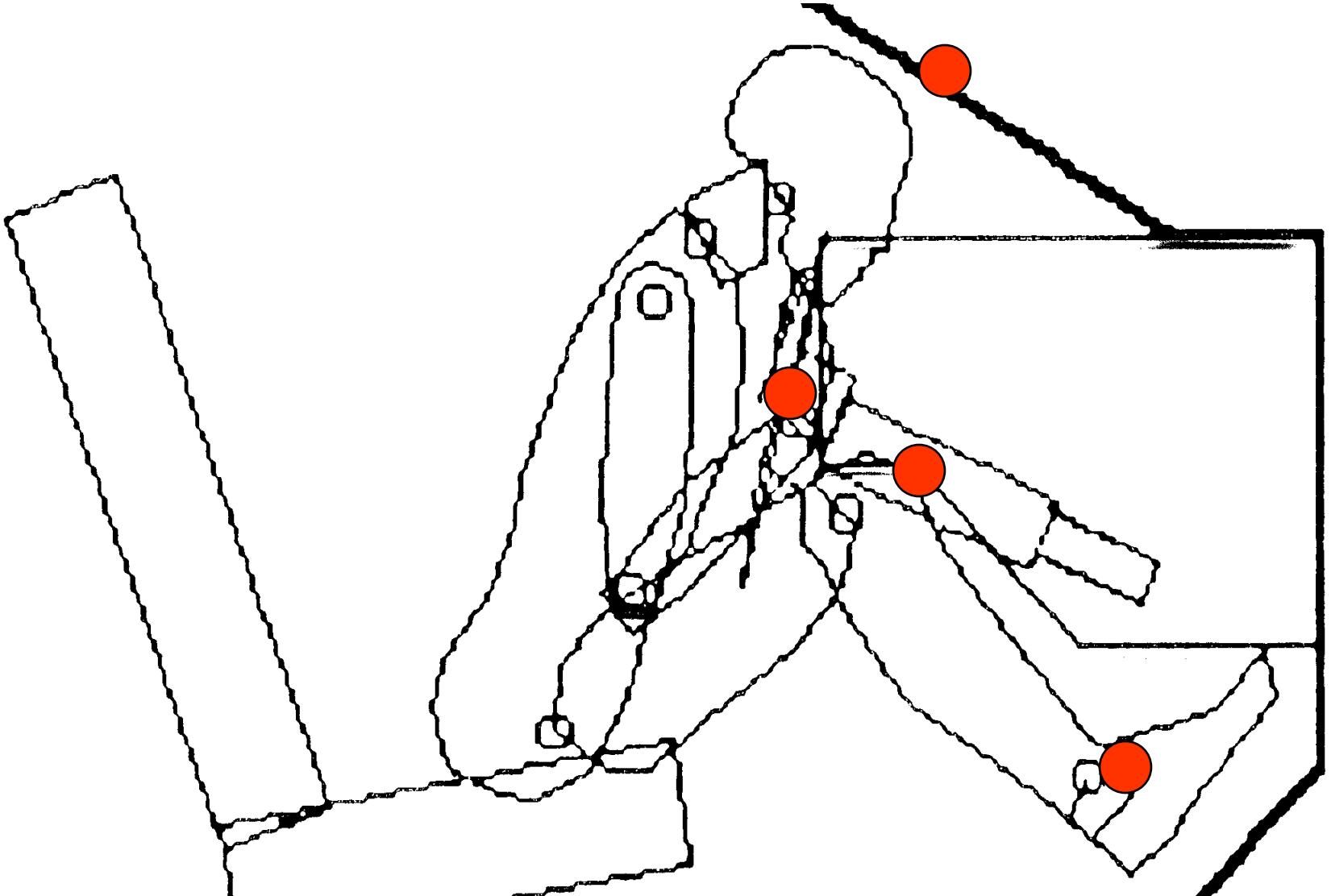
Notice the shape of the tires.

Let’s do an experiment to show how friction is related to weight.

