On Scene Accident Investigation – What You Need to Document

Joey Parker, Ph.D., P.E.
Jeremy Hunter, MSME, P.E.

3 Axis Engineering, LLC
5929 Knight Ave.
Tuscaloosa, AL 35405
Ph: 205-758-4488
Fax: 205-758-4489

A little bit about us

- Joey Parker (joey@3axisllc.com)
  - Taught in Department of Mechanical Engineering (dynamics, instrumentation) at The University of Alabama for 25 years
  - Research work involved interfacing electrical and mechanical devices to computers
  - Accident reconstruction work (99%+ civil litigation) since 2002
- Jeremy Hunter (jeremy@3axisllc.com)
  - Bachelor's and Master's in Mechanical Engineering from The University of Alabama
  - Involved in 600+ accident investigations since 2004
  - Developed overhead camera system

A little bit about 3Axis Engineering

- Doughty & Powers Engineering is now 3Axis Engineering
- We provide professional, data-driven, mechanical engineering solutions to motor vehicle accident reconstruction (i.e., "what happened") including:
  - passenger vehicles,
  - commercial vehicles, such as tractor-trailers and buses,
  - motorcycle, pedestrian and other accidents.

Brief Overview

- Event Data Recorders
  - Passenger vehicles
  - Commercial vehicles
- Accident Photography
  - Scene (on-roadway and off-roadway)
  - Vehicles
- Accident Scene Measurement

Note – Entire presentation available on our website:
www.3axisllc.com/resources

EDR - Event Data Recorder

- "Black boxes" that store accident data on many passenger and commercial vehicles best referred to as EDRs
- Typical questions:
  - What gets stored?
  - What vehicles have EDRs?
  - Can the data disappear or get erased?
- Answer: It depends!

Passenger Vehicle EDR

- Passenger vehicle event data found in the airbag control module (ACM), or powertrain control module (PCM) for Fords
  - GM (from 1994)
  - Ford (from 2001)
  - Chrysler (from 2005)
  - Toyota (from 2002)
  - Honda (from 2012)
  - Mazda (from 2011)
  - Nissan (from 2012)
  - some Saab & Suzuki
- Available data depends on engine manufacturer, model, year, etc.
- 3Axis Engineering can help with all phases of passenger vehicle EDR downloads – call us!

ACM access through DLC

ACM under passenger seat

Damaged PCM on firewall

ACM under center dash

Passenger Vehicle EDR

- Recording triggered by collision
  - Many store vehicle speed, braking, and other information for 2 to 5 seconds before a collision
  - Ford PCMs also have a “last stop” record
- Deployment of airbags (or belt tensioners)
  - Data usually locked and won’t get overwritten
- Non-Deployments
  - Accident data may exist, but not usually locked and may get overwritten if vehicle put back into service

Commercial Vehicle EDR

- Commercial vehicle event data typically stored in the diesel's engine / electronic control module (ECM)
  - Detroit Diesel
  - Cummins
  - Mack
  - Caterpillar
  - International
  - Volvo

Most potential for accident-related information to be stored

- Available data depends on engine manufacturer, model, year, etc.

Commercial Vehicle EDR

- Recording triggered by "hard" braking
  - vehicle slows by 7 to 10 mph in one second
- "Last stop" recorded by some Detroit Diesel and Mack engines
- Data volatility
  - Commercial vehicle EDR data is <u>not locked</u> and can be overwritten if the vehicle is driven or repaired
- 3Axis Engineering can help with all phases of commercial vehicle EDR downloads – call us!

Access through datalink connector

Access through ECM-specific connector

Benchtop download

Important EDR Tips

- Reduce chances of accidentally erasing data
  - Keep keys in a separate secure location after accident (especially Fords with PCM data)
    - Wrecker drivers will use your key to move the vehicle and can erase valuable data!
  - Turn vehicles off <u>with the key</u> if possible after an accident
    - Some commercial vehicle EDRs use the key-off to trigger writing of data to non-volatile memory

Accident Photography

Photos serve two important functions

1. Provide a permanent, accurate, and unbiased record of something specifically observed at accident scene
   - If there is not a fatality, you may be the only one documenting the evidence.
2. Capture evidence (mark on road or damage to a vehicle) that may later reveal significant details that were not observed at time photo was made

from *The Traffic-Accident Investigation Manual*, J Stannard Baker and Lynn B. Fricke, Northwestern University Traffic Institute, 9th Ed., 1986.

Photographs – "Dos"

- What to do
  - Learn how to use your camera
    - automatic settings work well for most shots
    - good to know the Macro mode for close-ups
  - Start wide, end narrow
    - details need context
  - Include fixed landmarks whenever possible
    - trees, utility poles, signs, manhole covers, roadway striping, etc.

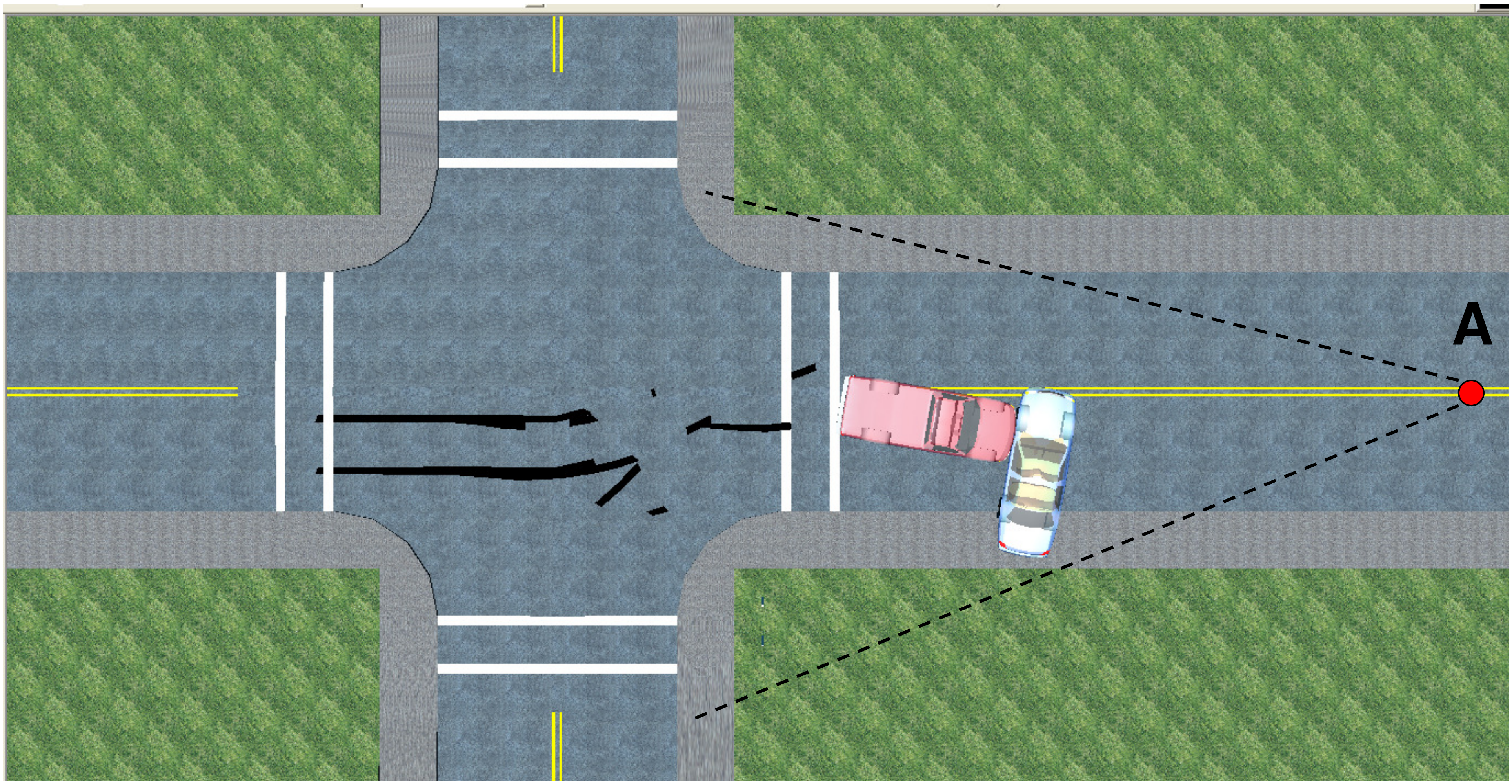
Photographs – “Don’ts”

- What not to do
  - Stand in one place and shoot approximately the same photo 5 to 20 times
  - Set camera on lowest resolution to get more photos on the memory card
  - Forget to copy photographs from camera’s memory card to more permanent location
  - Print photos (or save to PDF), then delete the original digital files

Basic At-Scene Photos

- Final positions of vehicles and bodies
- Evidence on the road surface
  - tire marks, scrapes, gouges, etc.
- Evidence off the road surface
  - ruts, furrows, damage to trees, etc.
- Recognizable landmarks that help identify location on the road
  - utility poles, road signs, mailboxes, etc.
- View that drivers may have had approaching accident area

