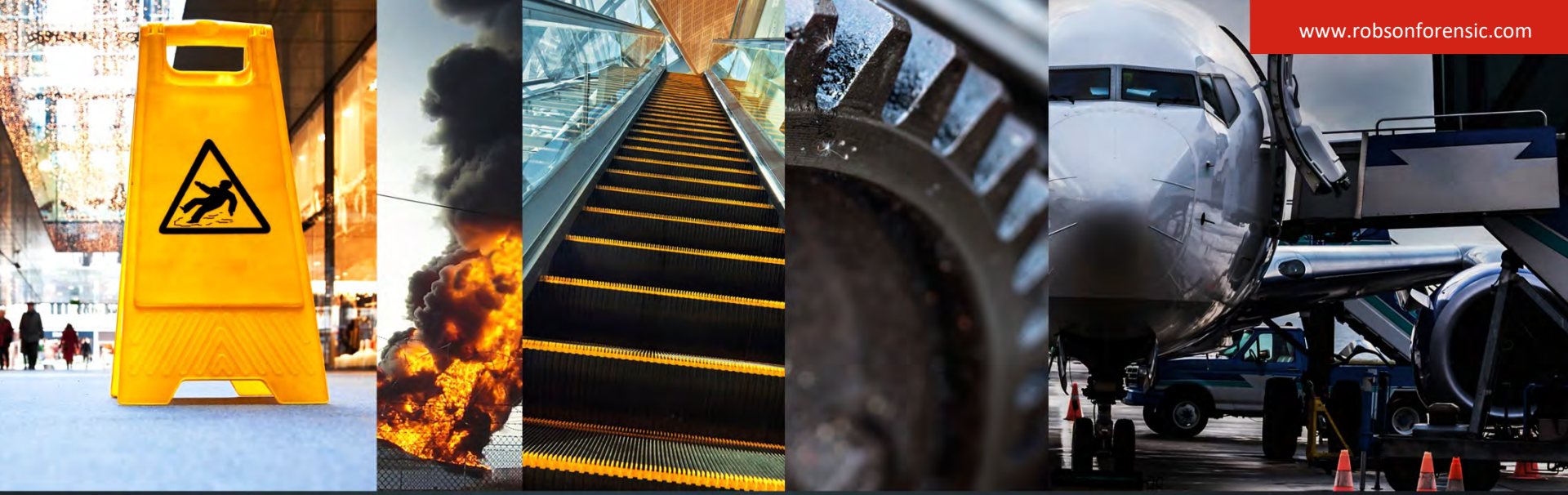


Premises Safety

ACCIDENT RECONSTRUCTION

Mark E. Williams, AIA, NCARB
ARCHITECT

AUGUST 9, 2018

THE EXPERTS
Robson Forensic


Dream Catchers Way
Dream Catchers Way
Dream Catchers Way
Dream Catchers Way
Dream Catchers Way
Dream Catchers Way
Dream Catchers Way
BlueGreen Vacations
134b DreamCatchersWay
Mountain Loft Dr
Mountain Loft Dr


05.15.2017 14:57

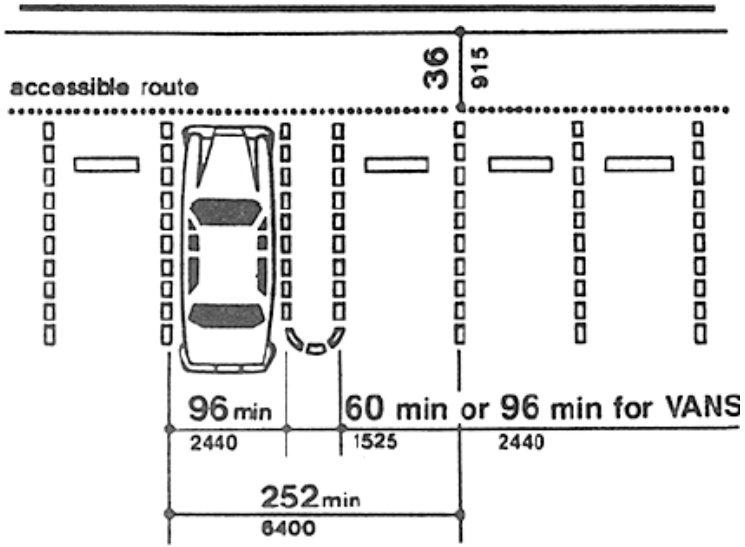
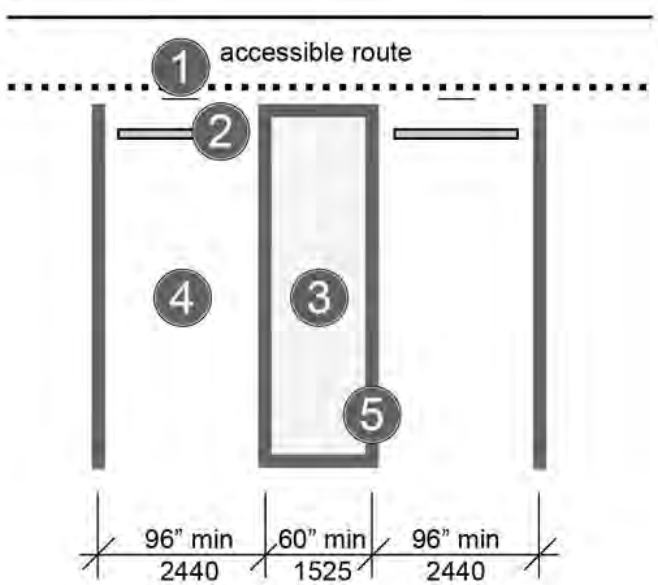


Fig. 9
Dimensions of Parking Spaces




HANDICAPPED
PARKING
ONLY
05.15.2017 15:47


05.15.2017 14:54


FIRE
EXTINGUISHER
EXIT
05.15.2017 14:59


510 Tom Hall St,
Fort Mill, SC 29715


Fort Mill, South Carolina
Street View - Sep 2007
CVS/pharmacy
DRIVE-THRU/pharmacy


Fort Mill, South Carolina
Street View - Sep 2007
CVS/pharmacy
CVS/pharmacy


06.14.2016 13:03


06.14.2016 13:04


CVS
06.14.2016 13:05


beauty
beer & wine
photo
pharmacy
MoneyGram
welcome
510
Try free curbside pickup.
06.14.2016 13:05


06.14.2016 13:06


Google


765


04.07.2015 14:14


04 07 2015 14:14


04.07.2015 14:14


04.07.2015 14:14


04.07.2015 14:17


06.03.2015 12:19


06.03.2015 11:19


LEVEL DIRECTORY
3
2
1
04.13.2017 14:18


05.14.2012 14:10


05.14.2012 14:10


STEP
05.14.2012 14:10


05.14.2012 14:11


05.14.2012 14:08


CAUTION
Traffic approaches from left
Shuttles:
Hotel/Motel
Rental Cars
Park & Ride
Prearranged Services/Limos
Taxi
Designated Smoking Area
Pet Relief Area
Prearranged Services
Hotel/Motel
Park & Ride
Limos
Rental Cars


2009/05/17


RESERVED PARKING
ProAxis
RESERVED PARKING
ProAxis
proaxistherapy
Suite E


WILSON'S 5¢ - $1.00


05.17.2018 12:01


VENETIAN
NAIL SPA
Madewell
Madewell


LUSH
ALEX AND ANI
BANANA REPUBLIC
bebe
MICHAEL KORS
FLIP

Describe the Hazard

It all starts with a physical condition.

THREE ELEMENTS OF A PROOF

1. What is the Standard of Care?
2. What was actually done in this Case?
3. Was there a deviation between 1 and 2?

Hierarchy of Importance

1. Governing Code (Mandatory)
2. Applicable Code (Permissive)
3. Industry Standard
4. State of the Art

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Accident Reconstruction 101

Brian Pfeifer, Ph.D., P.E.

Evidence Documentation

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BEC
CONSULTING, LLC

When?

As soon as possible!

Why?