FRICTION = WEIGHT x drag factor

more friction on front tires

FIRST LAW MOTION MAY PRODUCE EVIDENCE OF OPERATION




CUFF

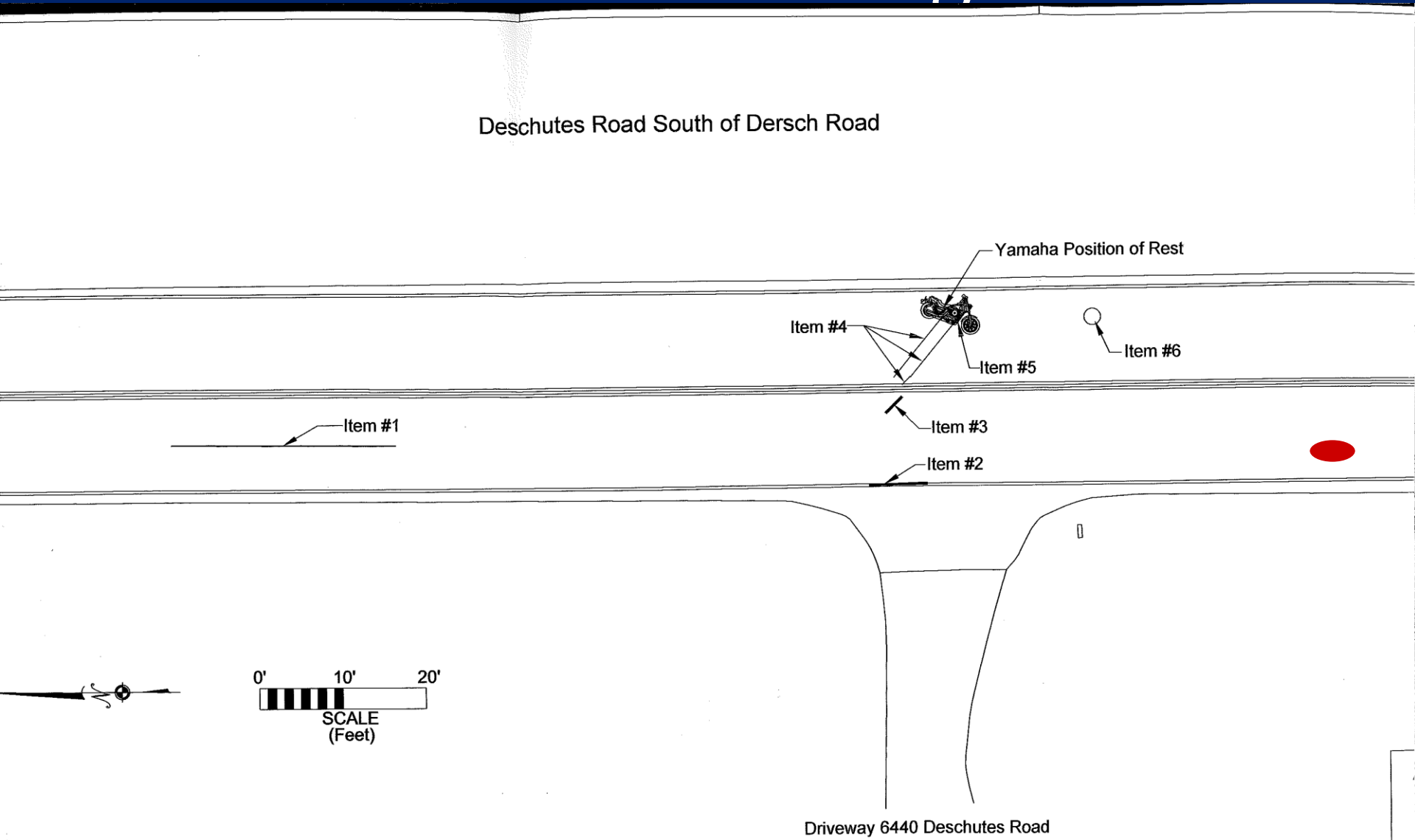

SOMETIMES THE CONSEQUENCE
OF THE FIRST LAW IS FATAL

People v. Meridian

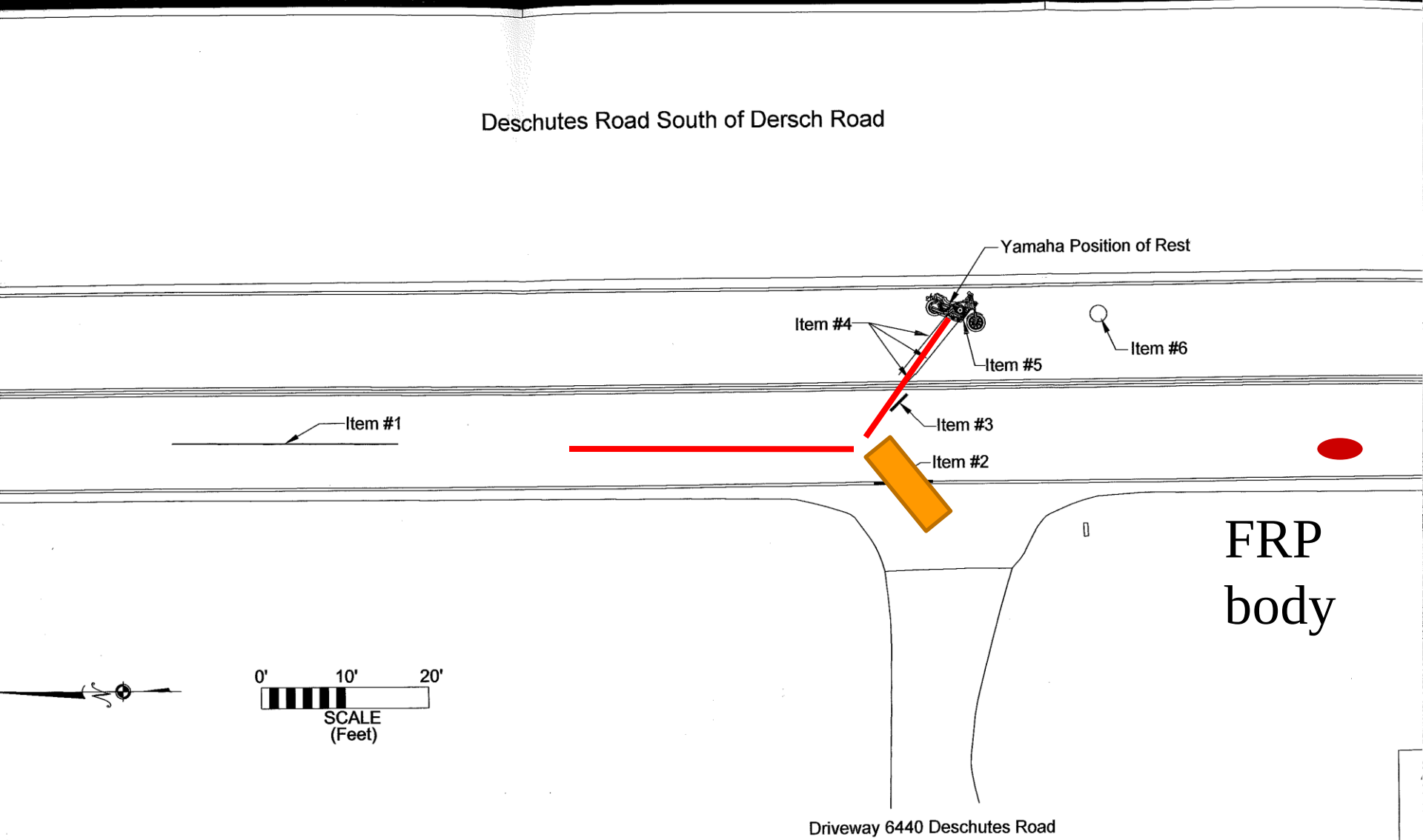
Opposing expert opinions.

Neither expert does any calculations

Scene Drawing



State's Reconstruction

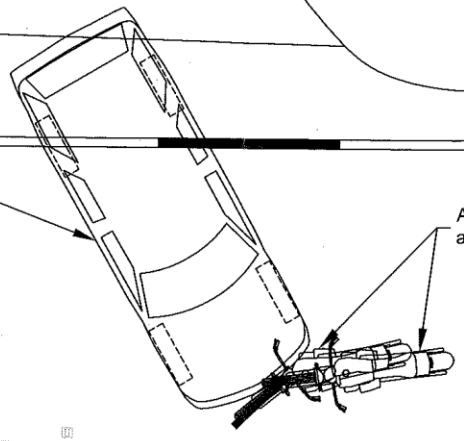


Date of Incident	Time (2400)	NCIC Number	Officer I.D.	Number
09-03-2010	1545	9135	12099	20100900

Deschutes Road, south of Dersch Ro

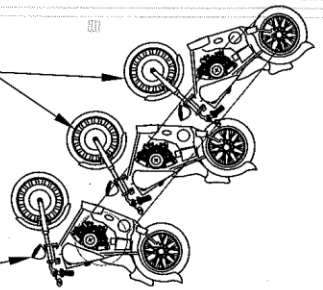
North

6'
2'
0
SCALE



Estimated Orientation of GMC (Vehicle #1) as it Collided with the Yamaha (Vehicle #2)

Approximate Position of Yamaha (Vehicle #2) as it Collided with the GMC (Vehicle #1)



Approximated Orientation of Yamaha (Vehicle #2)

Yamaha (Vehicle #2) at Its Position of Rest

STATE'S RECONSTRUCTION

California High
orthern Divis

NL-014

epared by: S

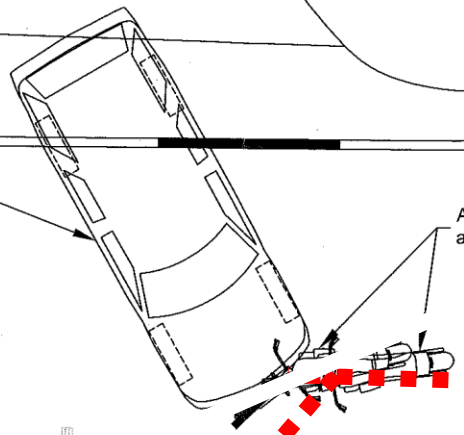
Vehicle Dynam

Date of Incident	Time (2400)	NCIC Number	Officer I.D.	Number
09-03-2010	1545	9135	12099	20100900

Deschutes Road, south of Dersch Ro

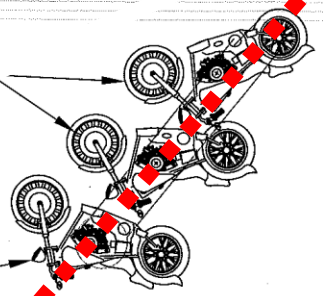
North

6'
2'
0
SCALE



Estimated Orientation of GMC (Vehicle #1) as it Collided with the Yamaha (Vehicle #2)

Approximate Position of Yamaha (Vehicle #2) as it Collided with GMC (Vehicle #1)