At-Scene Photos – View A



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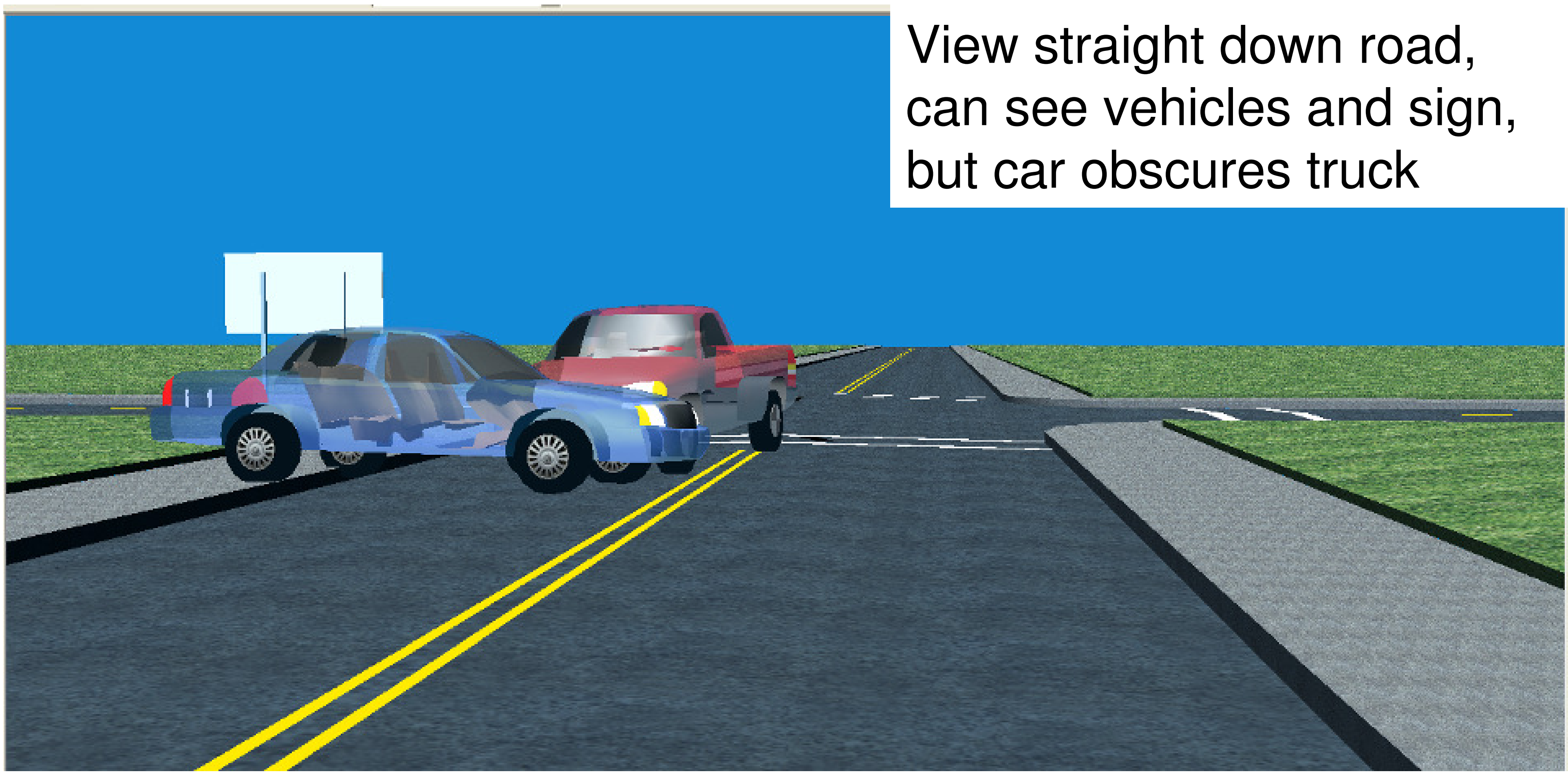
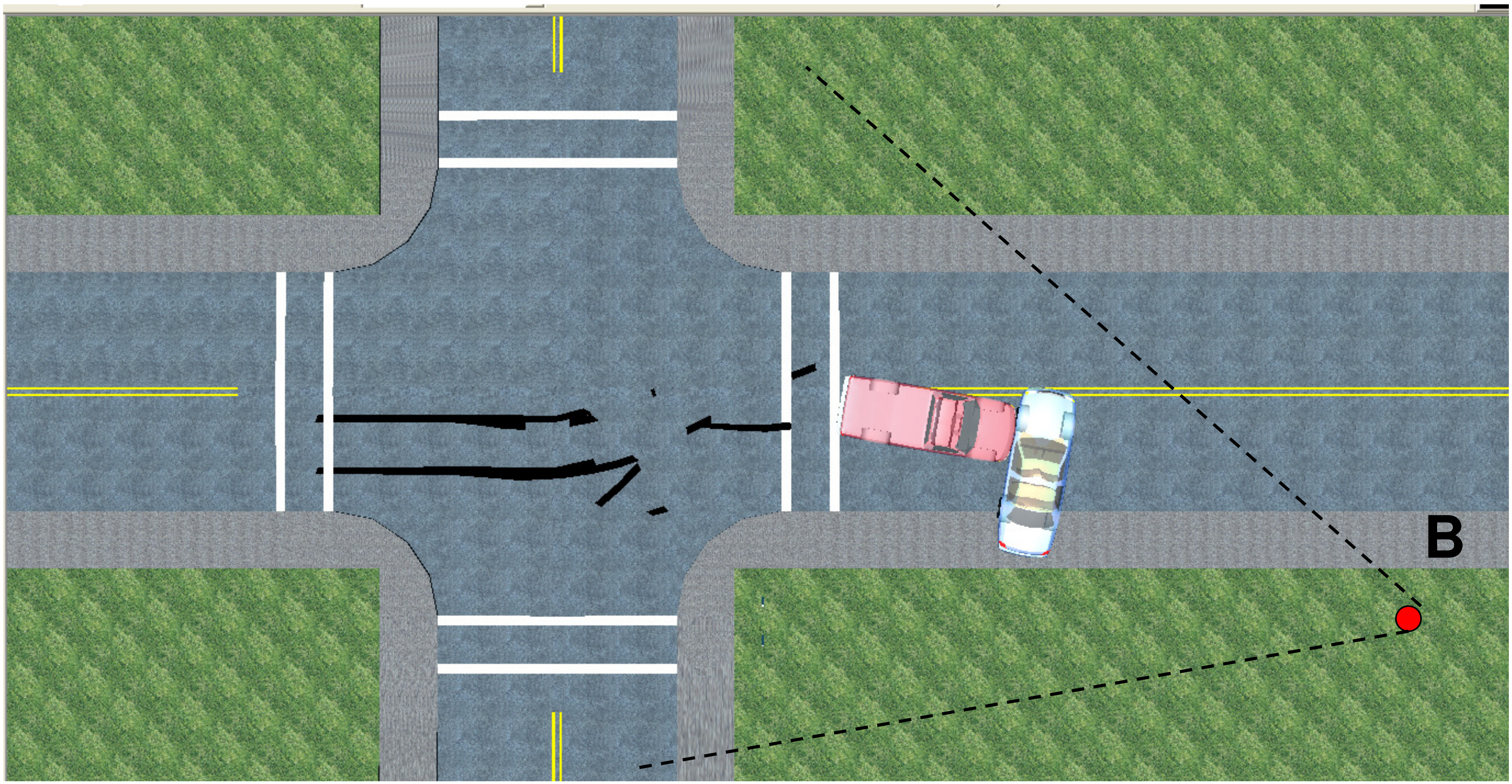
At-Scene Photos – View A



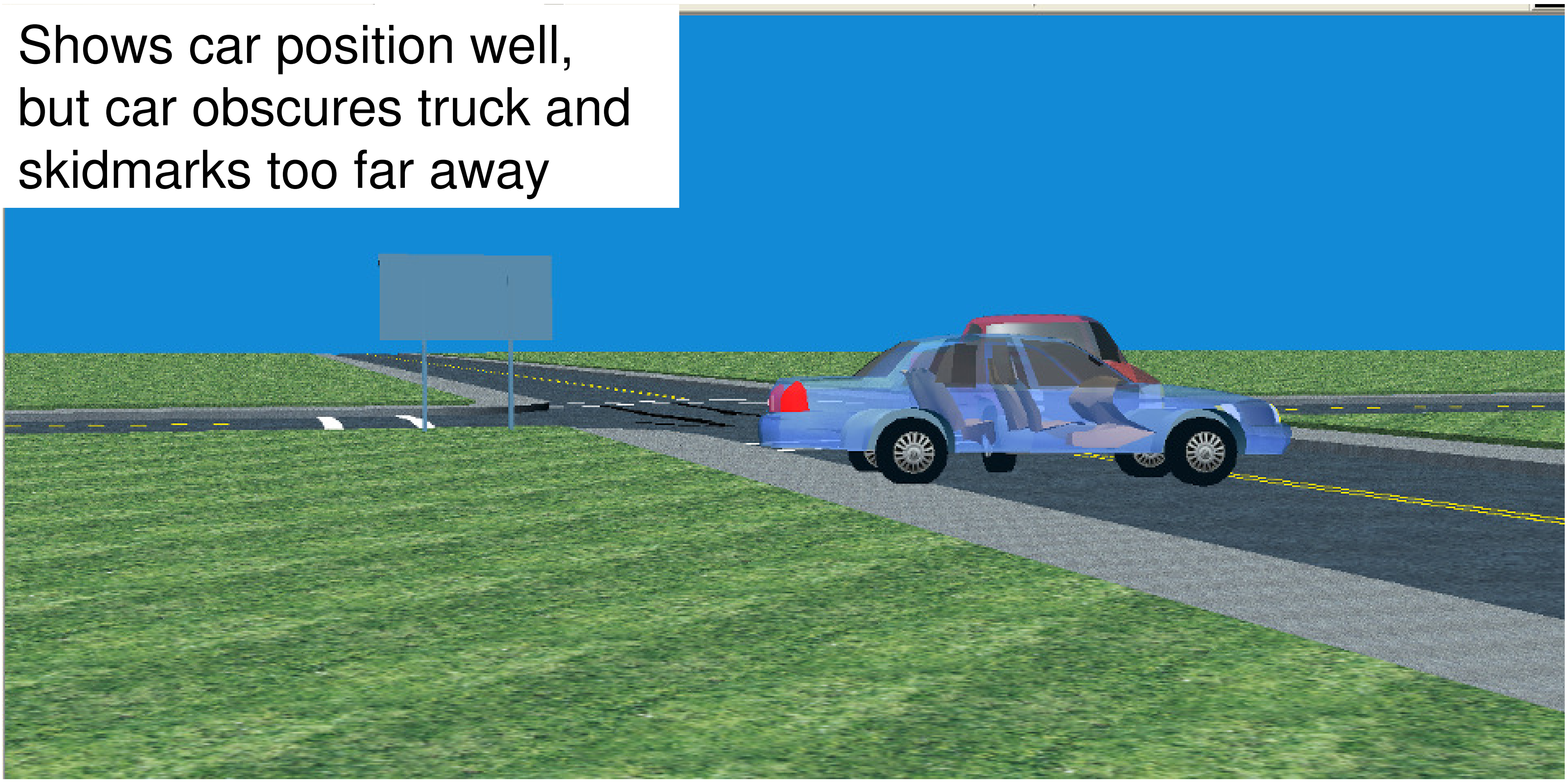
View straight down road, can see vehicles and sign, but car obscures truck