Preserve valuable evidence

- Skid marks
- Gouge marks
- Lighting conditions
- Vehicle crush measurements
- Light bulbs
- Seat belt evidence
- Electronic Evidence
- And more …

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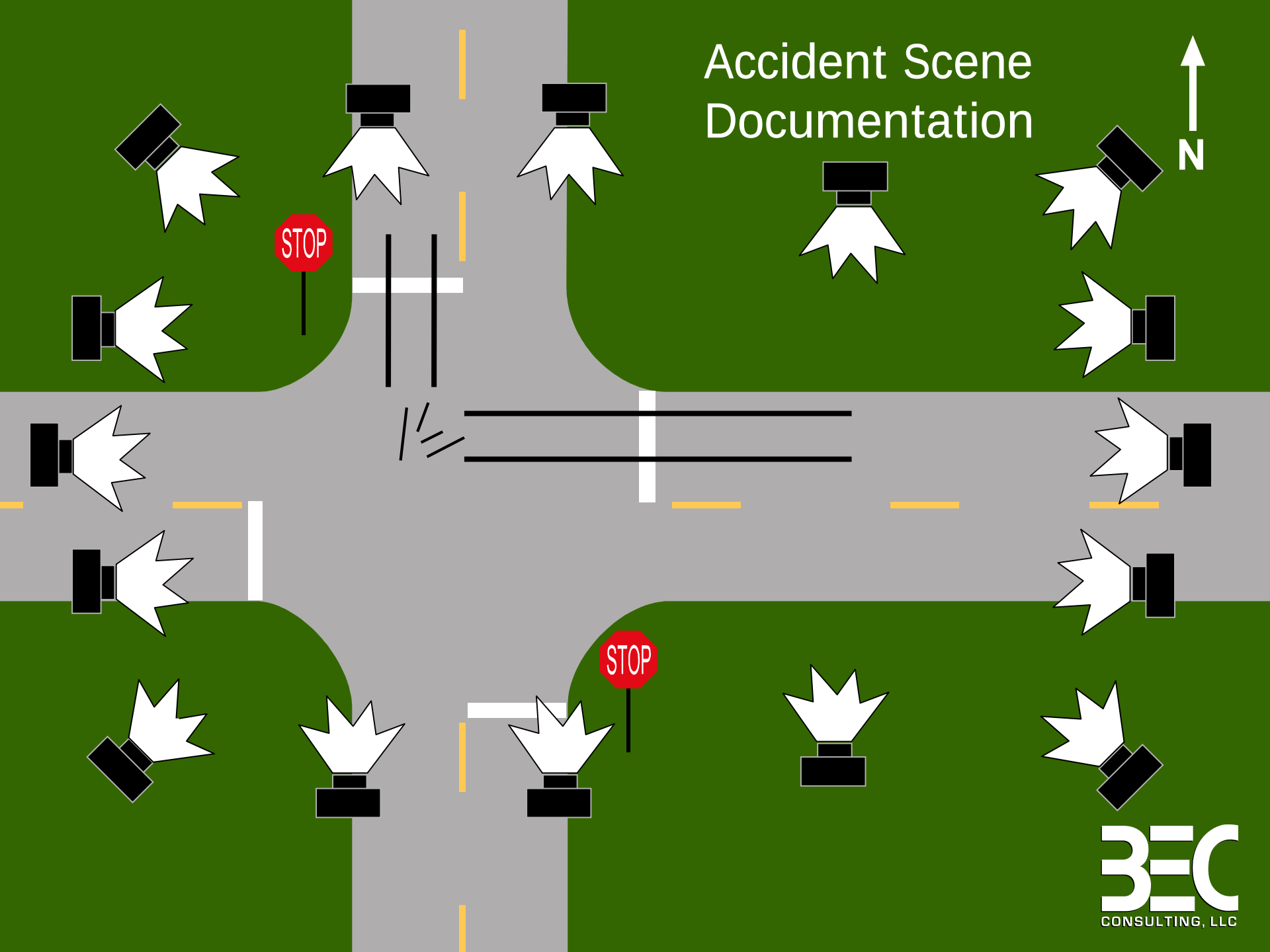
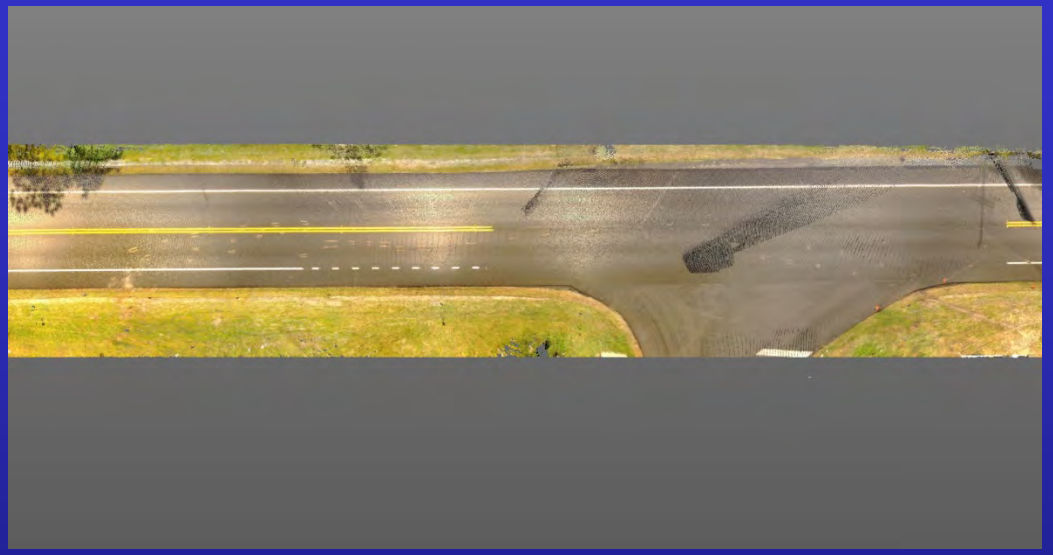
Day of Accident

BEC CONSULTING, LLC

Two years after Accident

BEC CONSULTING, LLC


Accident Scene
Documentation
N
STOP
STOP
CONSULTING, LLC



Survey or 3-D Scan of scene to collect evidence and document roadway geometry

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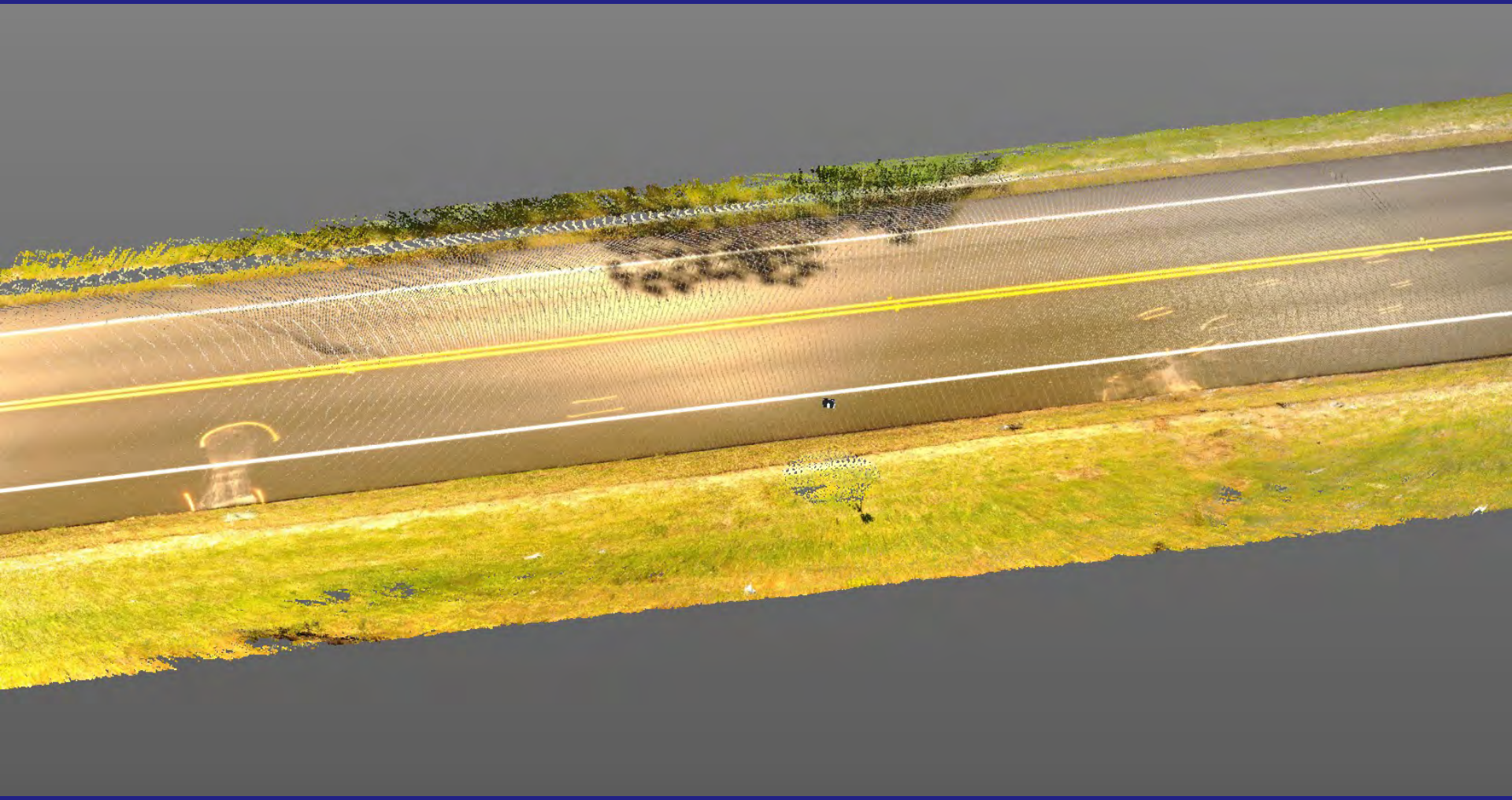
CONSULTING, LLC