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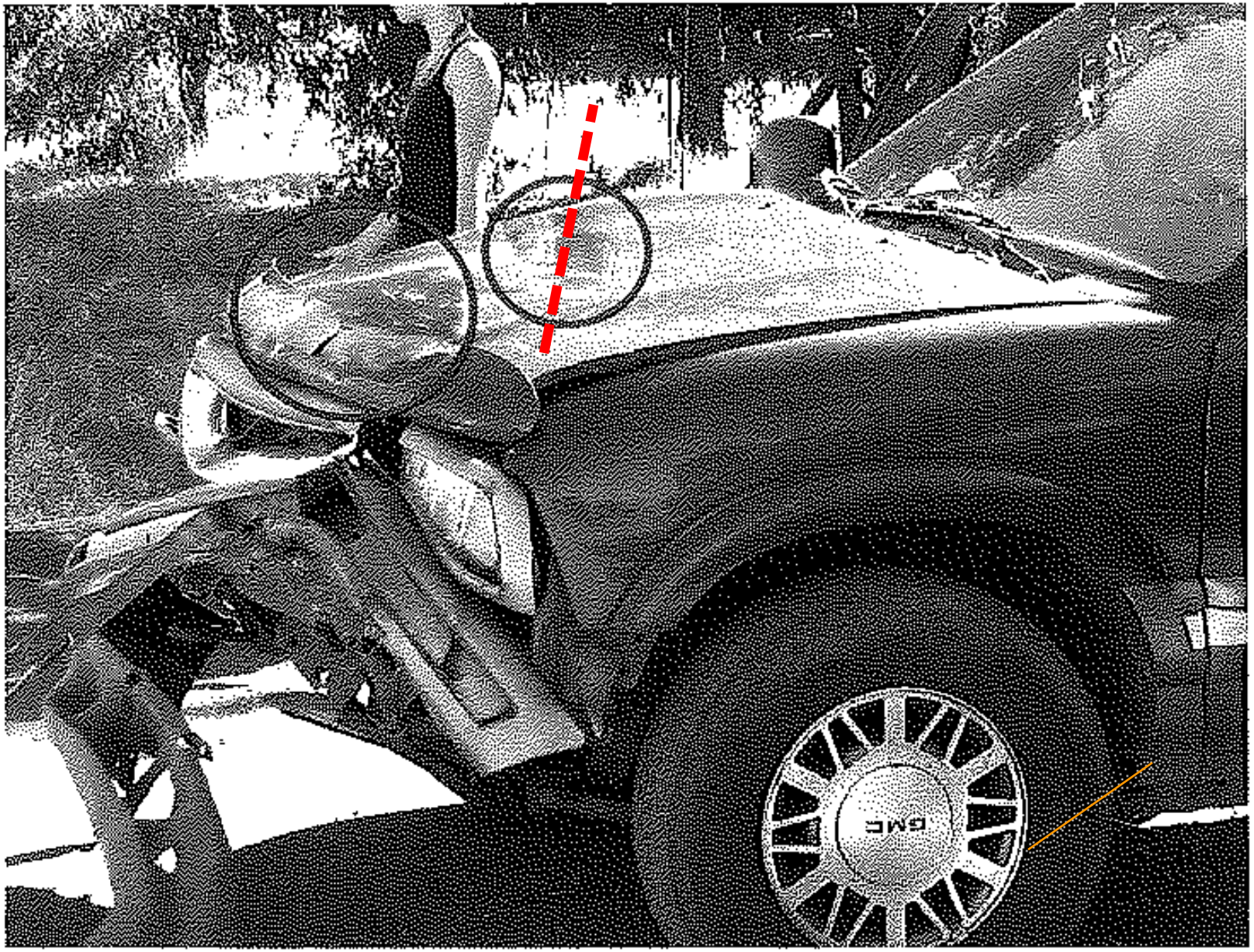
California High
Northern Divis

NL-014

Prepared by: S

Vehicle Dynam



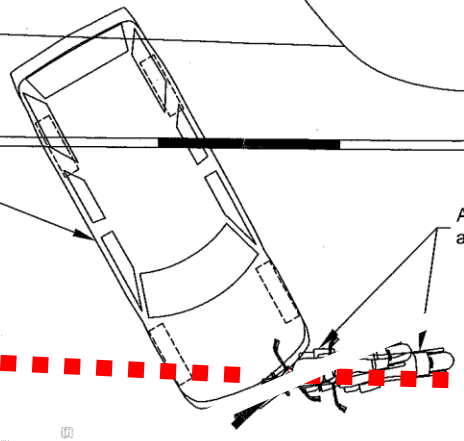
Streaks on Hood of GMC

Date of Incident	Time (2400)	NCIC Number	Officer I.D.	Number
09-03-2010	1545	9135	12099	20100900

Deschutes Road, south of Dersch Ro

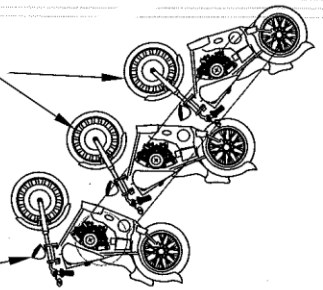
North

6'
2'
SCALE
0



Estimated Orientation of GMC (Vehicle #1) as it Collided with the Yamaha (Vehicle #2)

Approximate Position of Yamaha (Vehicle #2) as it Collided with GMC (Vehicle #1)



Approximated Orientation of Yamaha (Vehicle #2)