At-Scene Photos – View B

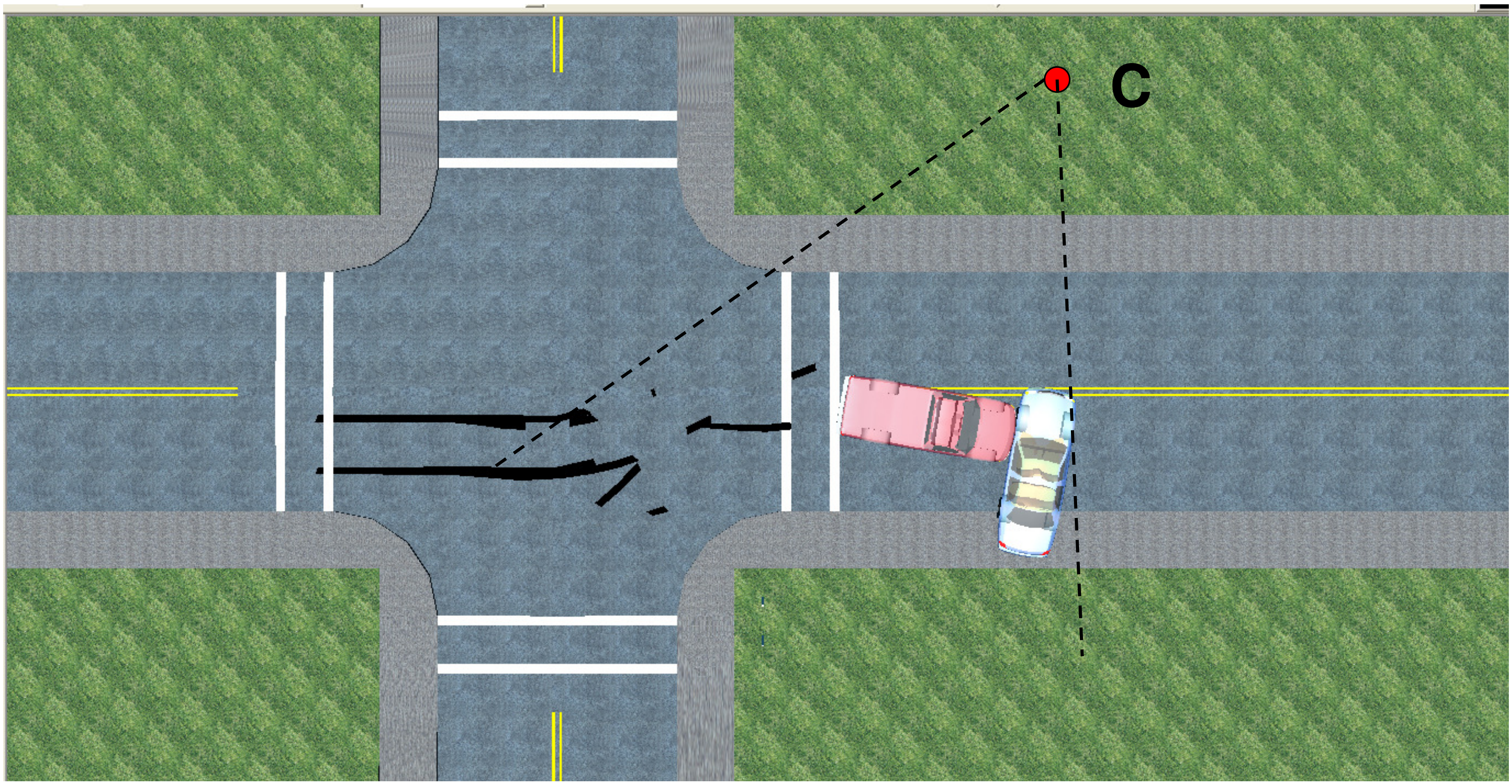


At-Scene Photos – View B

Shows car position well, but car obscures truck and skidmarks too far away



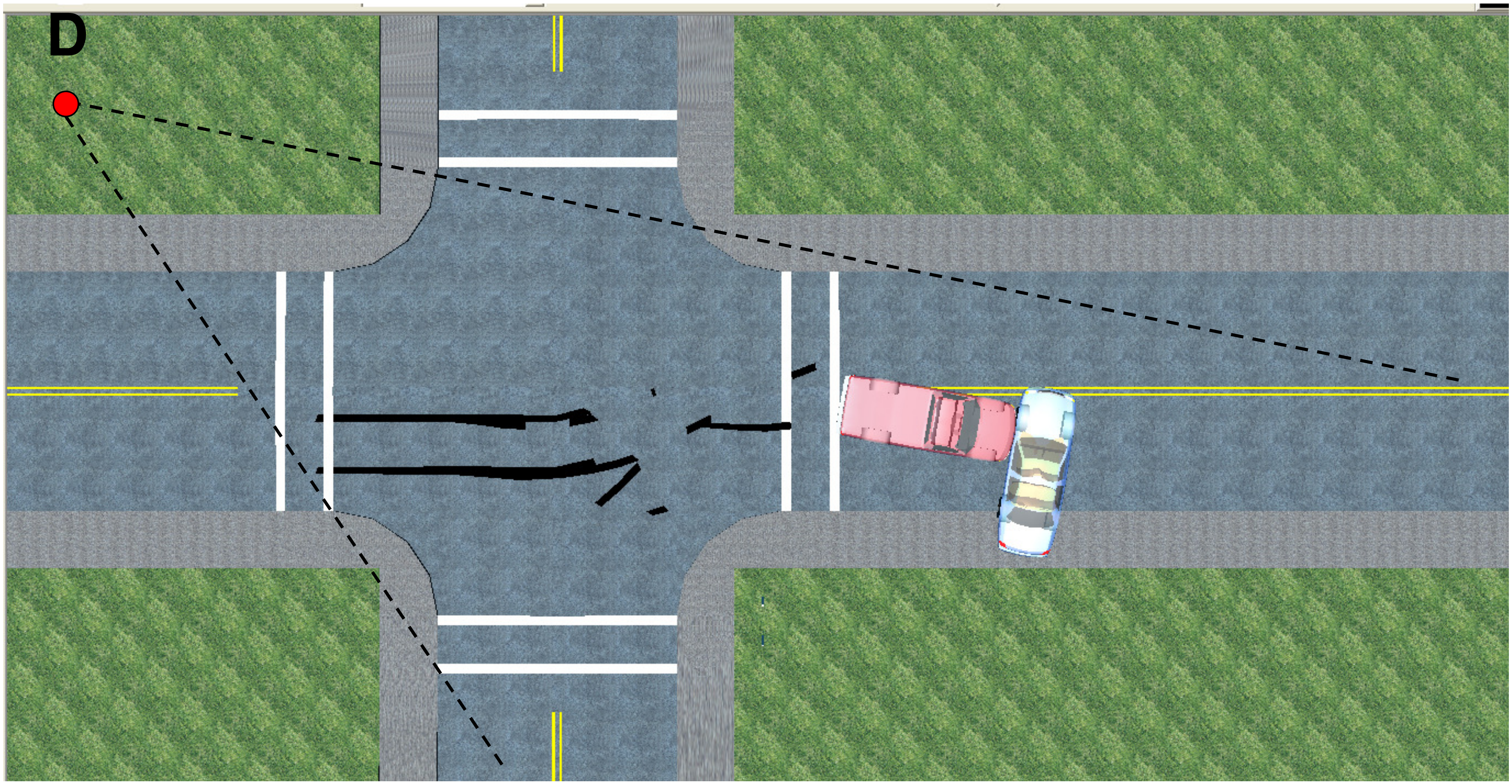
At-Scene Photos – View C



At-Scene Photos – View C

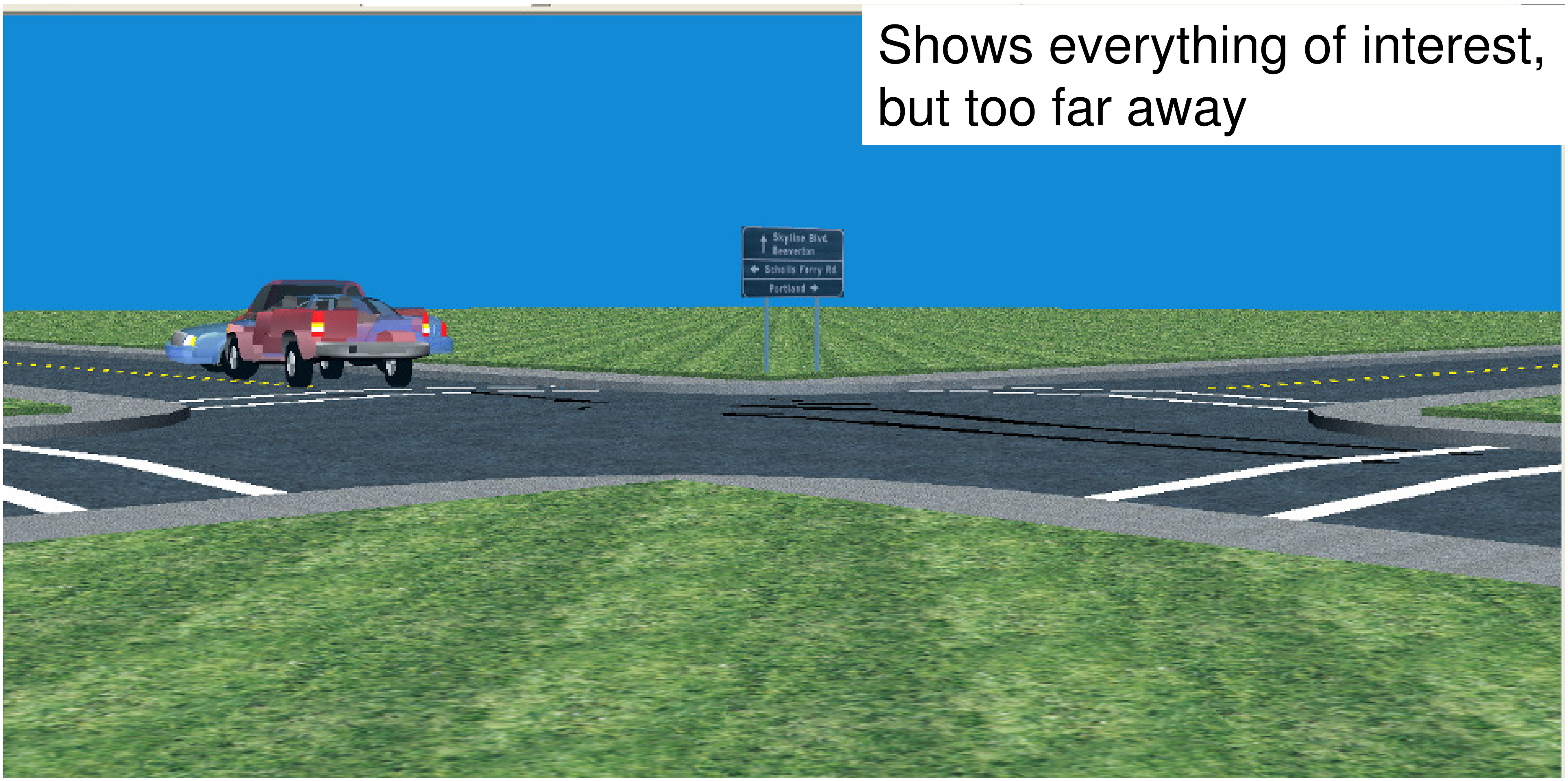
Good view of side of truck, also shows engagement, but hard to see skidmarks