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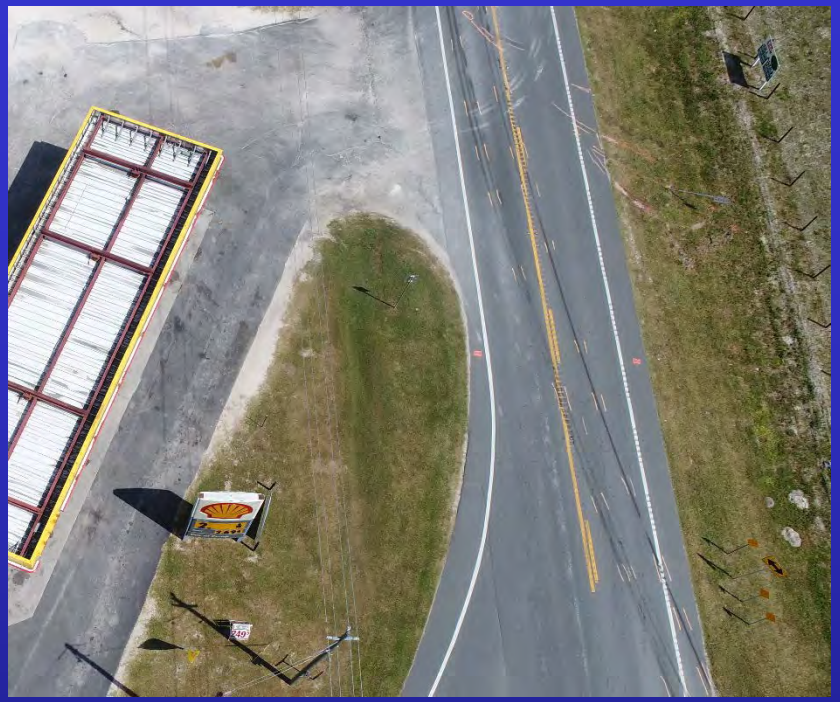

Aerial Photography / Mapping to collect evidence and document roadway geometry

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CONSULTING, LLC

BEC CONSULTING, LLC

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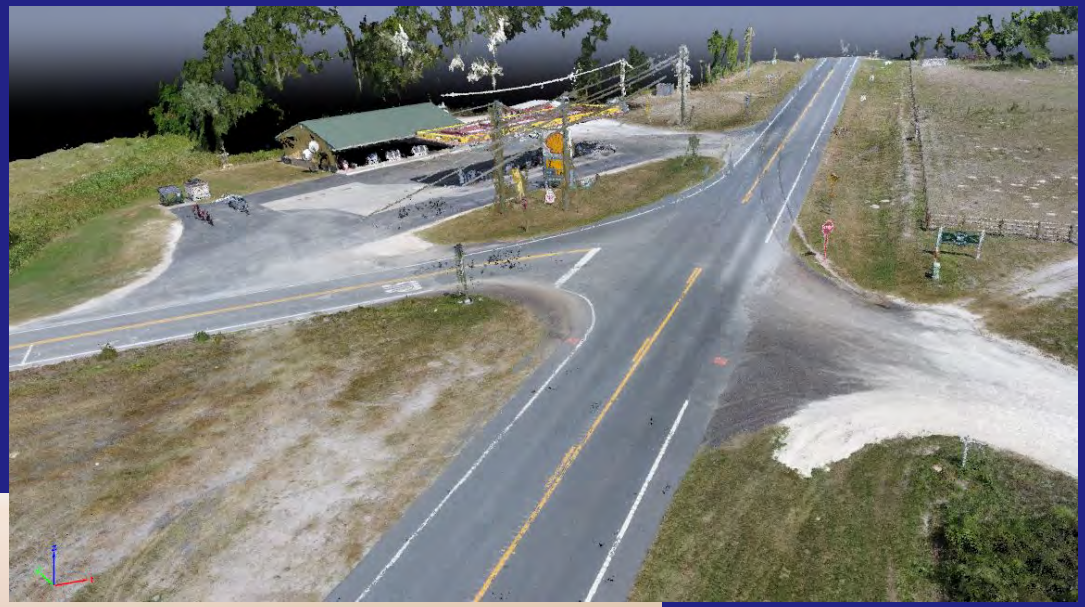
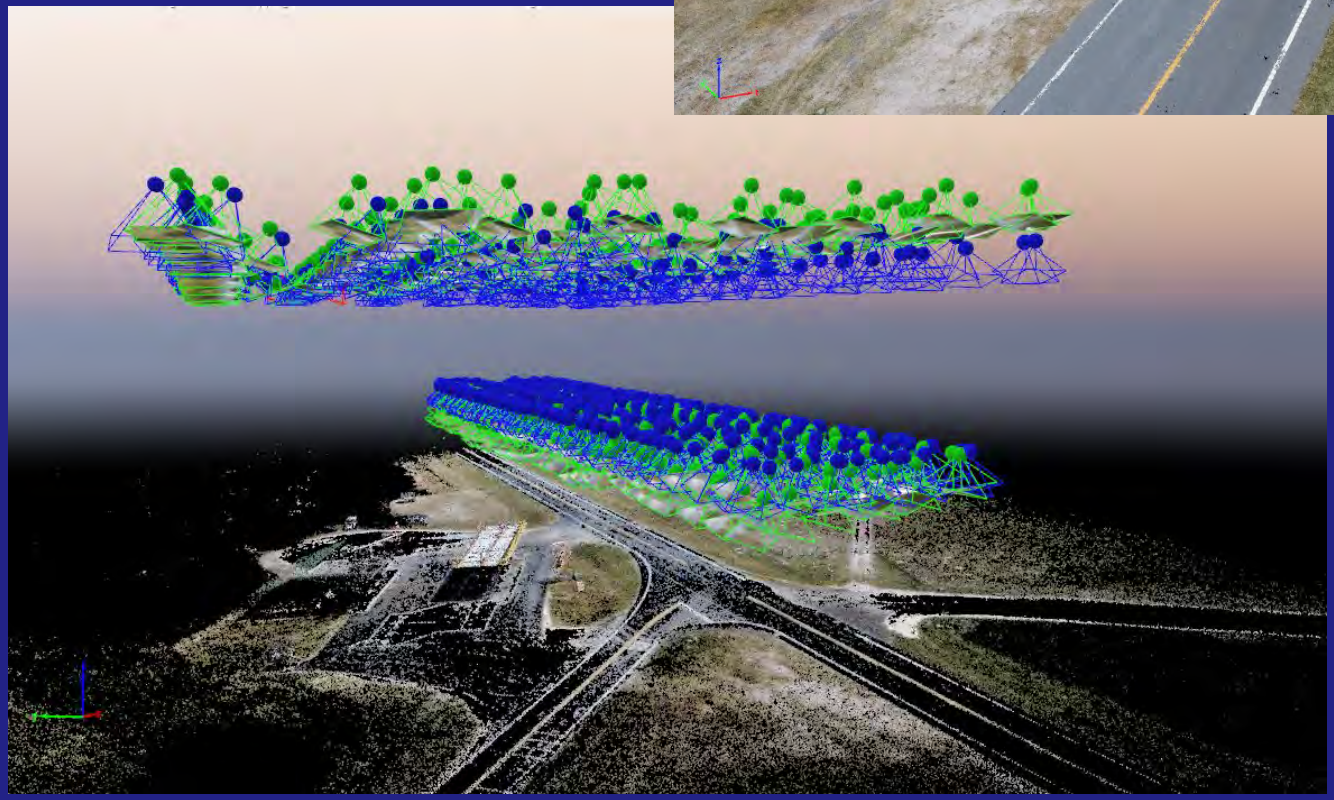
BEC CONSULTING, LLC