Yamaha (Vehicle #2) at Its Position of Rest

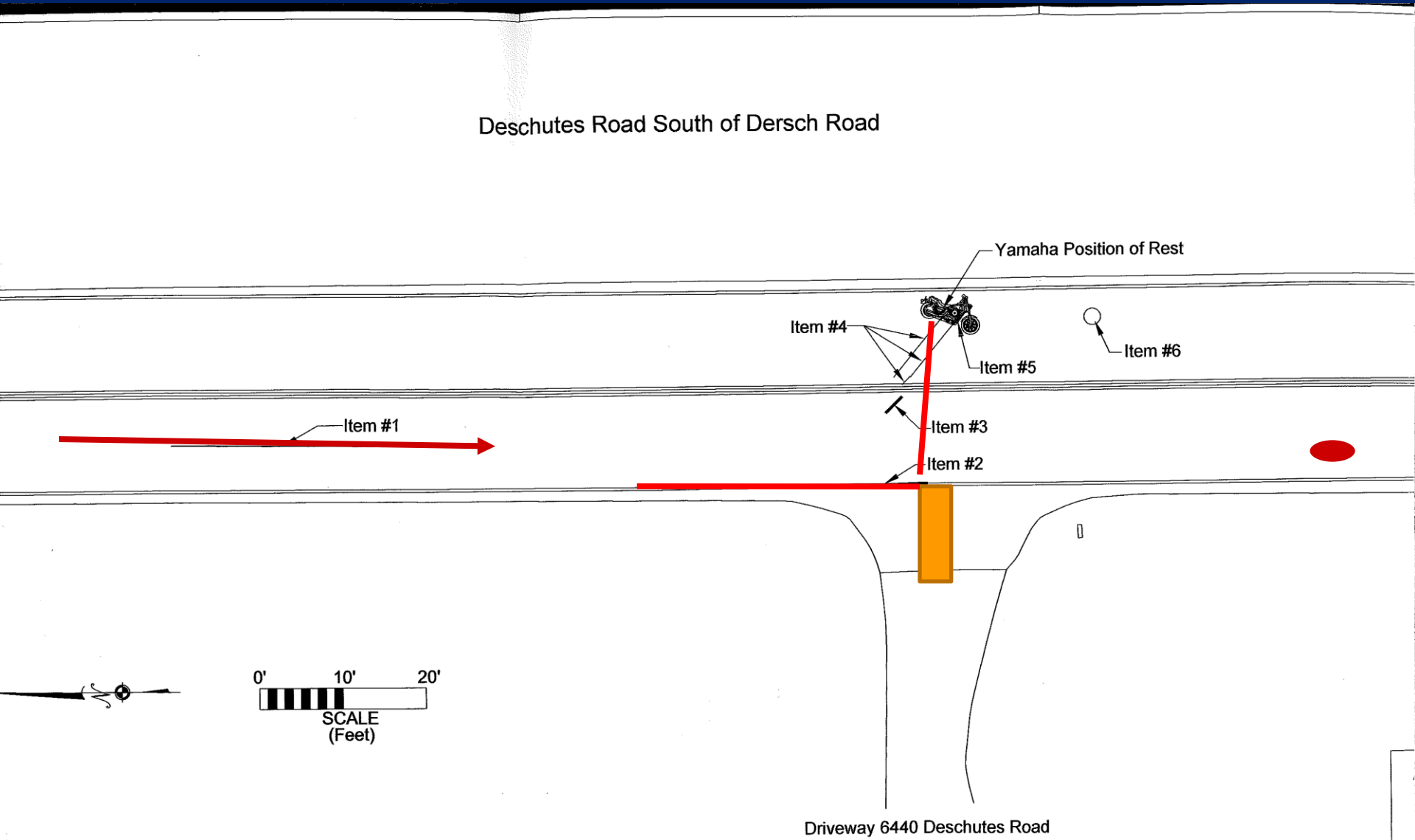
California High
Northern Divis

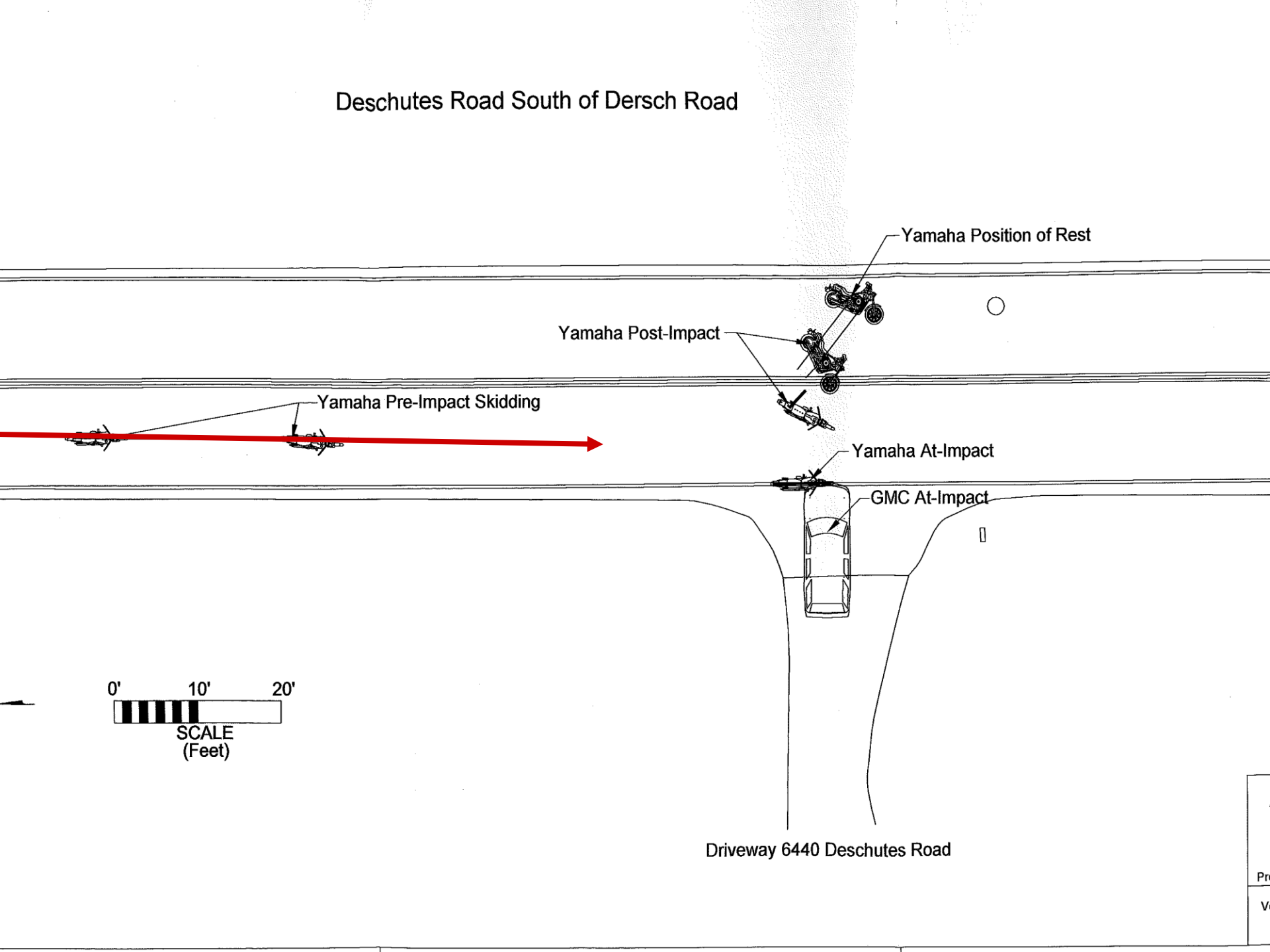
NL-014

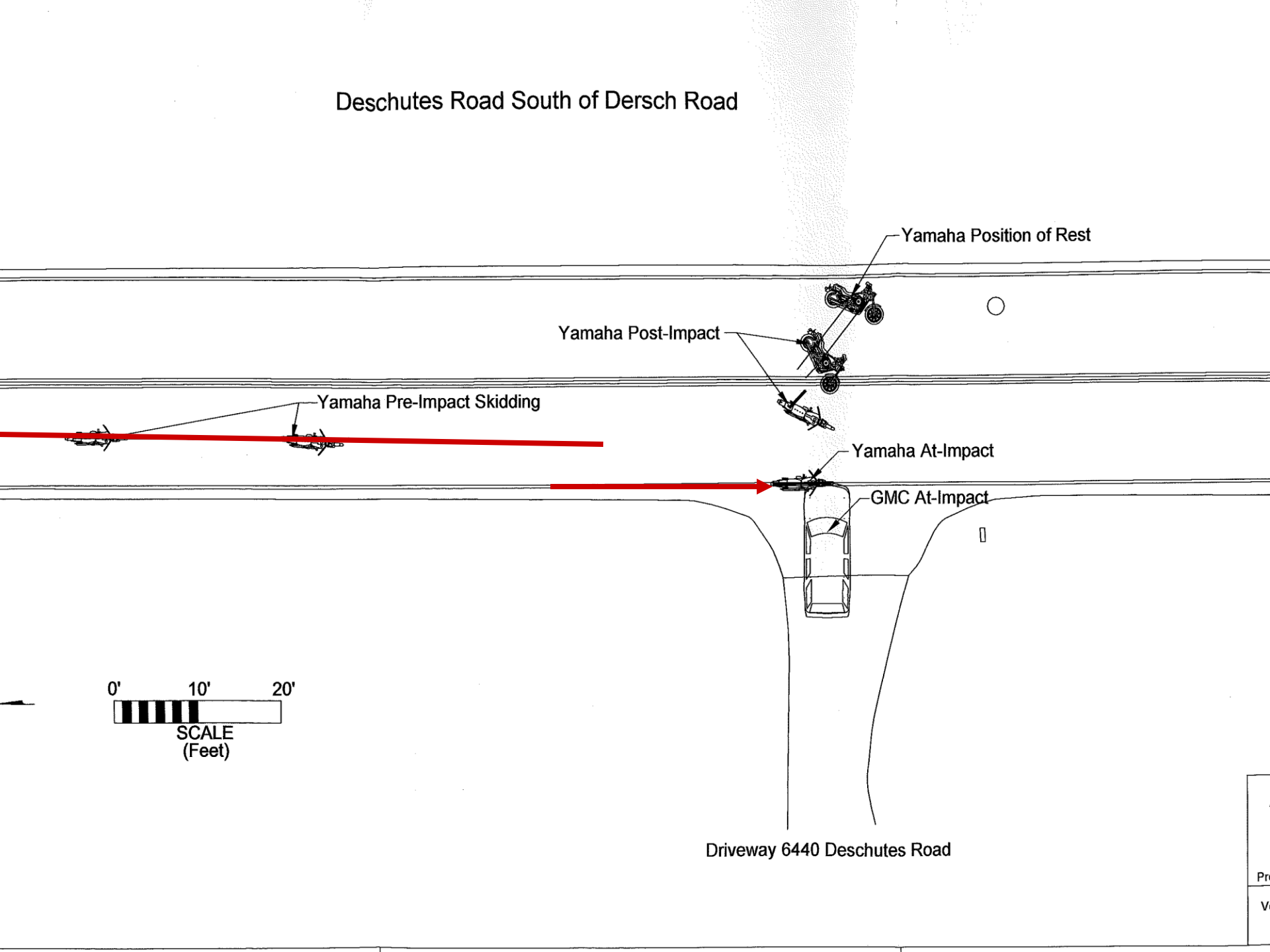
Prepared by: S

Vehicle Dynam

Defense Reconstruction




Deschutes Road South of Dersch Road
Yamaha Position of Rest
Yamaha Post-Impact
Yamaha Pre-Impact Skidding
Yamaha At-Impact
GMC At-Impact
0'
10'
20'
SCALE
(Feet)
Driveway 6440 Deschutes Road