At-Scene Photos – View D

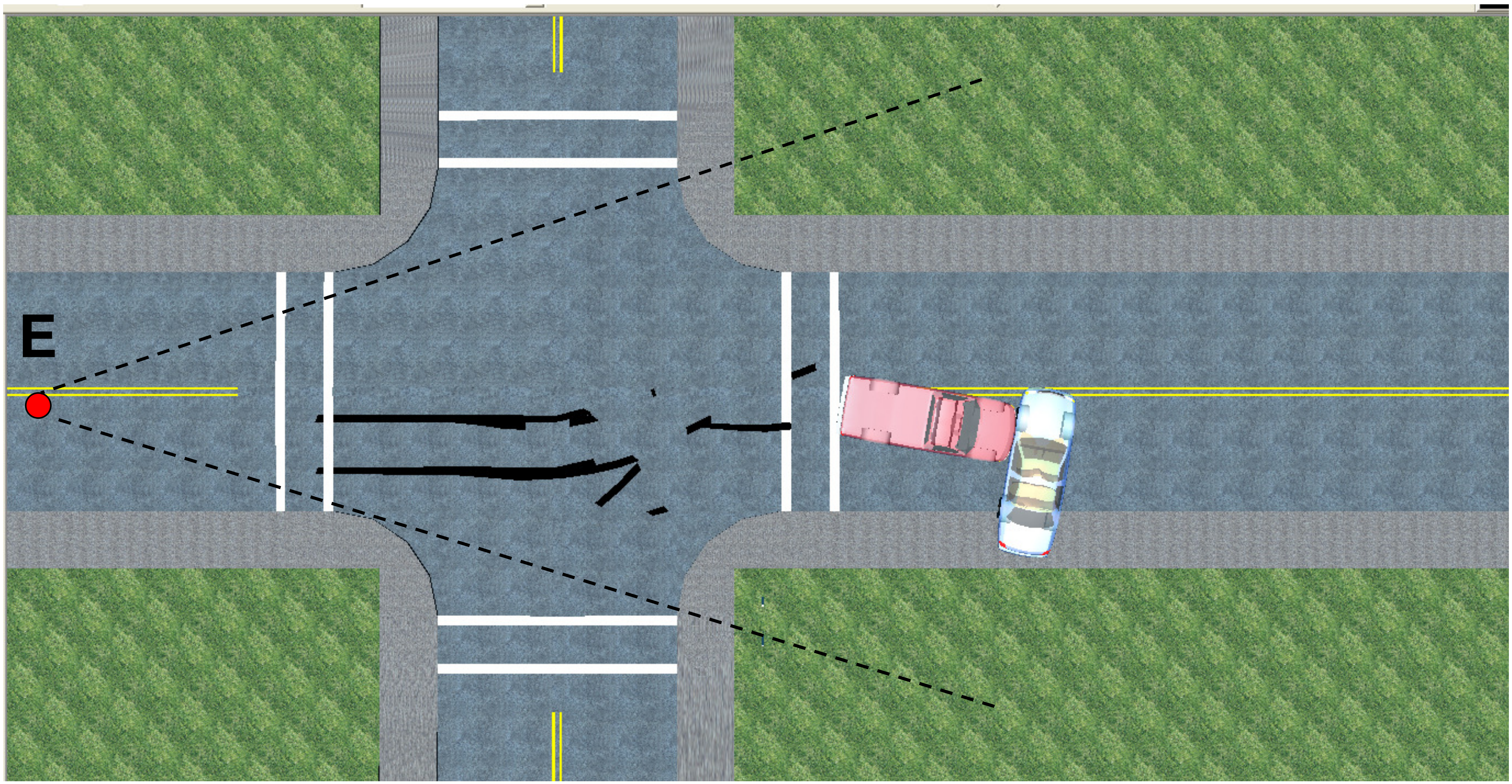


At-Scene Photos – View D

Shows everything of interest, but too far away



At-Scene Photos – View E



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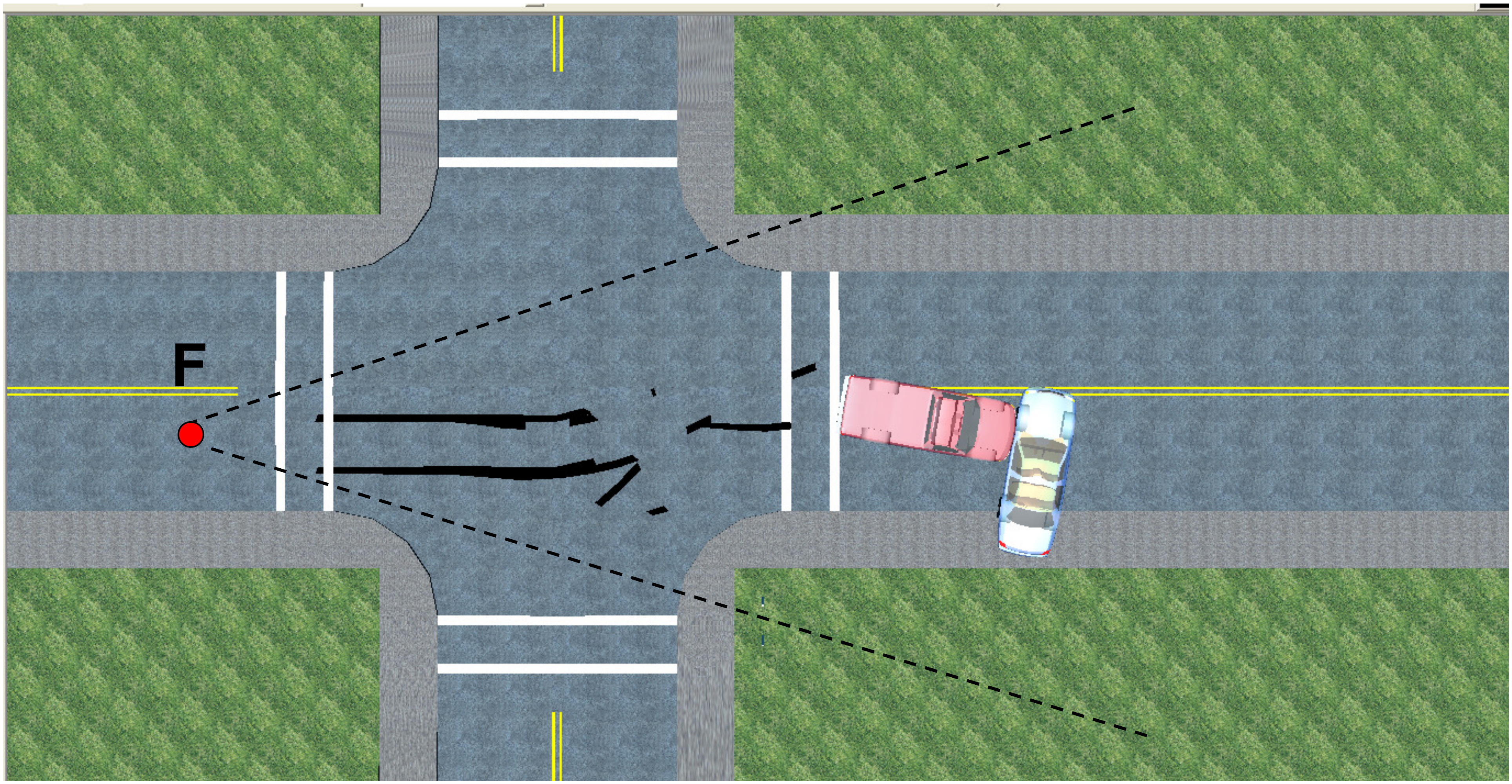
At-Scene Photos – View E

View straight down road, can see vehicles, sign, and skidmarks, including start

At-Scene Photos – View F



At-Scene Photos – View F

Keys to Good Scene Photographs

- Make photographs soon of things that will change
  - Locate vehicle rest positions quickly if they need to be moved for traffic control
  - Some tire marks (particularly the faint marks left with anti-lock brakes) may disappear quickly with traffic
  - Debris will be swept up and moved or discarded

from *The Traffic-Accident Investigation Manual*, J Stannard Baker and Lynn B. Fricke, Northwestern University Traffic Institute, 9th Ed., 1986.

Photographing Roadway

- Start with camera view including a landmark <u>fixed</u> object
- Approach area of interest with smaller field of view (but more detail)
- End with area of interest in detail near center of photo

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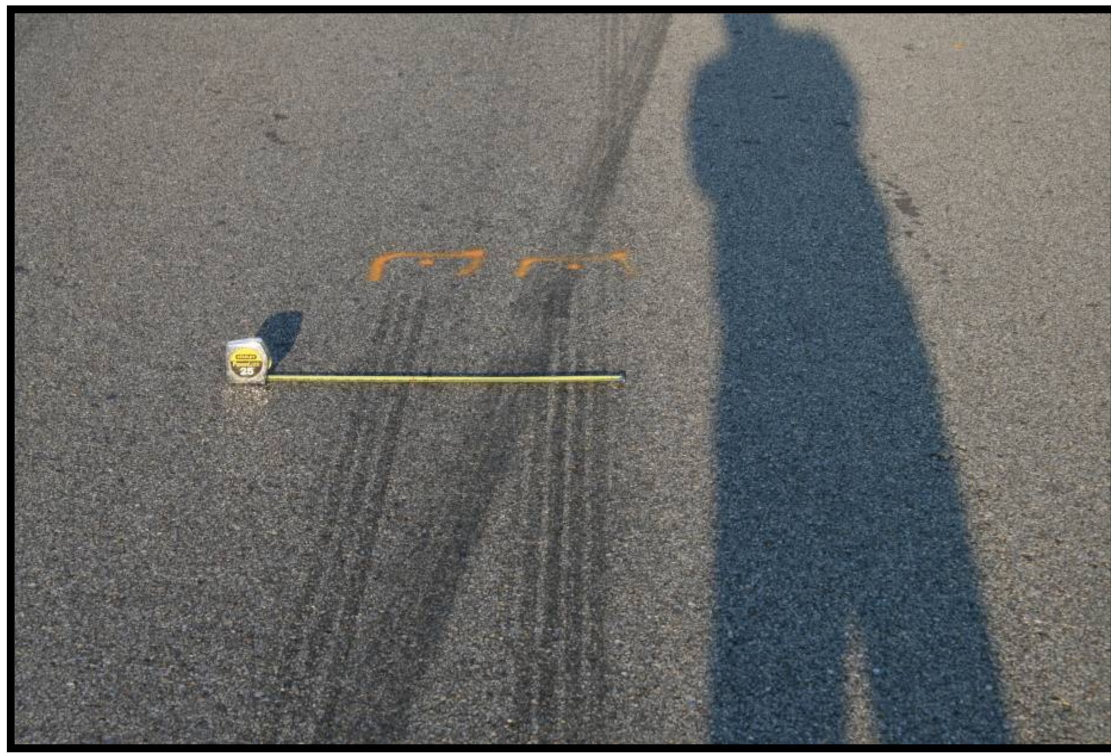
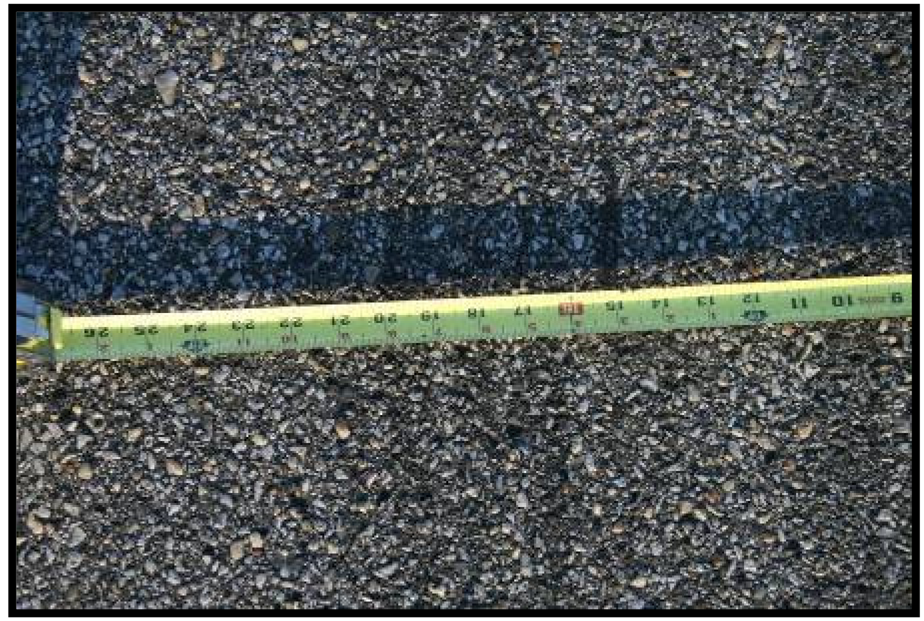
Photographing Roadway