PIX4D





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Dash Cam Video / Drivers Perspective

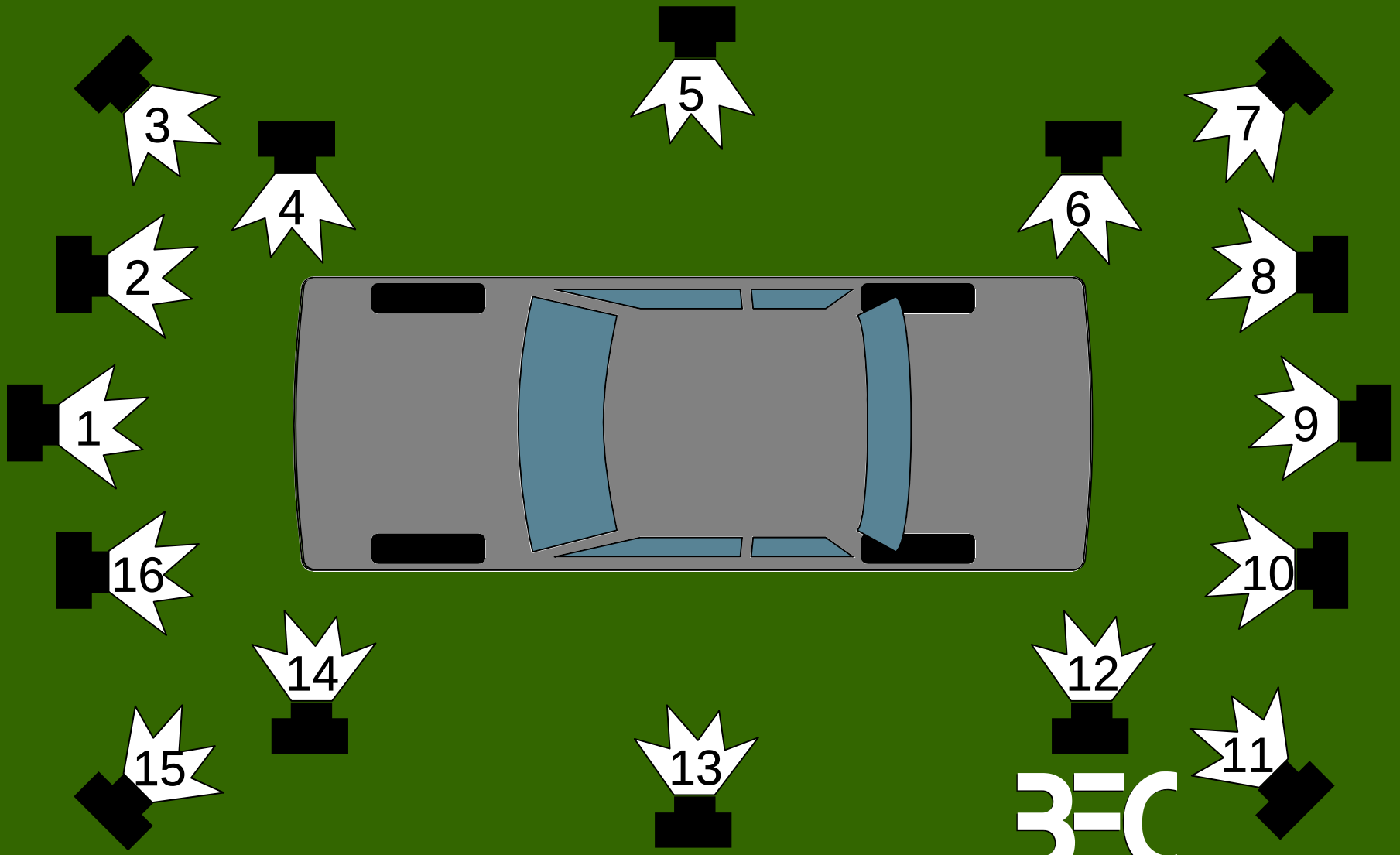
BEC CONSULTING, LLC

BEC
CONSULTING, LLC

Vehicle Documentation

BEC CONSULTING, LLC

Minimum Exterior Photographs



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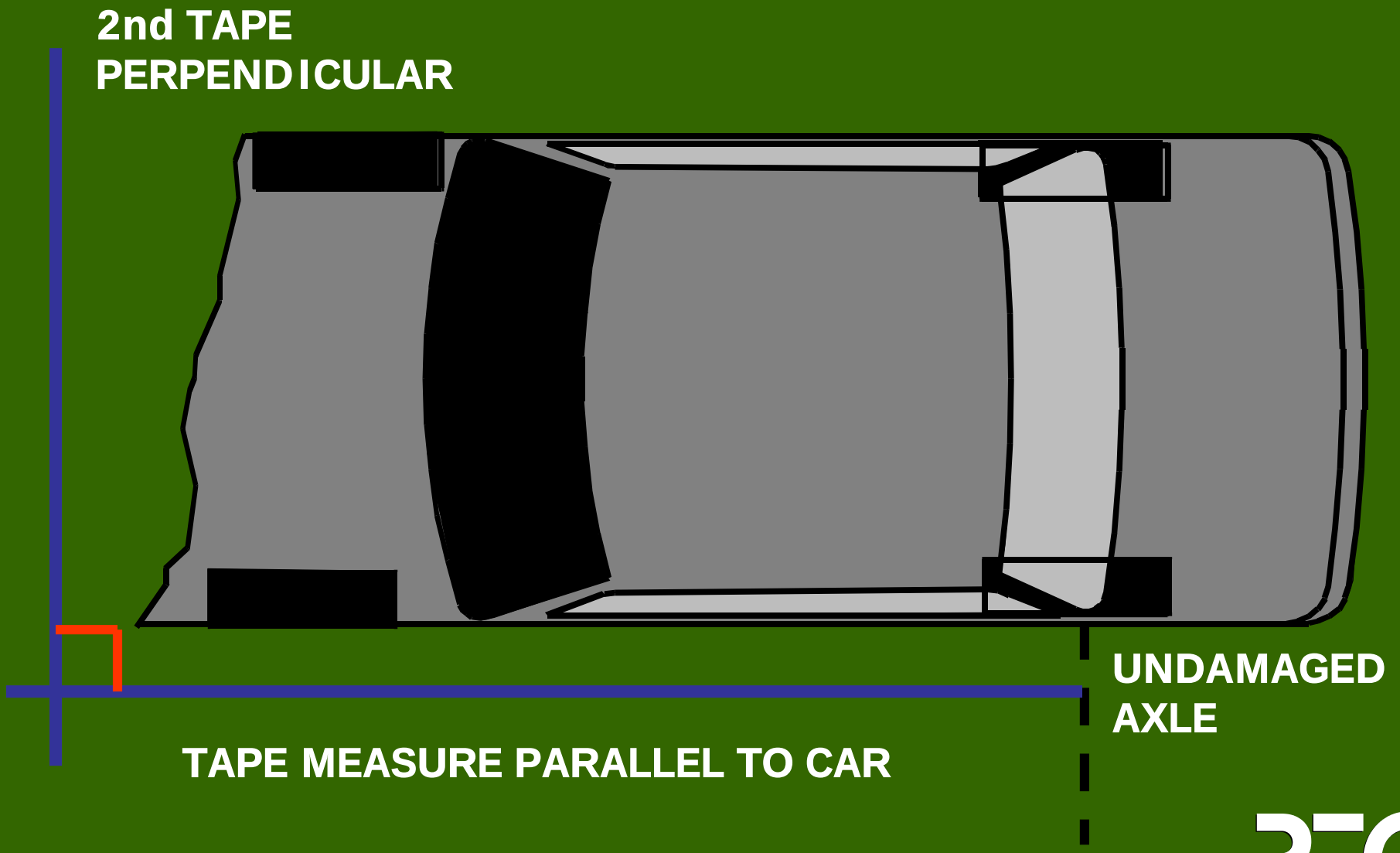
Frontal Crush