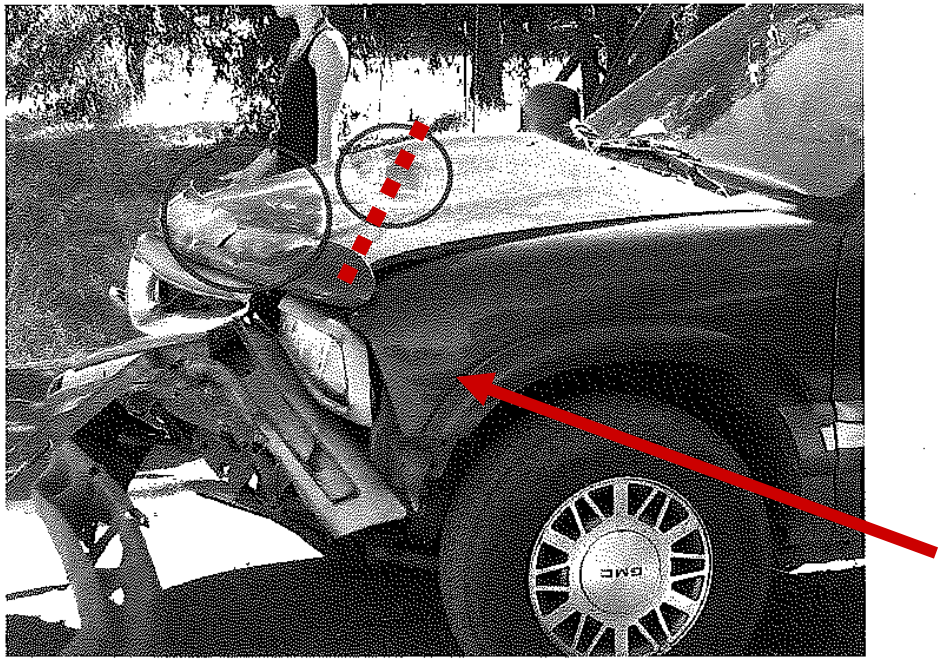

Deschutes Road South of Dersch Road
Yamaha Position of Rest
Yamaha Post-Impact
Yamaha Pre-Impact Skidding
Yamaha At-Impact
GMC At-Impact
0'
10'
20'
SCALE
(Feet)
Driveway 6440 Deschutes Road

Analysis and Opinion – Physical Evidence Descriptions (continued)

Physical Evidence in Area Photographs

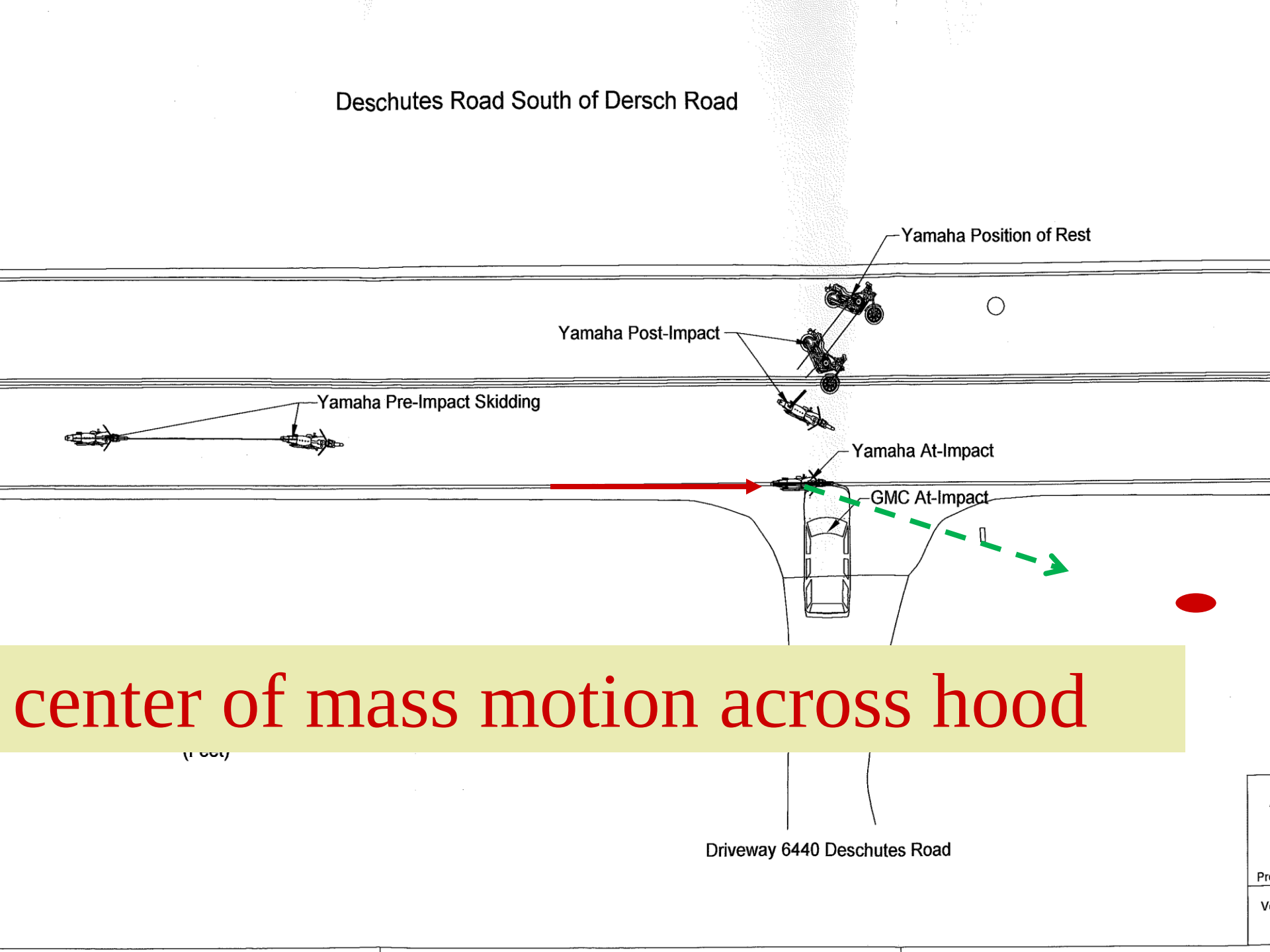
Photographs taken by CHP Redding Area personnel at the collision scene were examined and physical evidence that aided in determining the area of impact was identified.

The hood of the GMC was covered with a layer of dirt. The following photograph shows streaks of cleaned areas on the leading edge and right side of the hood.



Streaks on Hood of GMC

The left leading edge of the hood of the GMC had contact damage to the rear of the broken bug deflector. The source of this contact damage was most likely the right handle bar of the Yamaha. There was no other contact damage observed to the hood from the Yamaha.