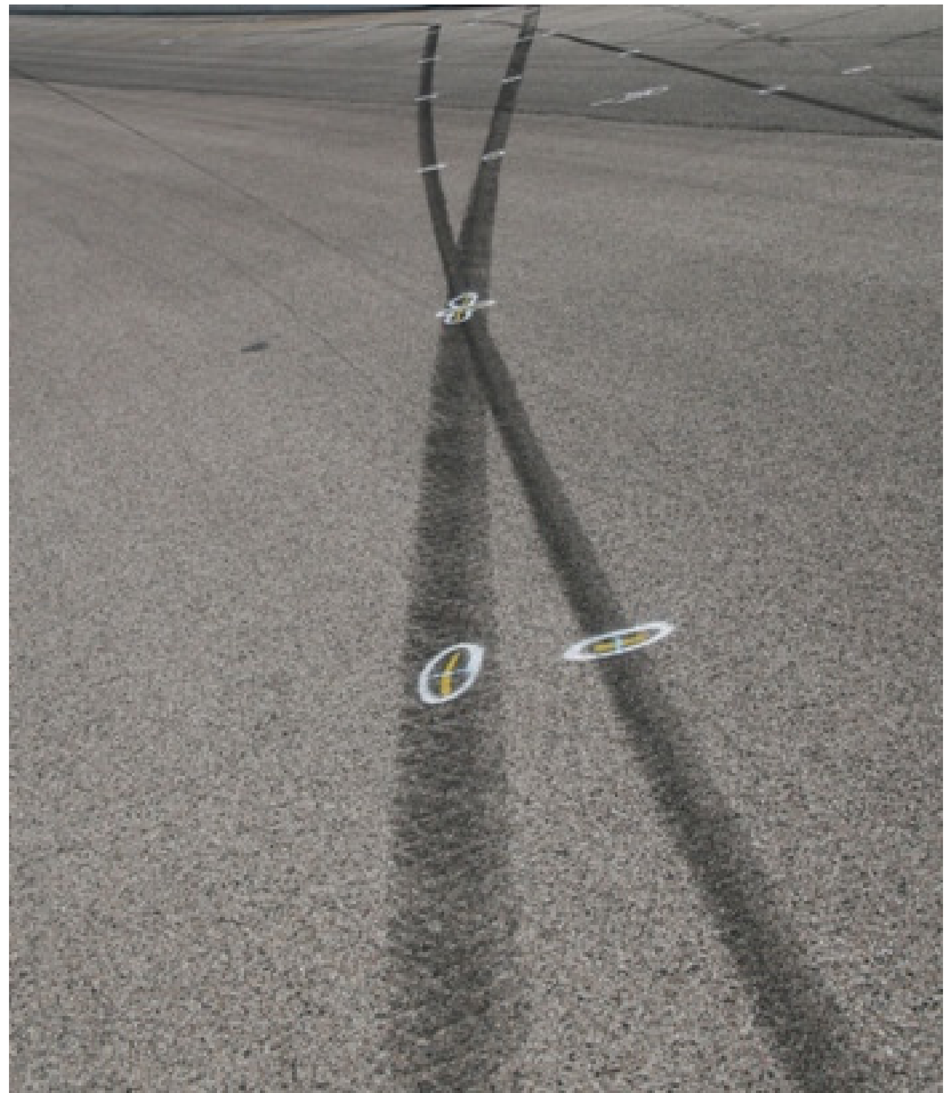
- Tire marks
  - A ruler or tape across a braking tire mark can help identify which tire left the mark
    - May also rule out some tire marks as not related to the particular accident





Photographing Roadway

- Tire marks
  - Yaw mark striations should be well-documented
  - Yaw marks indicate that the tires are not pointed in the direction the vehicle is moving



Photographing Roadway

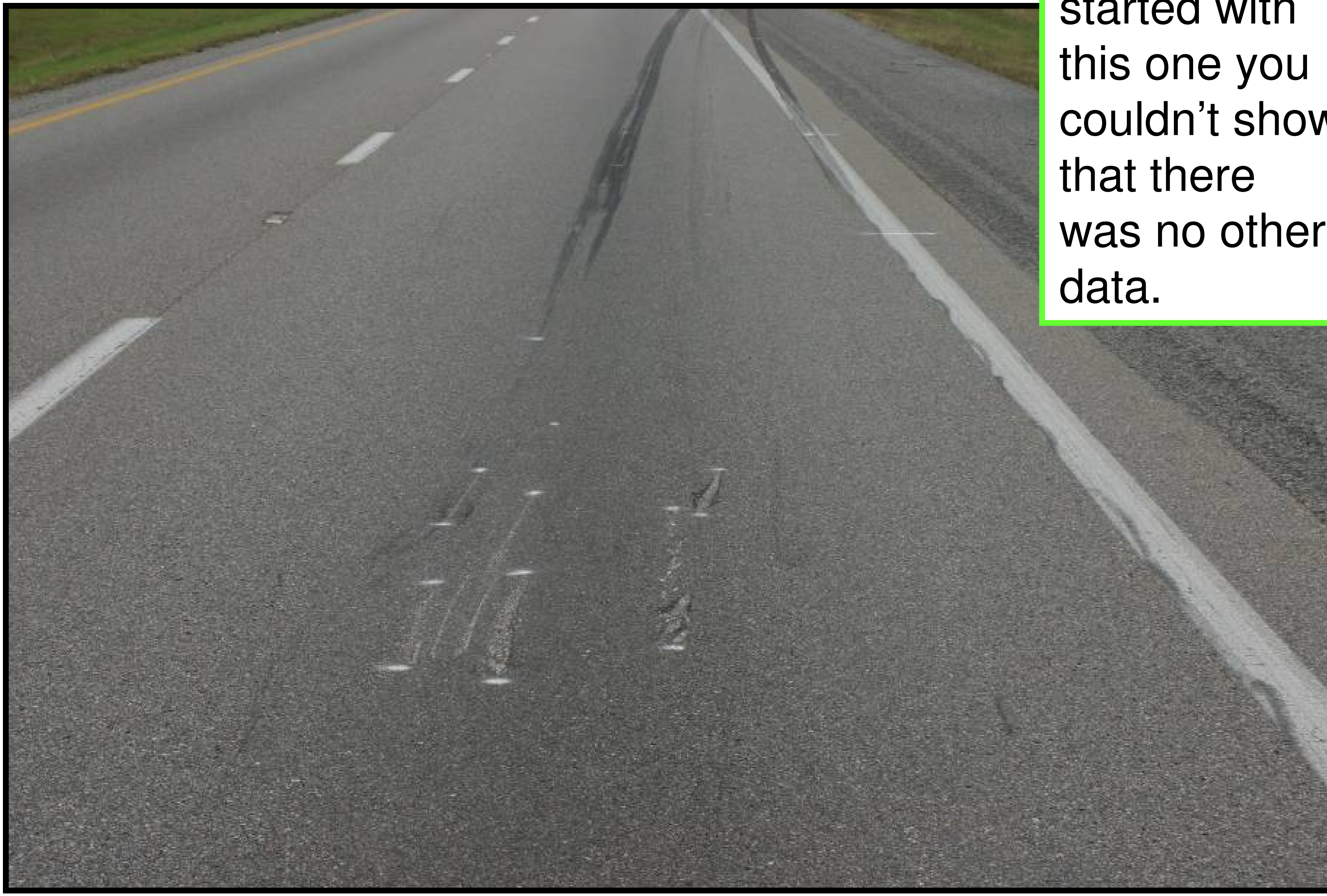
- Long tire marks
  - First photographs should be taken <u>before tire mark starts</u>
  - Usually best to follow tire mark in the direction it was created
  - Photographs should overlap if taken in a series
  - Get additional detail if there are any irregularities or changes in appearance of tire mark