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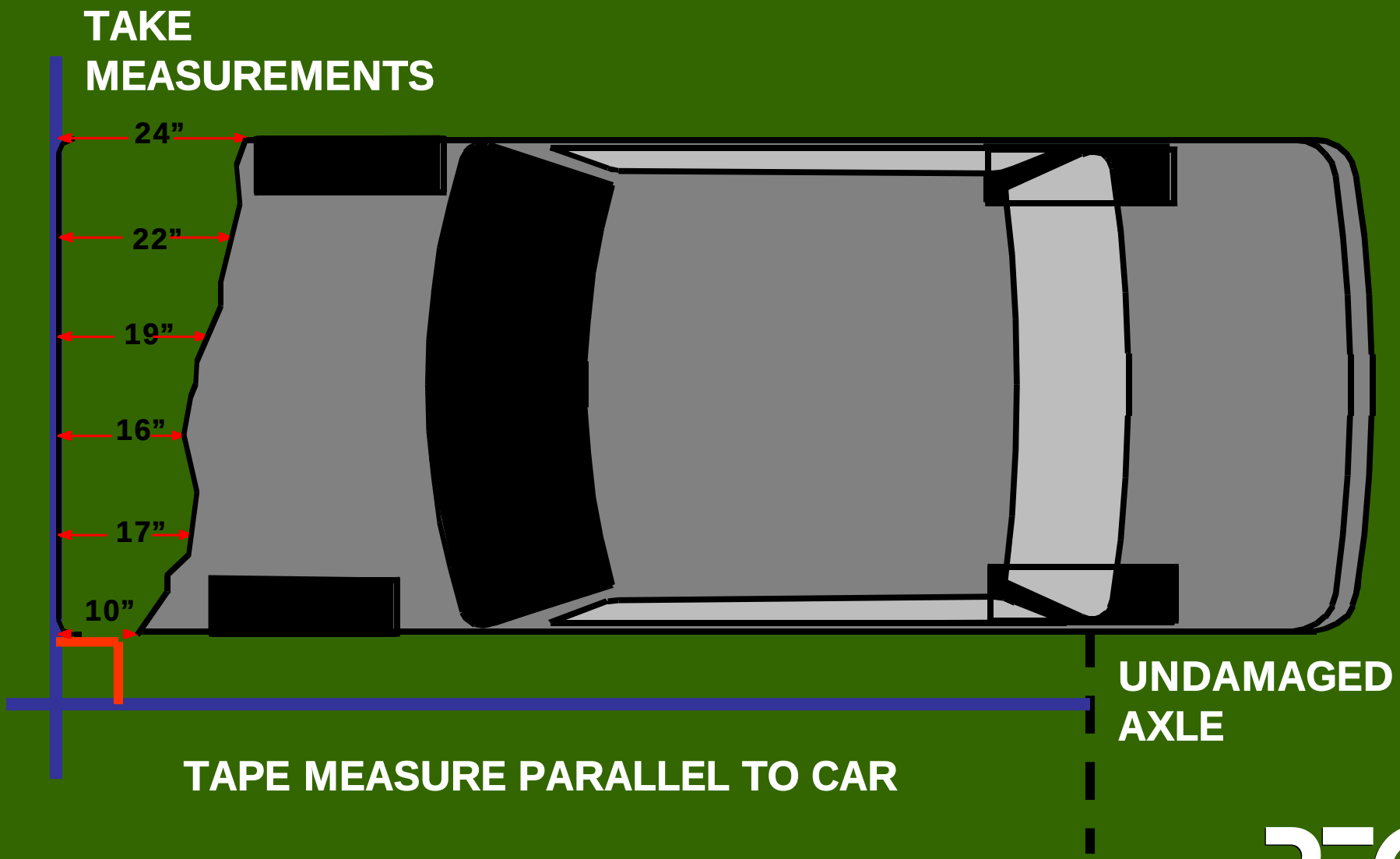
Frontal Crush