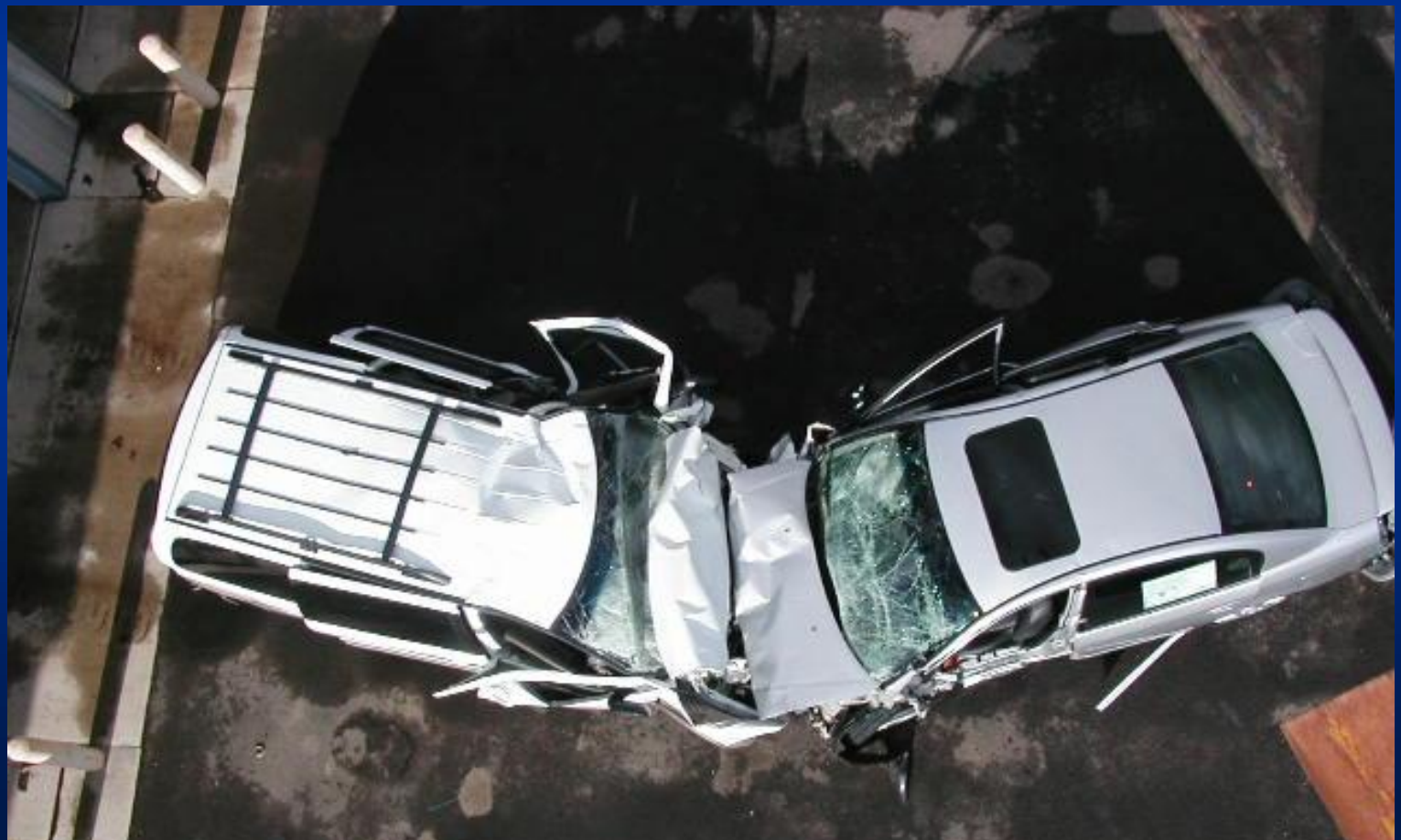
center of mass motion across hood

NEWTON'S SECOND LAW:

FORCES CAUSE MASSES TO ACCELERATE

$$\vec{F} = m\vec{a}$$

“Crumple Zones” increase Δt and reduce acceleration, ΔV/Δt



long Δt, low acceleration

T/F The greater the weight of a vehicle the longer it's braking distance will be.

FALSE

T/F The greater the weight of a vehicle the longer it's braking distance will be.

Remember our experiment :

friction = weight x drag factor

$$F = W\ f$$

2nd LAW DURING BRAKING:

$$F = m\,a$$

friction force

2nd LAW DURING BRAKING:

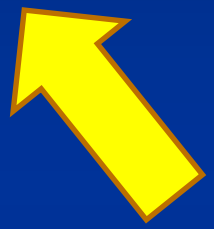
$$F = m\,a$$

friction force

W f

2nd LAW DURING BRAKING:

$$F = m\,a$$



$$W / g$$

2nd LAW DURING BRAKING:

$$F = ma$$

$$W f = (W/g)\, a$$

2nd LAW DURING BRAKING:

$$F = ma$$

$$W f = (W/g) a$$

$$g f = a$$

2nd LAW DURING BRAKING:

$$F = ma$$

$$W f = (W/g) a$$

$$g f = a$$

rate of slowing does <u>not</u> depend on weight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THE VEHICLE STOPPED IN THE ***SAME DISTANCE***

Let’s really add some weight and compare how a vehicle stops.

BOTH VEHICLES STOPPED IN THE ***SAME DISTANCE***

THEN WHY DOES A TRACTOR TRAILER HAVE A GREATER BRAKING DISTANCE THAN A CAR ?

Tires are made of different rubber compounds,

truck	car
f = .62	f = .78

truck has pneumatic “brake lag”.

NEWTON'S THIRD LAW:

WHEN OBJECTS COME INTO CONTACT, EQUAL AND OPPOSITE FORCES ACT

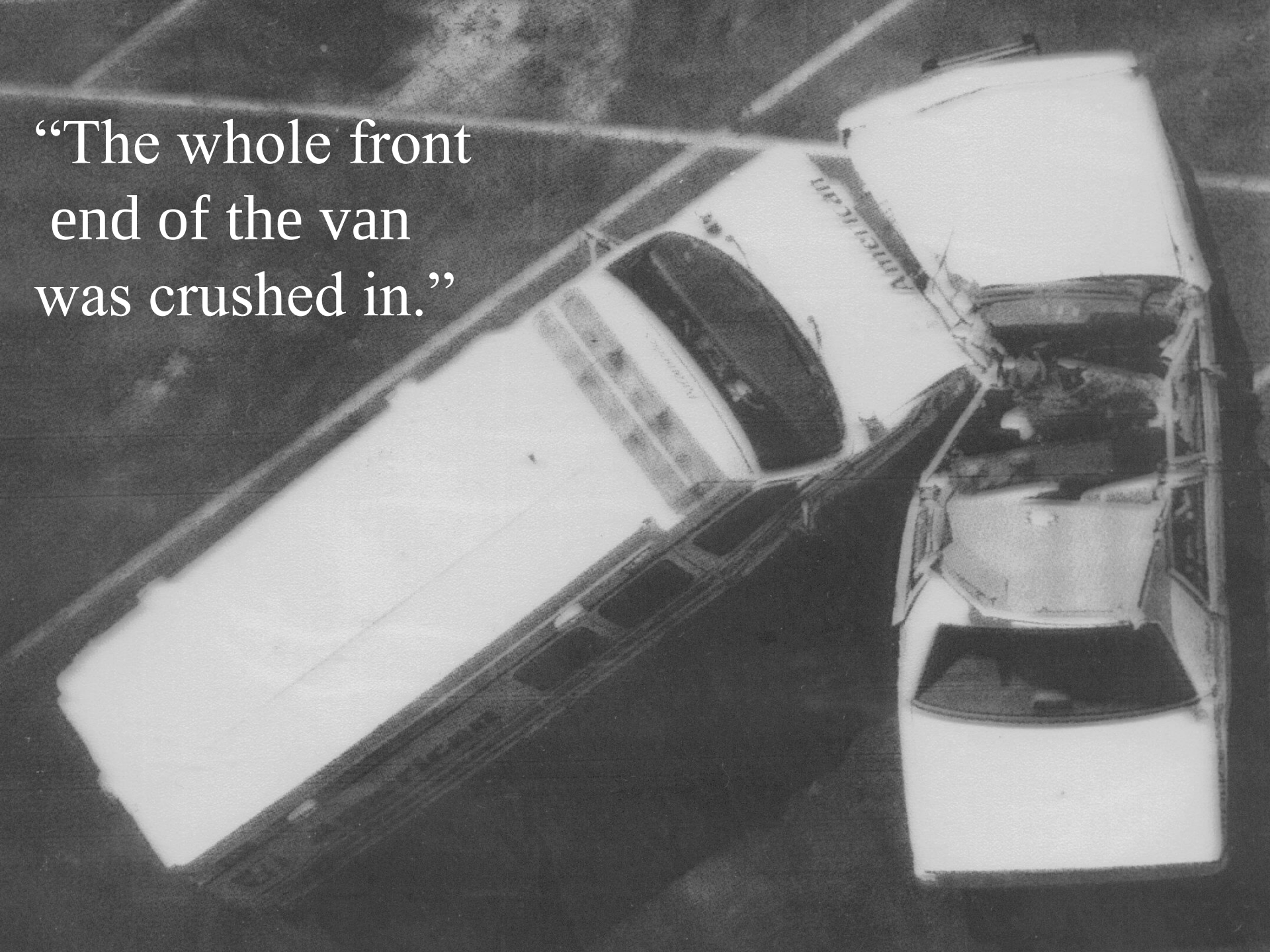
(ACTION-REACTION FORCES)