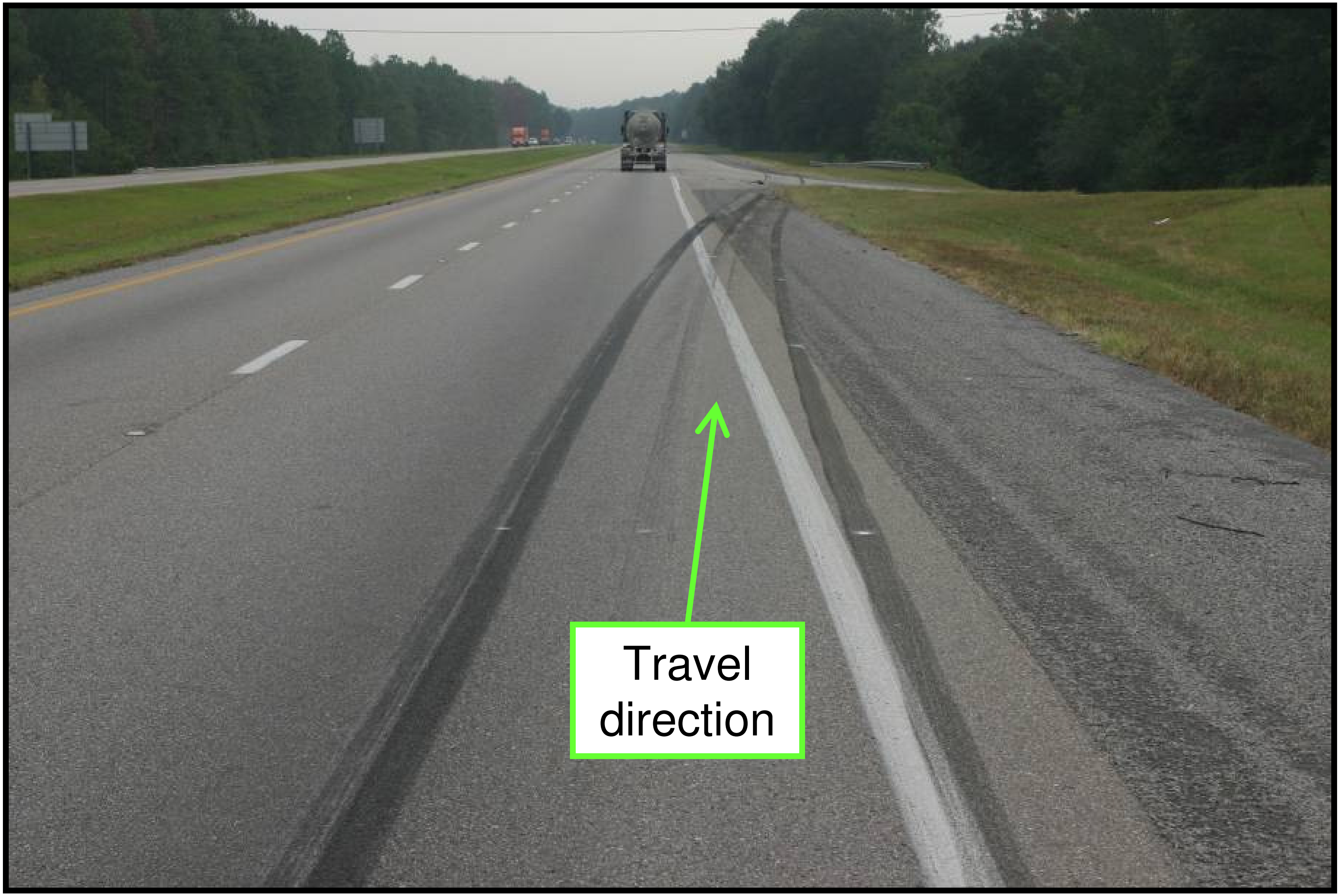
Photographing Roadway

- Scrapes and Gouges
  - Need wide view photos (with landmarks) initially to clearly locate scrape or gouge
  - Gradually get closer with one or more medium range views
  - Full detail shot in center of photo
  - Identifying individual scrapes and gouges with chalk or paint can be useful


Shows
that there
is no
other
evidence

If you had started with this one you couldn't show that there was no other data.




Travel
direction

Keys to Good Scene Photographs

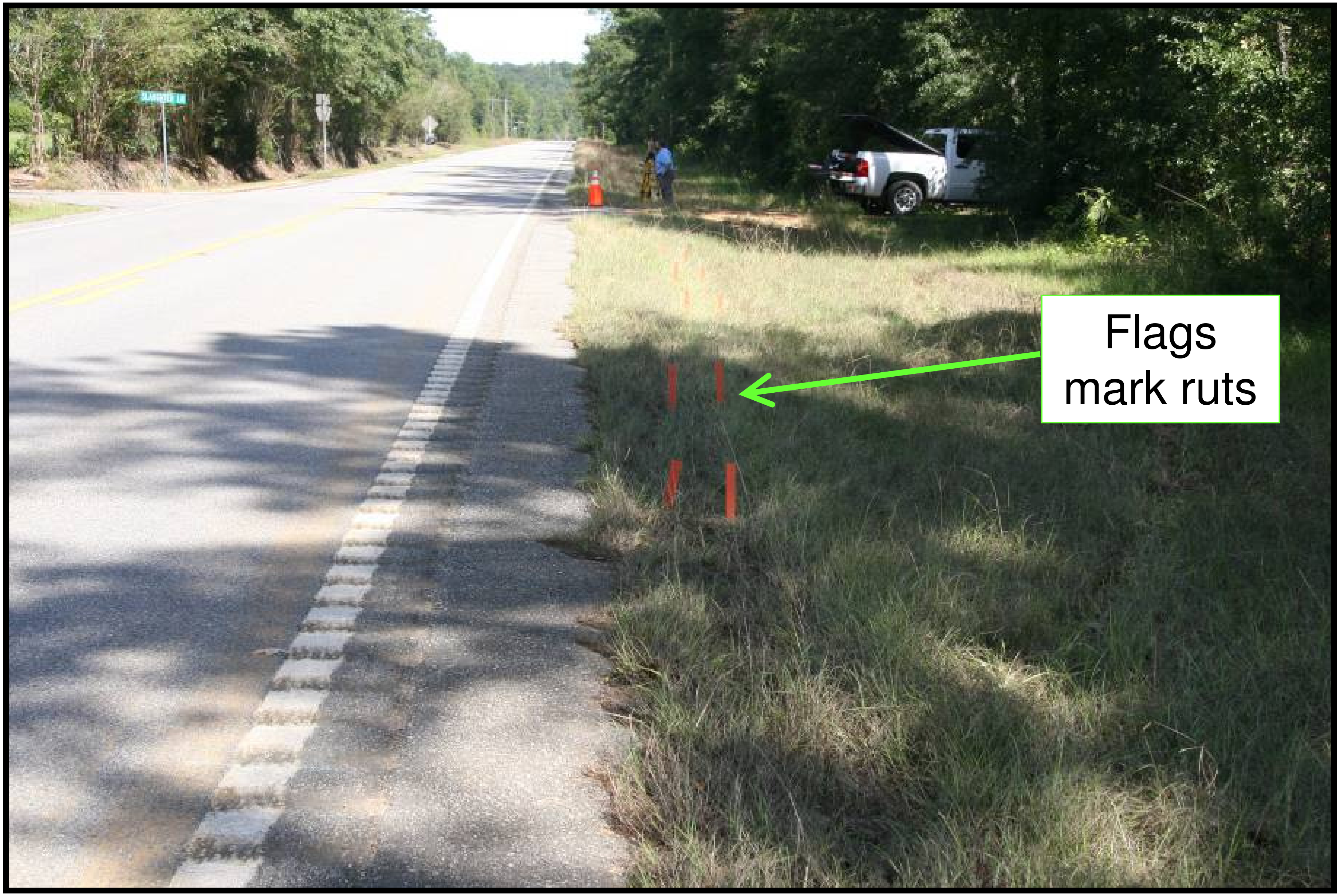
- Photographs can be taken later
  - Off-road vehicle rest positions
  - General scene
  - View obstructions
  - Damage to vehicles
  - Positions of signs
- In general, take photos both before and after putting down any paint

from *The Traffic-Accident Investigation Manual*, J Stannard Baker and Lynn B. Fricke, Northwestern University Traffic Institute, 9th Ed., 1986.

Photographing Off-Roadway

- Ruts and Furrows
  - Need wide view photos (with landmarks) initially to clearly locate start
  - Usually best to follow in the direction created
  - Surveying flags may be helpful to clearly locate ruts in grass
  - Matted grass is hard to photograph. Take shots from more than one angle to produce different glare on the blades.


Flags
mark ruts


Flags
mark ruts

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Low Sun Issues

- With low sun, keep sun to your back
  - May also have to walk in direction opposite vehicle travel
  - Still go in both directions for completeness


Low sun in
foreground

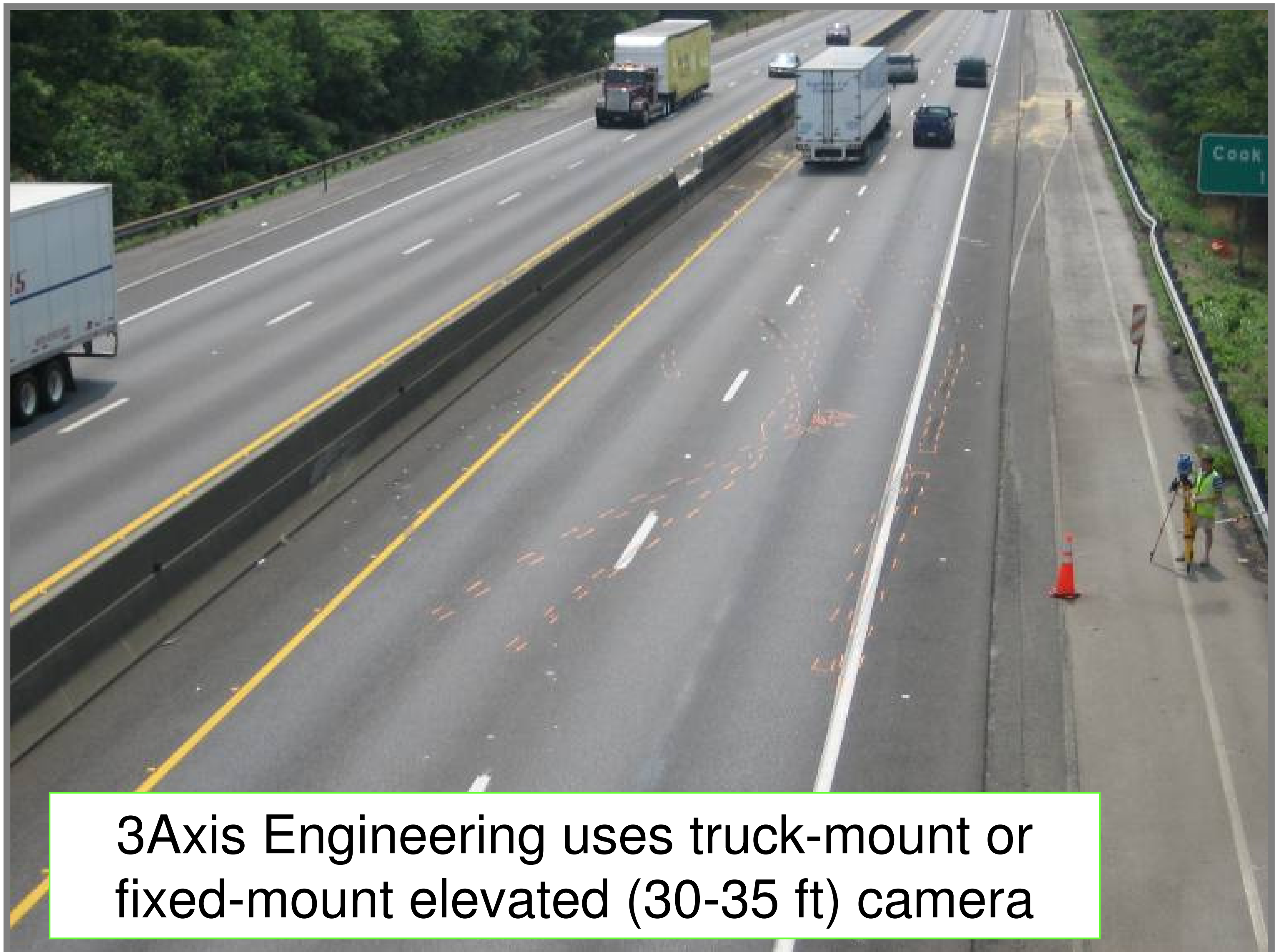

Same tire marks
looking back

Other Tips

- Show the horizon but don’t fill up half of the pictures with sky
- It’s hard to tell depth in a photograph. If depth is important, take a photo, move a few feet, take another photograph
- Standing in the bed of a pickup can give a different perspective and allow more data to be shown clearly in a photograph