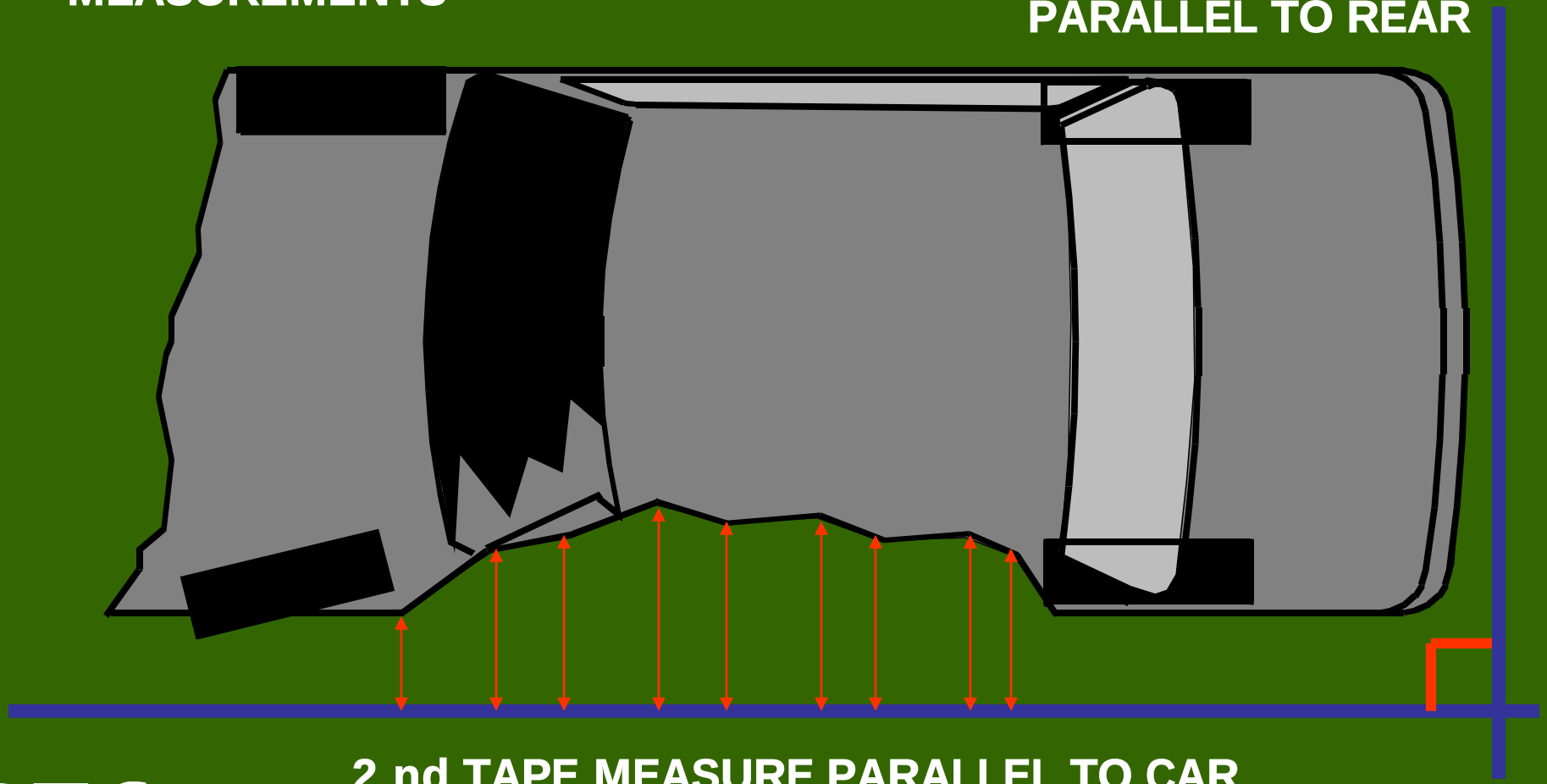


BEC CONSULTING, LLC

Side Crush

TAKE MEASUREMENTS

TAPE MEASURE PARALLEL TO REAR



2 nd TAPE MEASURE PARALLEL TO CAR

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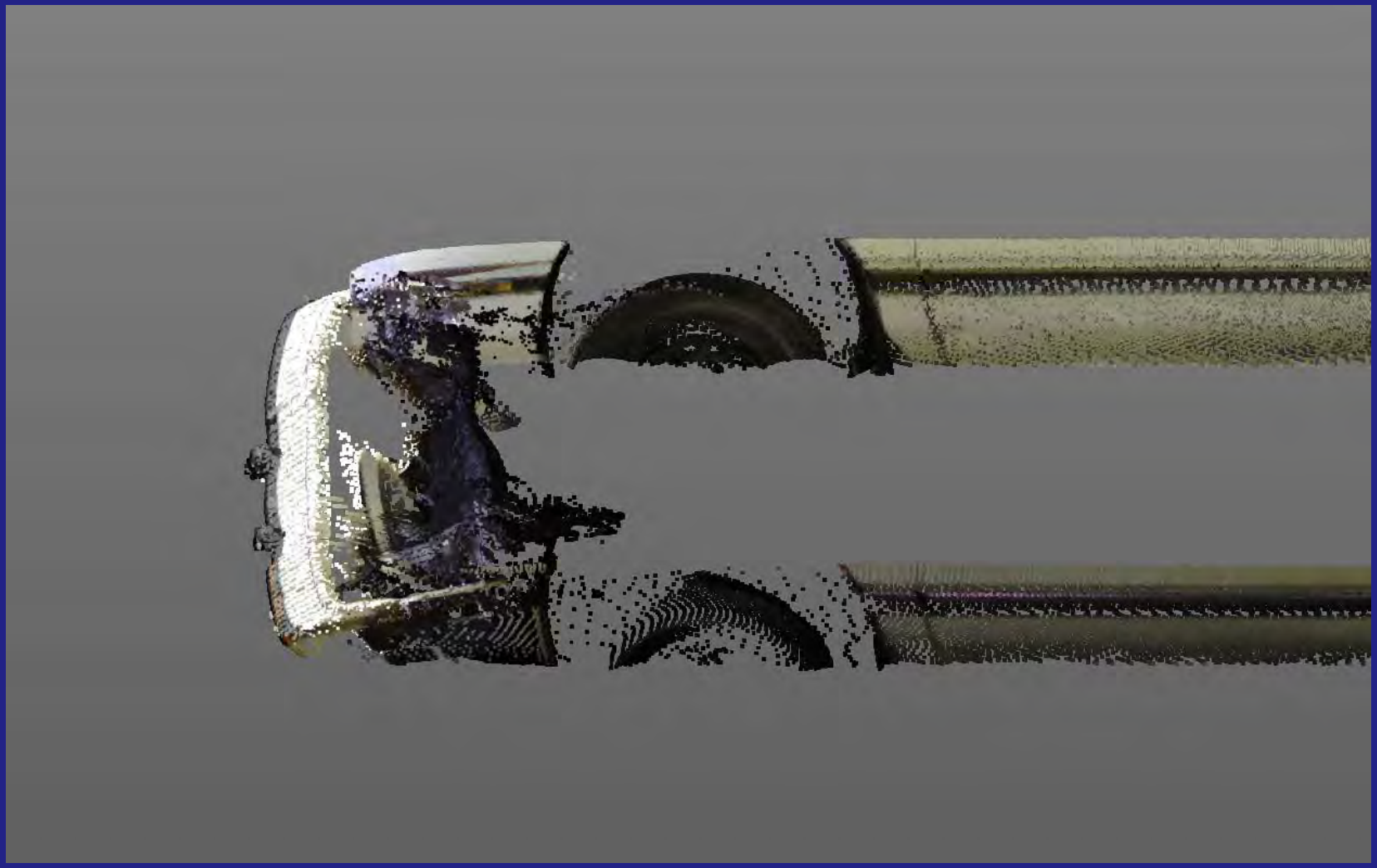
3-D Scan

BEC CONSULTING, LLC

3-D Scan

BEC CONSULTING, LLC

3-D Scan



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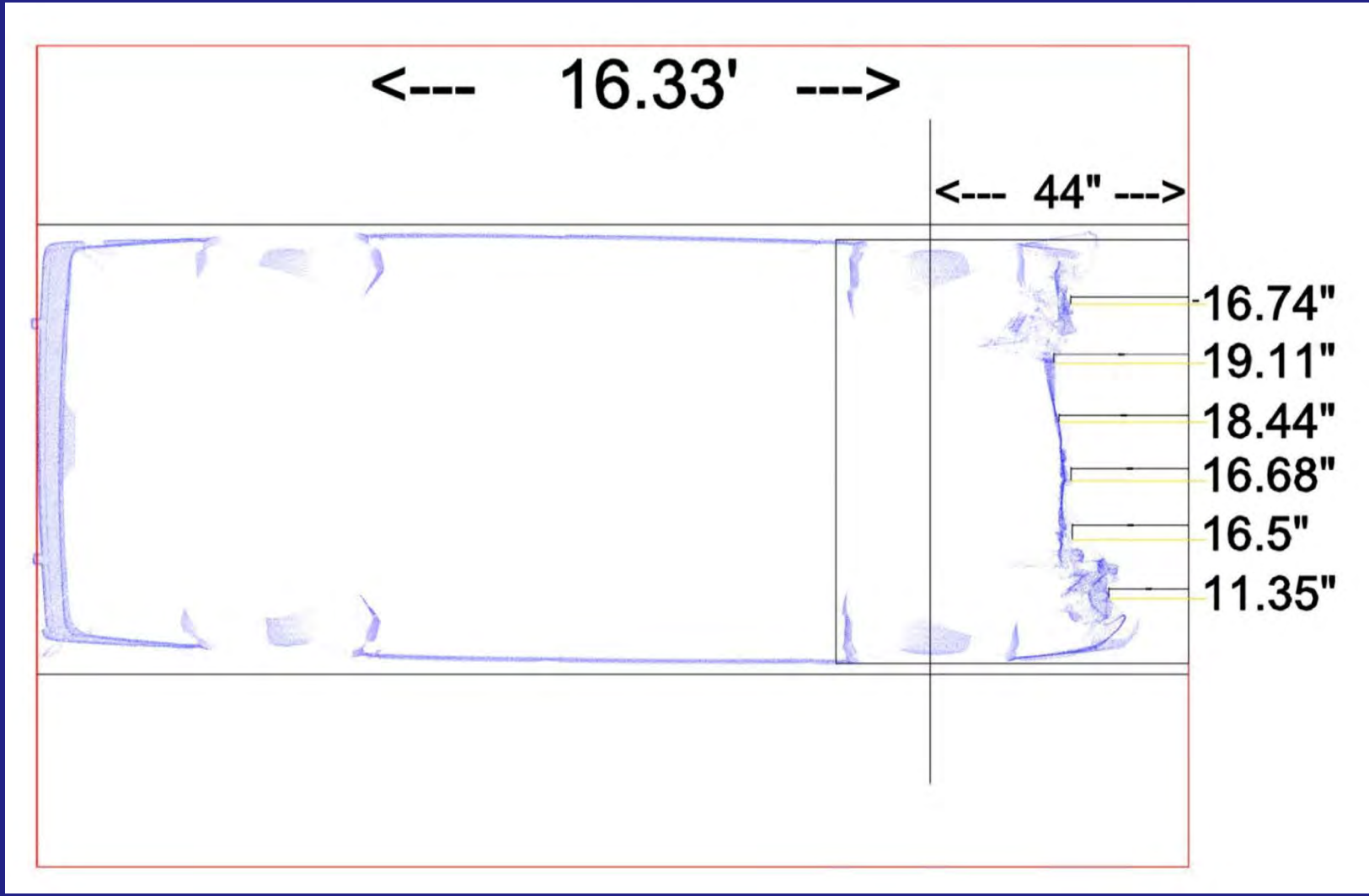
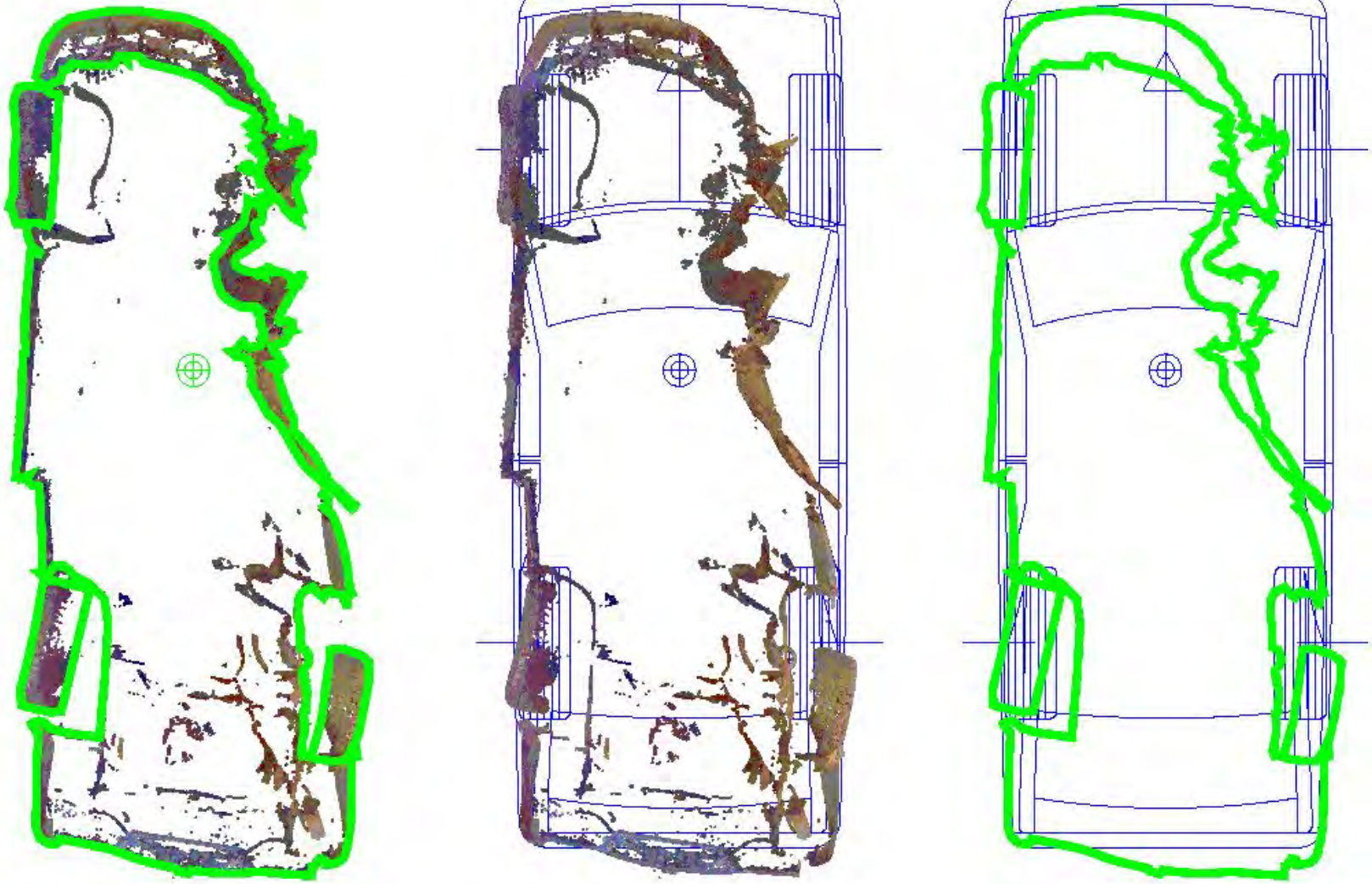
3-D Scan