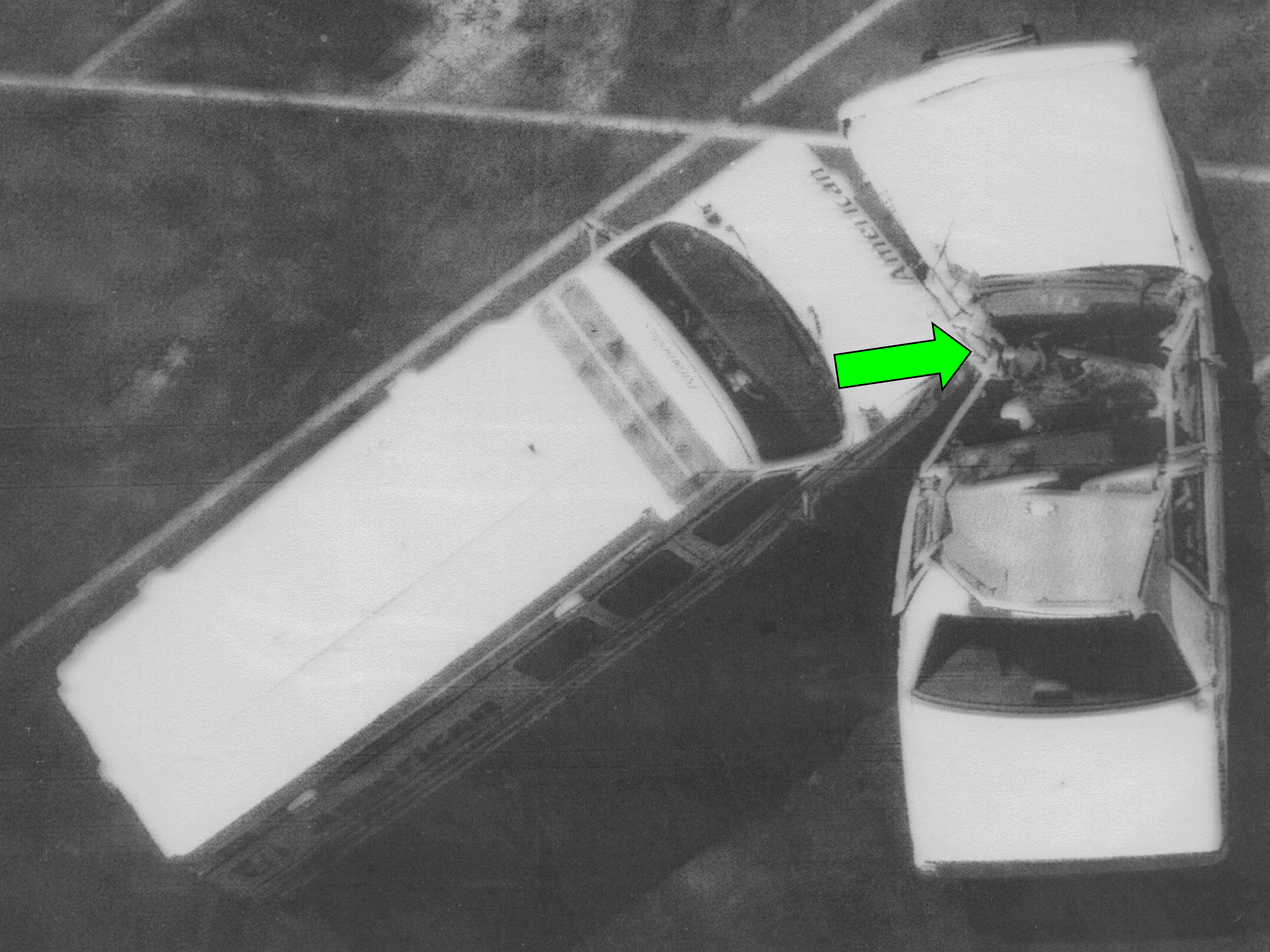
the “ACTION” force

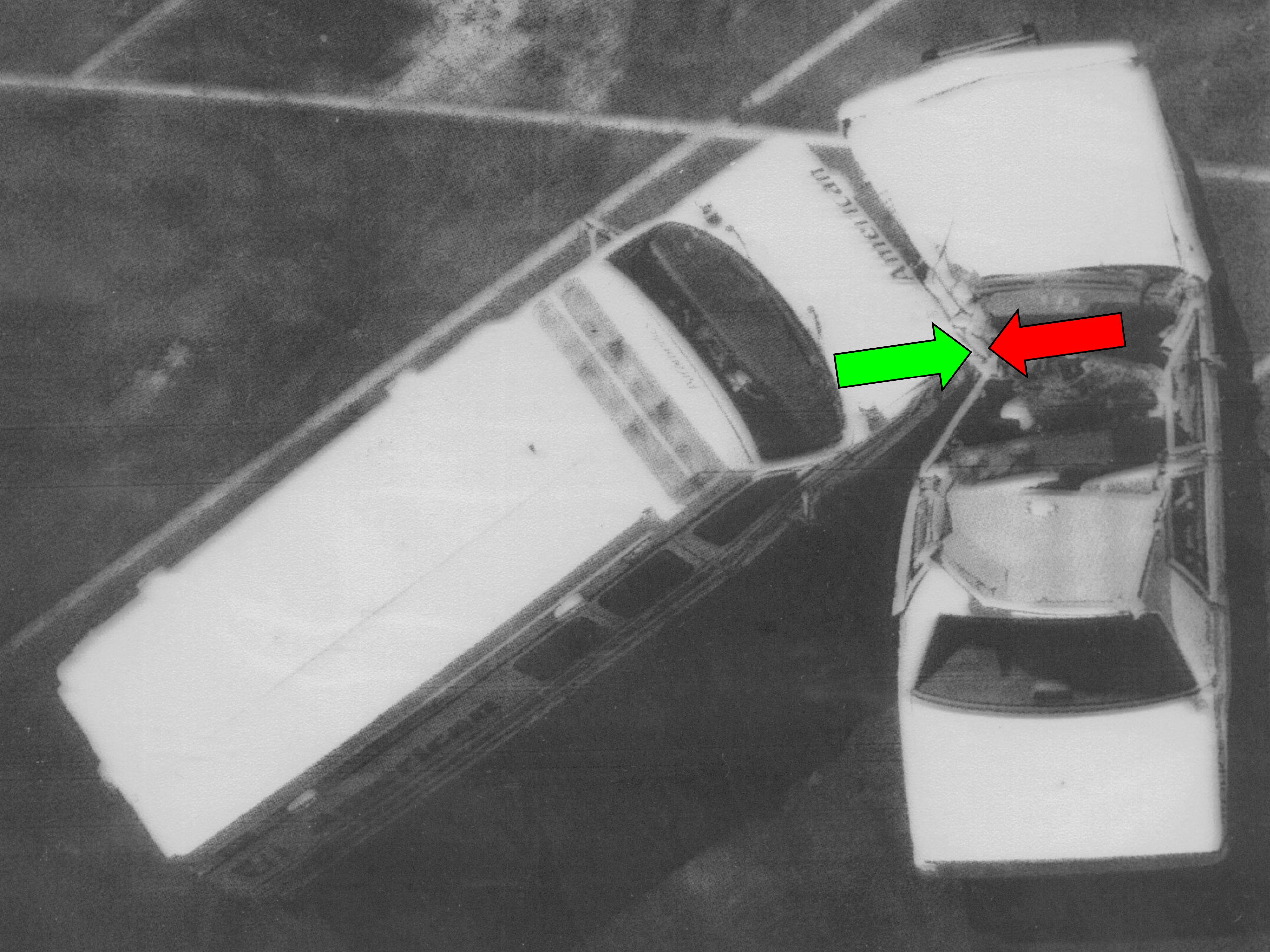
the “REACTION” force

EQUAL FORCES, but UNEQUAL DAMAGE ?