Ground Level Photograph

Elevated Camera

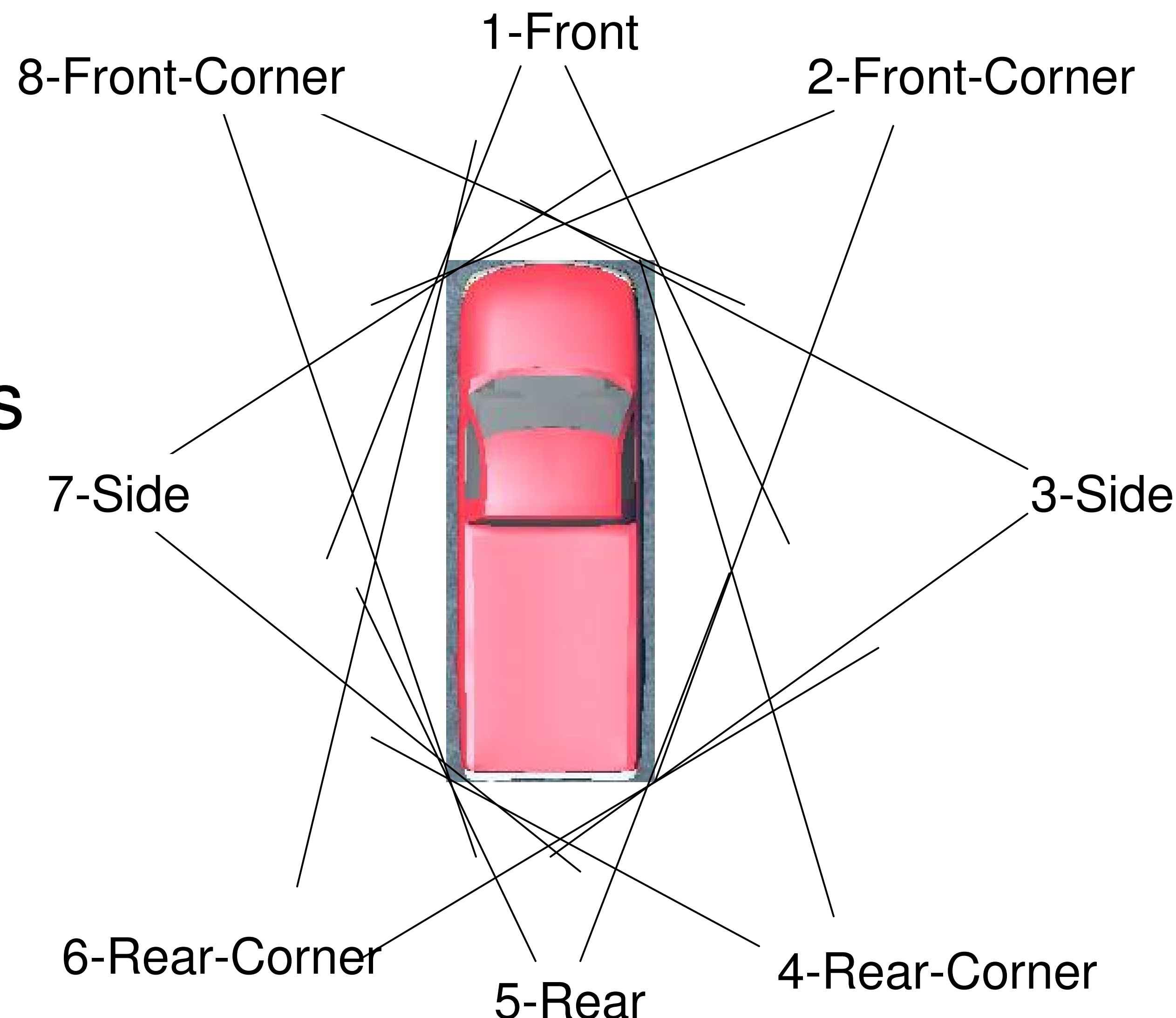


3Axis Engineering uses truck-mount or fixed-mount elevated (30-35 ft) camera

Elevated Camera

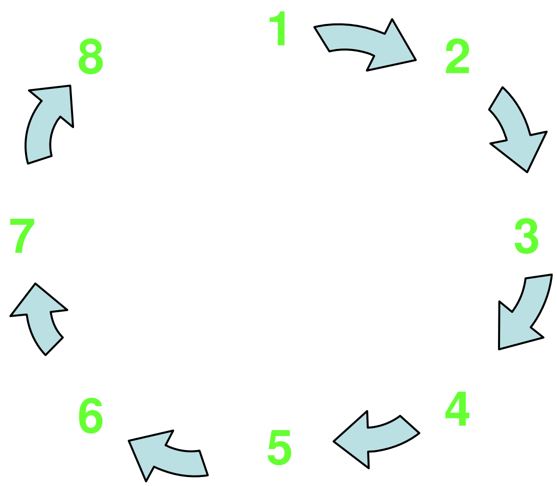
Photographing Vehicles

- Start with the “basic 8”
- Front, side, and rear shots should be perpendicular to vehicle if possible



Photographing Vehicles

- Details of damage
  - Use same “start wide, end narrow” approach
- Items of typical interest
  - Imprints of one vehicle on another
  - Tire or other abrasion marks
  - Damage to head-, tail- or marker-lights
  - Damage to wheels or tires
    - Document if tires “pinned” against vehicle in collision


1
2
3
4
5
6
7
8

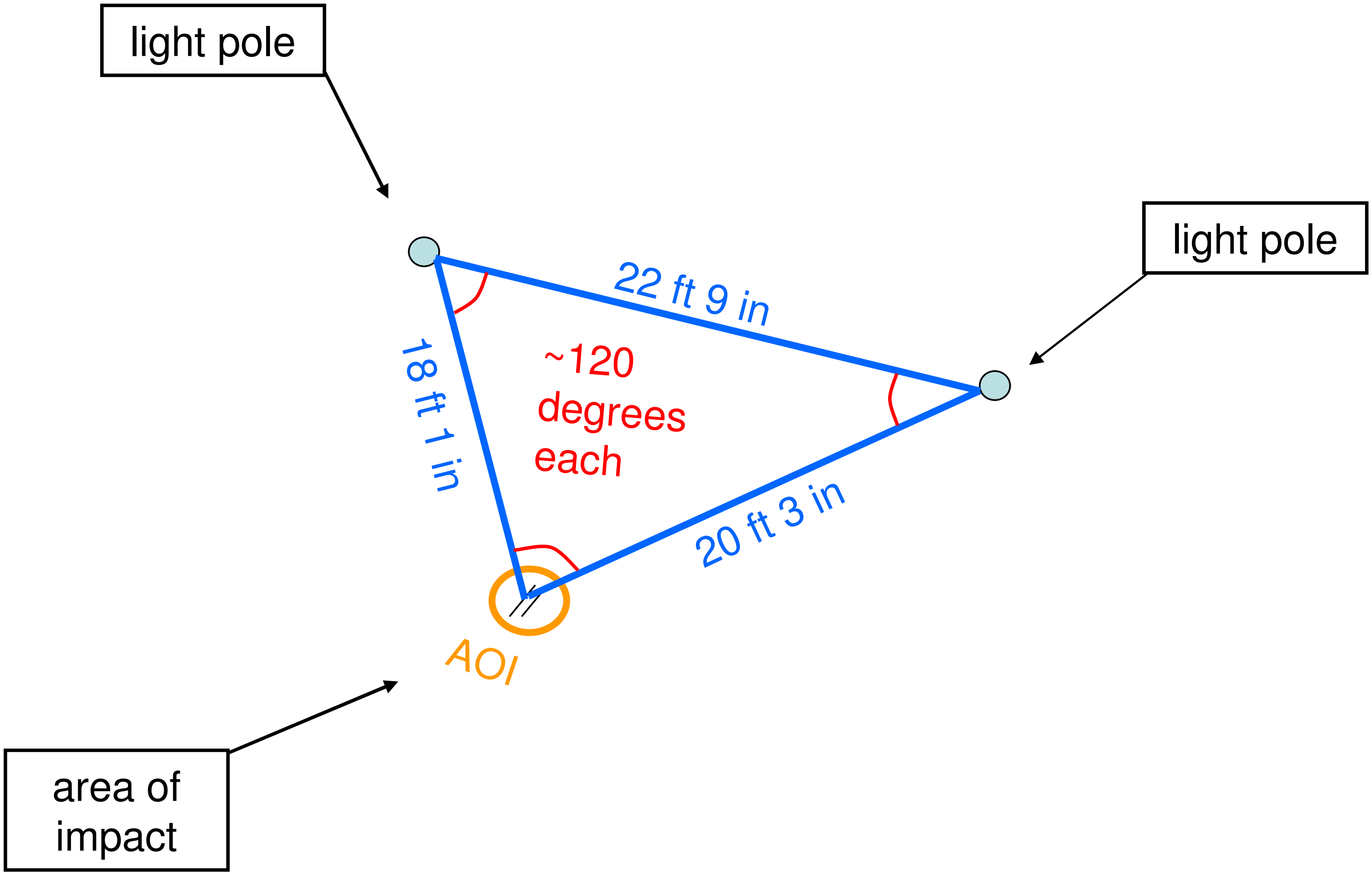
Accident Scene Measurements

- Distance measurements can be invaluable
  - Not always available from photographs alone
- In order of decreasing accuracy:
  - Total station / surveying equipment
  - Measuring tapes or wheels
  - Paces
  - ~~“Eyeball” estimates~~