BEC CONSULTING, LLC



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Light Bulb Filament Analysis

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Seat Belt Pre-Tensioner

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Seat Belt Documentation

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Evidence Of Seatbelt Usage

Latchplate Abrasions

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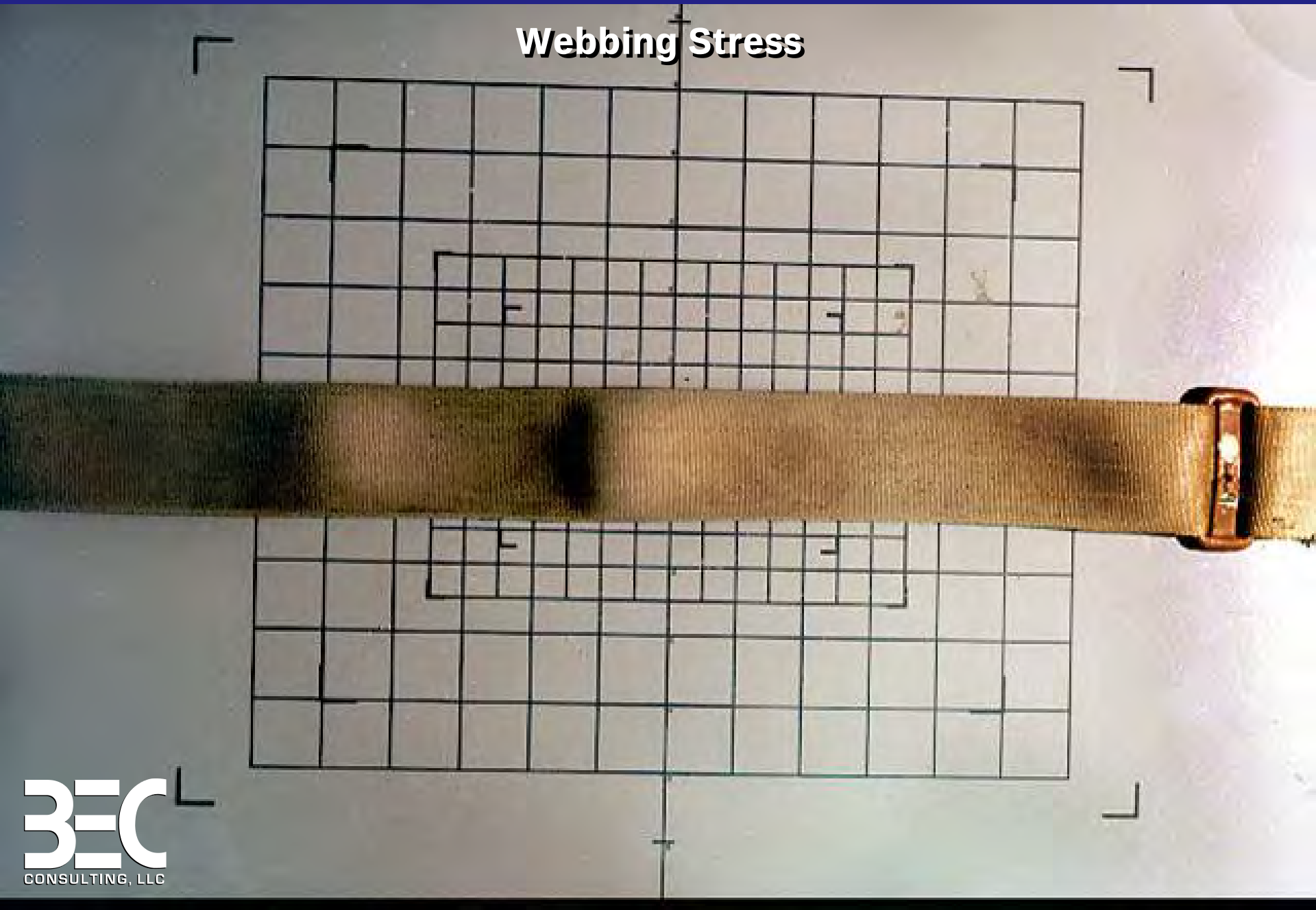
Evidence Of Seatbelt Usage

Webbing Stress



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Evidence Of Seatbelt Usage

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Occupant Kinematics Analysis

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Security Video

BEC CONSULTING, LLC

Bus Video of Accident


CH1
BUS:00002001
04/25/2013 15:29:20


CH2
BUS:00002001
04/25/2013 15:29:20


CH3
BUS:00002001
04/25/2013 15:29:20

Photogrammetry

- Utilization of photographs to place evidence on a scene or vehicle.