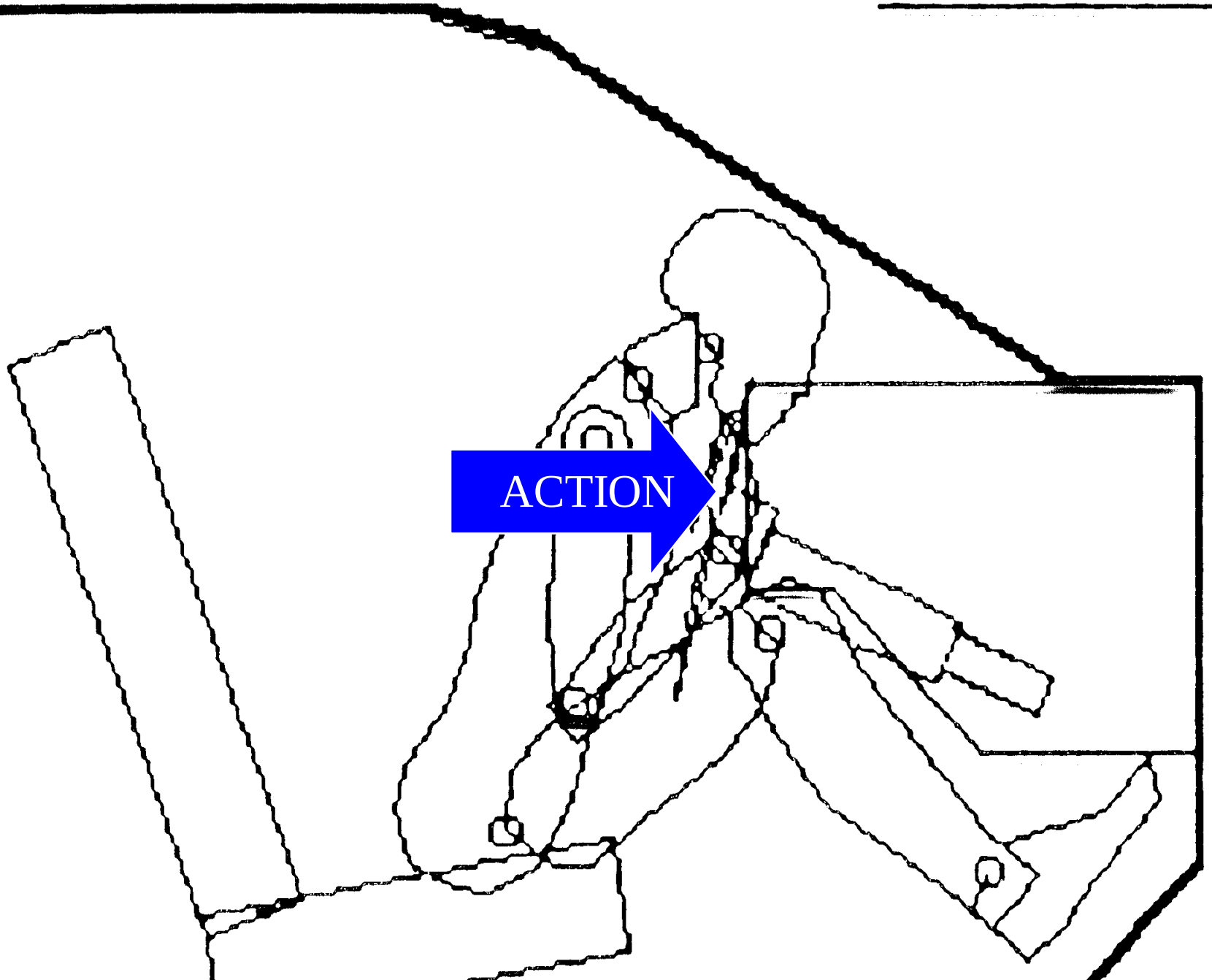

American


"The whole front
end of the van
was crushed in."

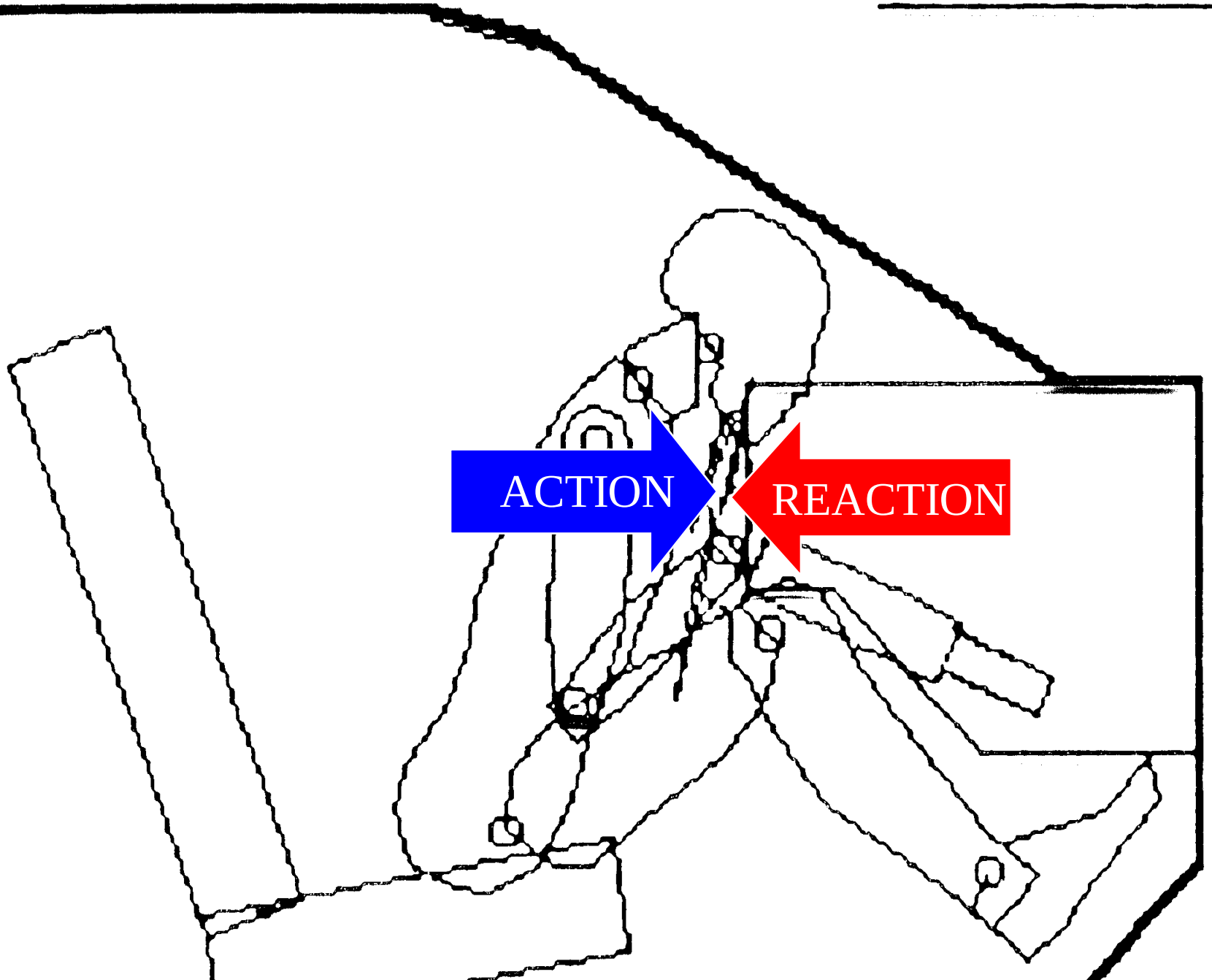

American


American

UNRESTRAINE



UNRESTRAINE



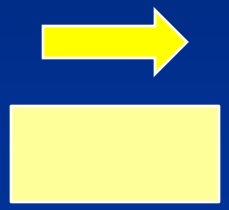

“I think we know
who the driver is.”

Kwasnoski's FOURTH LAW ?

FOR EVERY EXPERT OPINION THERE IS AN OPPOSITE EXPERT OPINION.

KINETIC ENERGY = .03376 WS^2

$KE = .03376WS^2$



A VEHICLE IN MOTION HAS KINETIC ENERGY

$KE = .03376WS^2$

$KE = .03376WS^2$

CONSERVATION OF ENERGY

THE KINETIC ENERGY OF A VEHICLE IS CHANGED TO OTHER FORMS AS THE VEHICLE REACHES ITS FINAL REST POSITION (FRP).

CONSERVATION OF ENERGY

THE CRASH INVESTIGATOR LOOKS FOR THOSE ENERGIES TO RECONSTRUCT THE PRE-CRASH ENERGY (SPEED)