Measurement by Paces

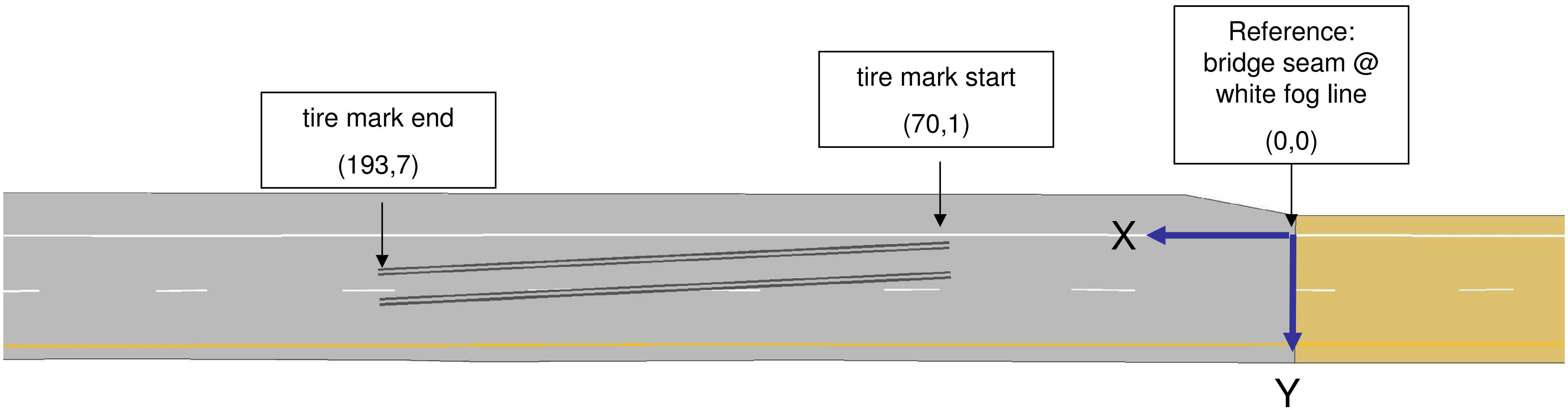
- Triangulation is best technique
  - measurements from 3 fixed objects in approximately 120º increments
- Bisection with measurements from 2 fixed objects about 90º apart also works
- Calibrate pace by measuring a few road features that are likely to remain constant
  - record these along with pace measurements of accident features

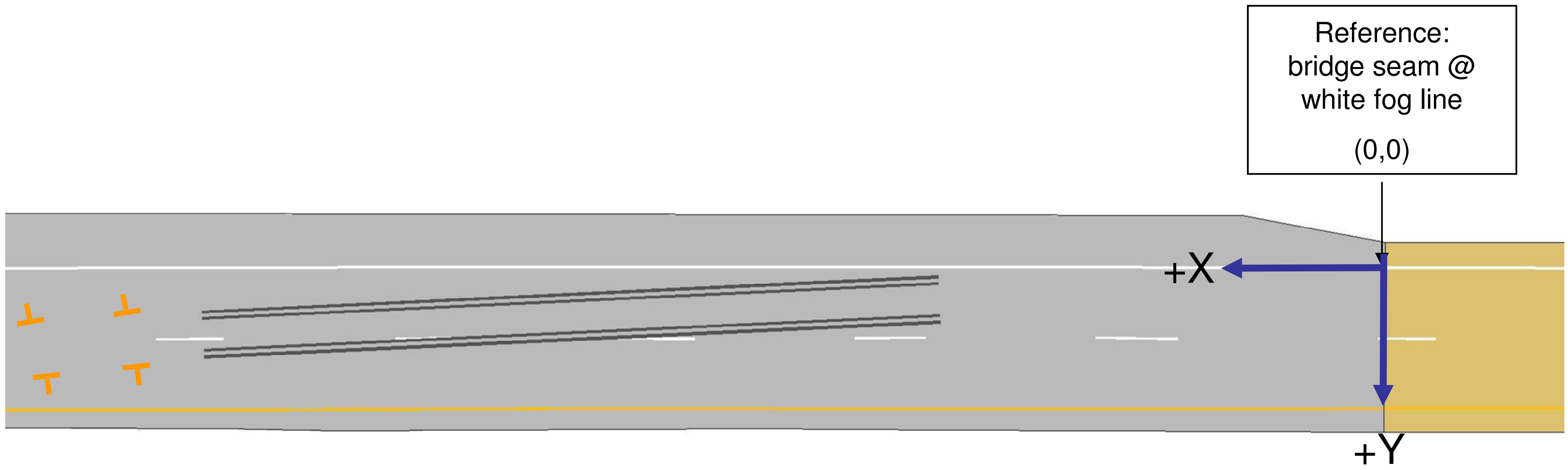
Triangulation

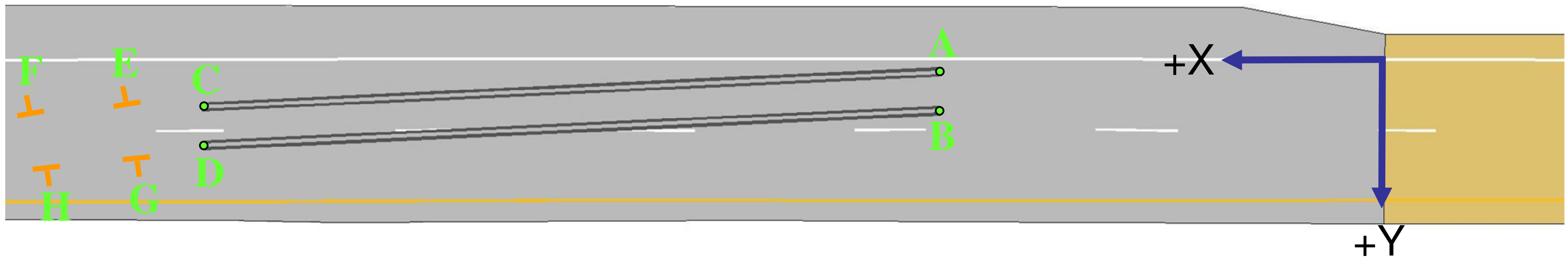


Measurement by Tape or Wheel

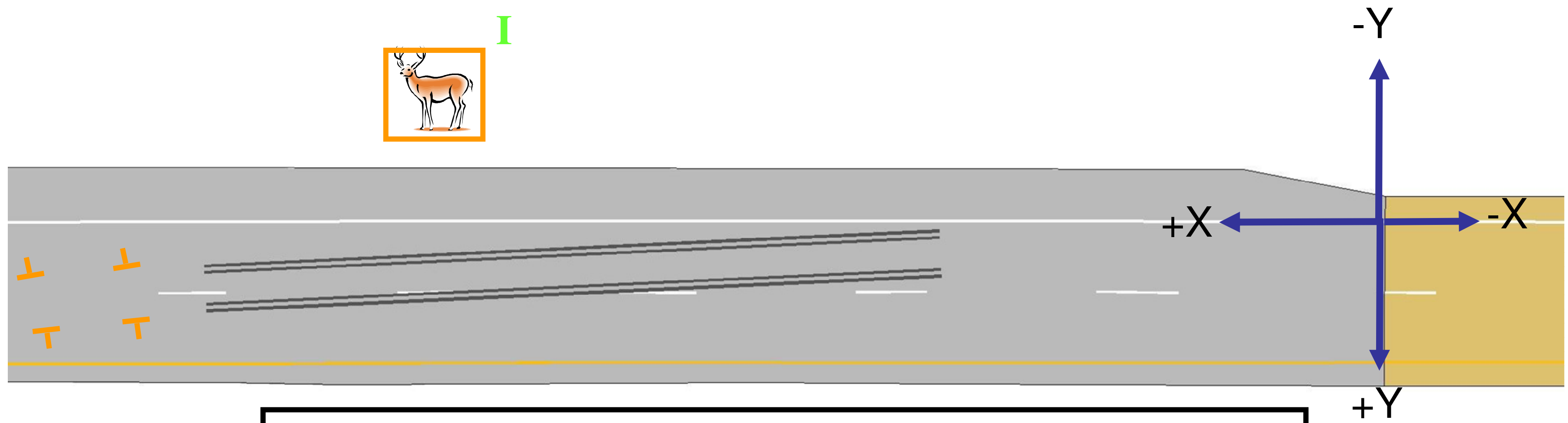
- Triangulation is best technique
  - measurements in ideally 120º increments from 3 fixed objects
- Rectangular grid approach also works well
  - Use a known straight line (white or yellow fog lines) as one of the axes
  - Other measurements taken perpendicular (at right angle) to the straight line axis
  - Measure a fixed object such as a utility pole or end of a line


tire mark end
(193,7)
tire mark start
(70,1)
Reference:
bridge seam @
white fog line
(0,0)
X
Y


Reference:
bridge seam @
white fog line
(0,0)
+X
+Y



A	(70,1)	tire mark start, right side
B	(70,8)	tire mark start, left side
C	(193,7)	tire mark end, right side
D	(193,14)	tire mark end, left side
E	(204,15)	right rear wheel position
F	(232,16)	right front wheel position
G	(204,22)	left front wheel position
H	(232,23)	left front wheel position



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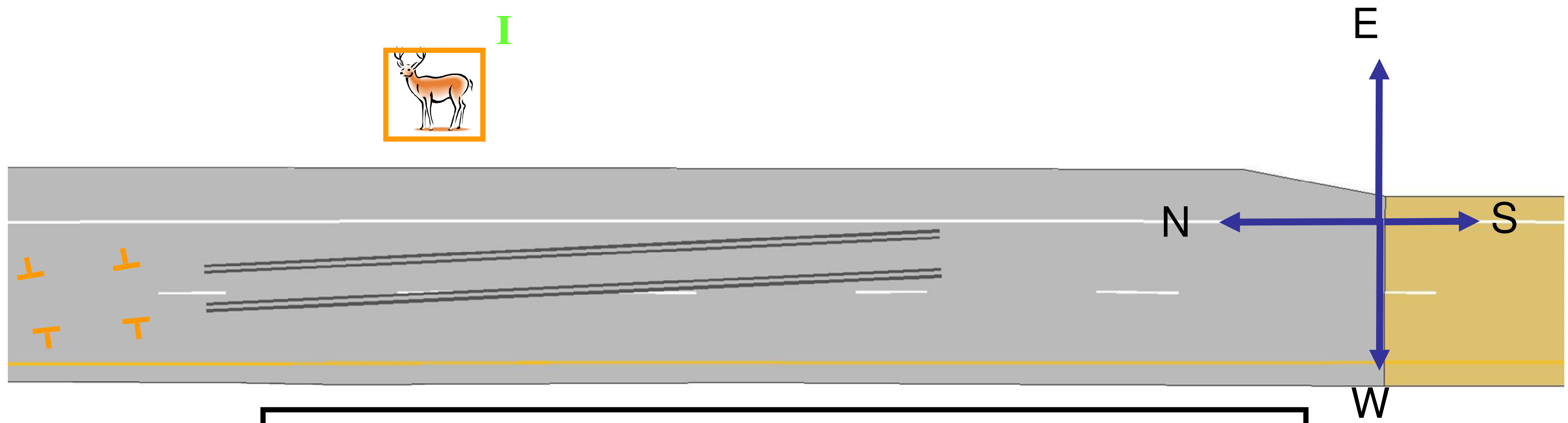
H	(232,23)	left front wheel position
I	(155,-15)	deer



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Thank You!

Any Questions?

Call us if we can help: 205-752-4488