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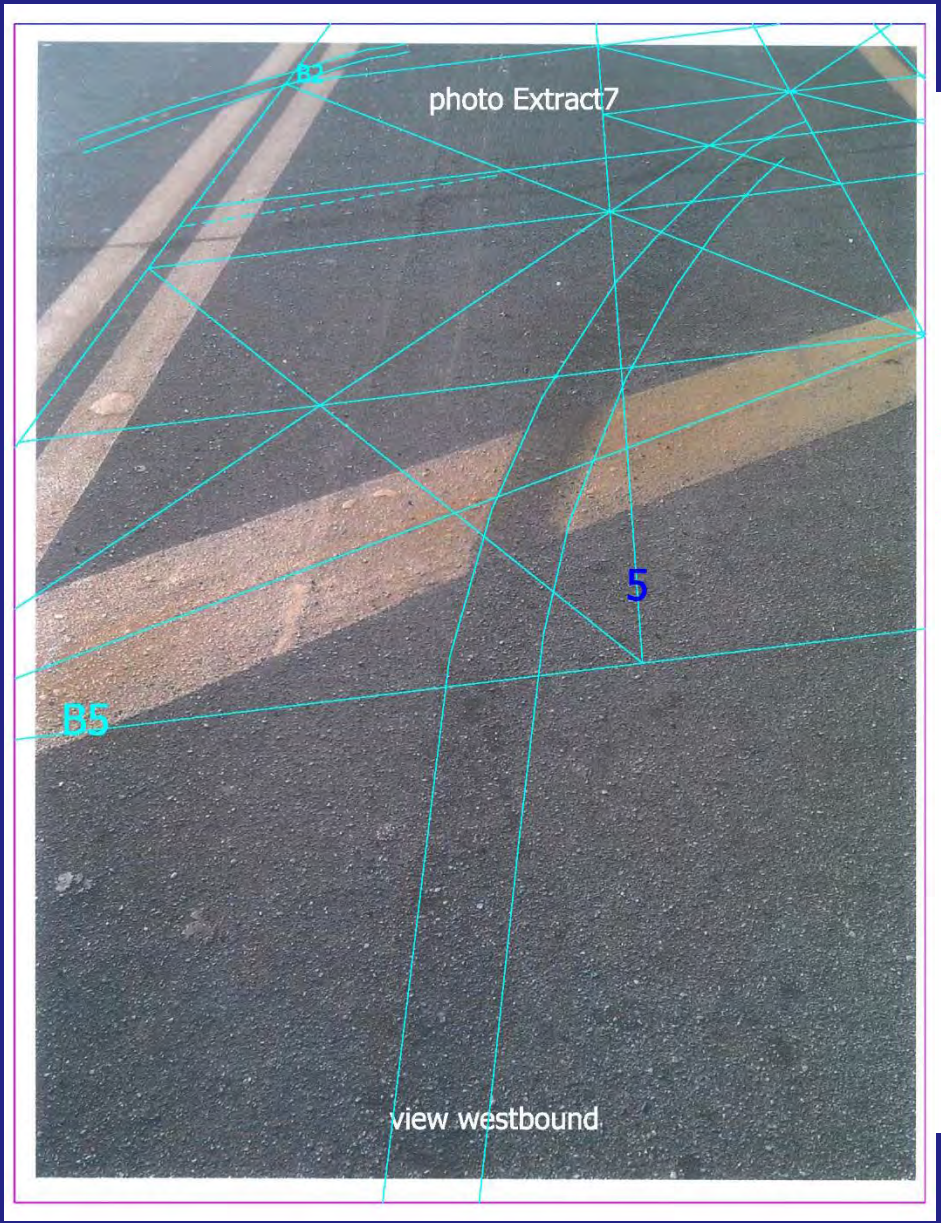
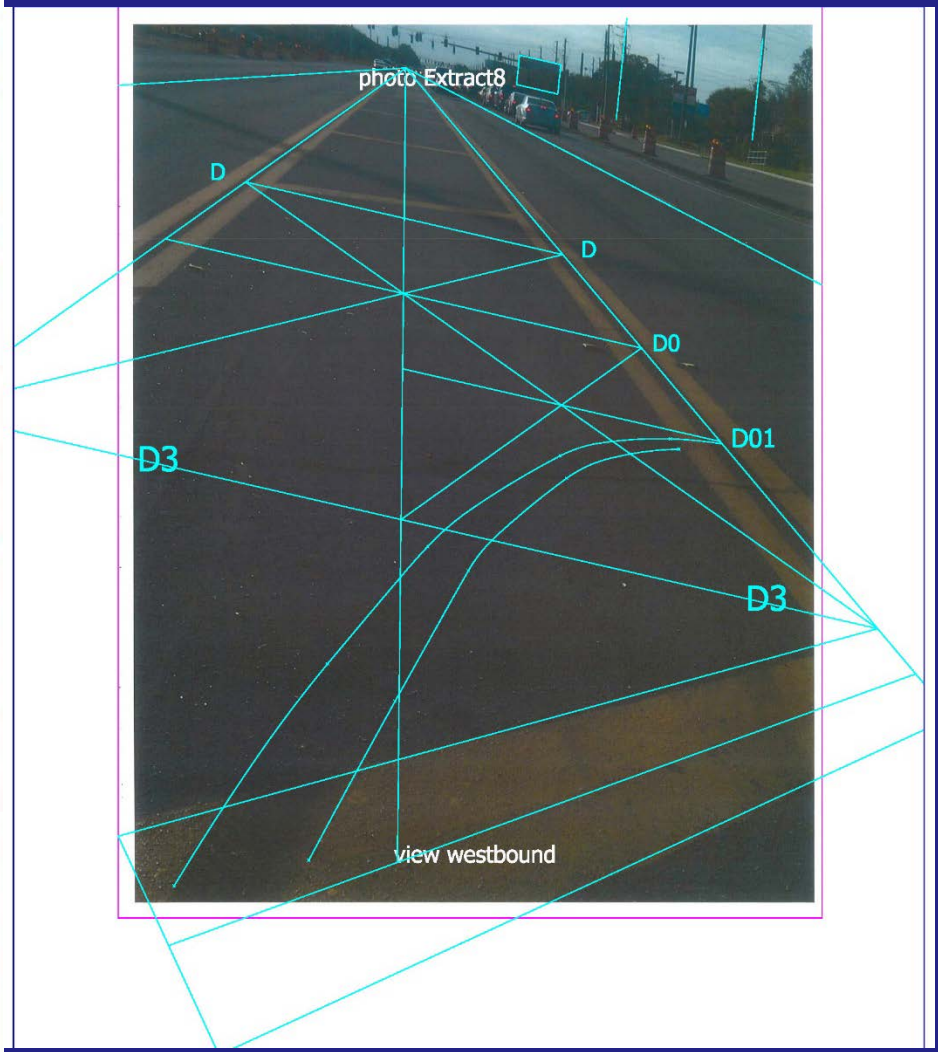
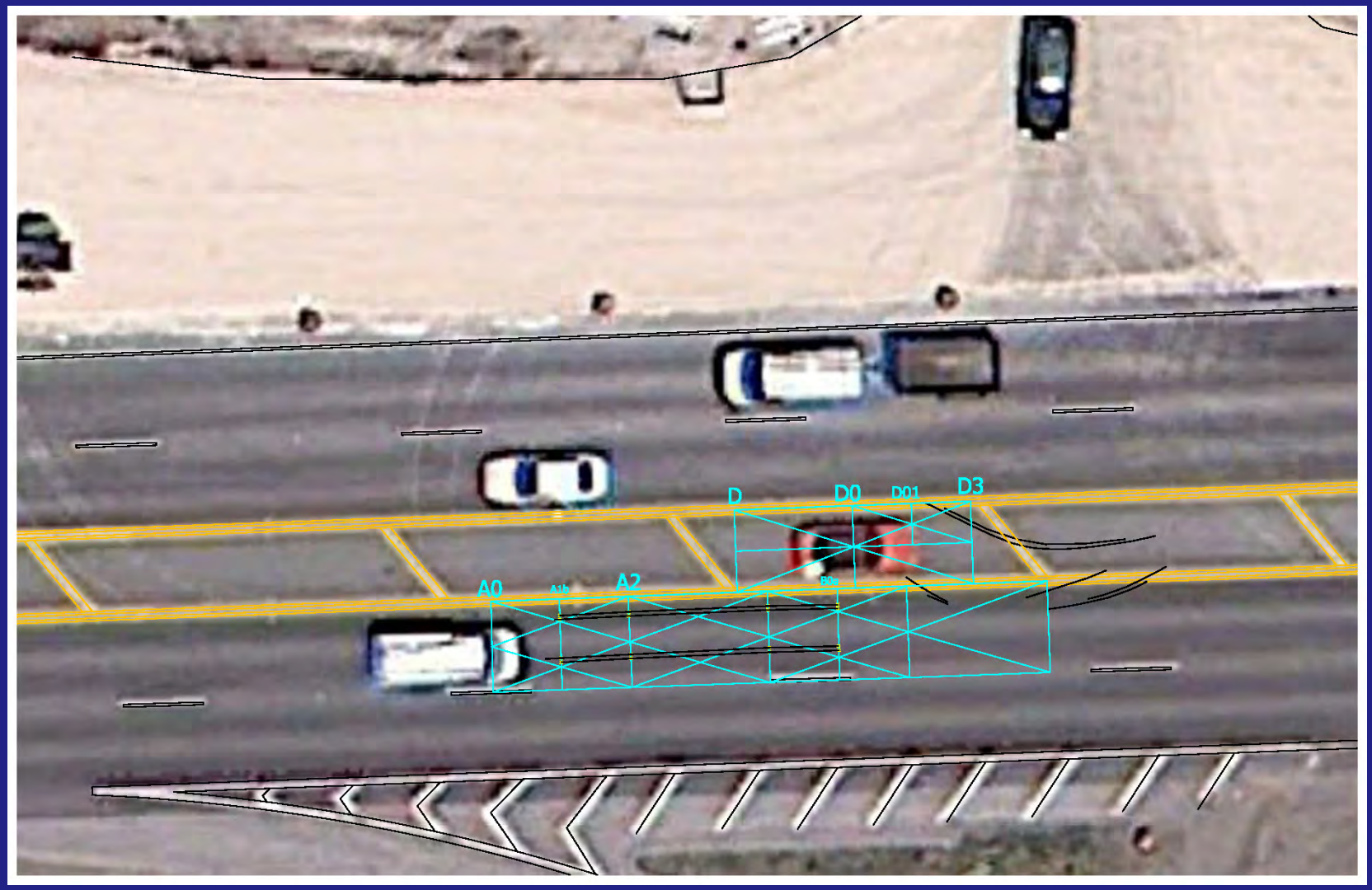
Utilize Geometry to Establish Dimensions

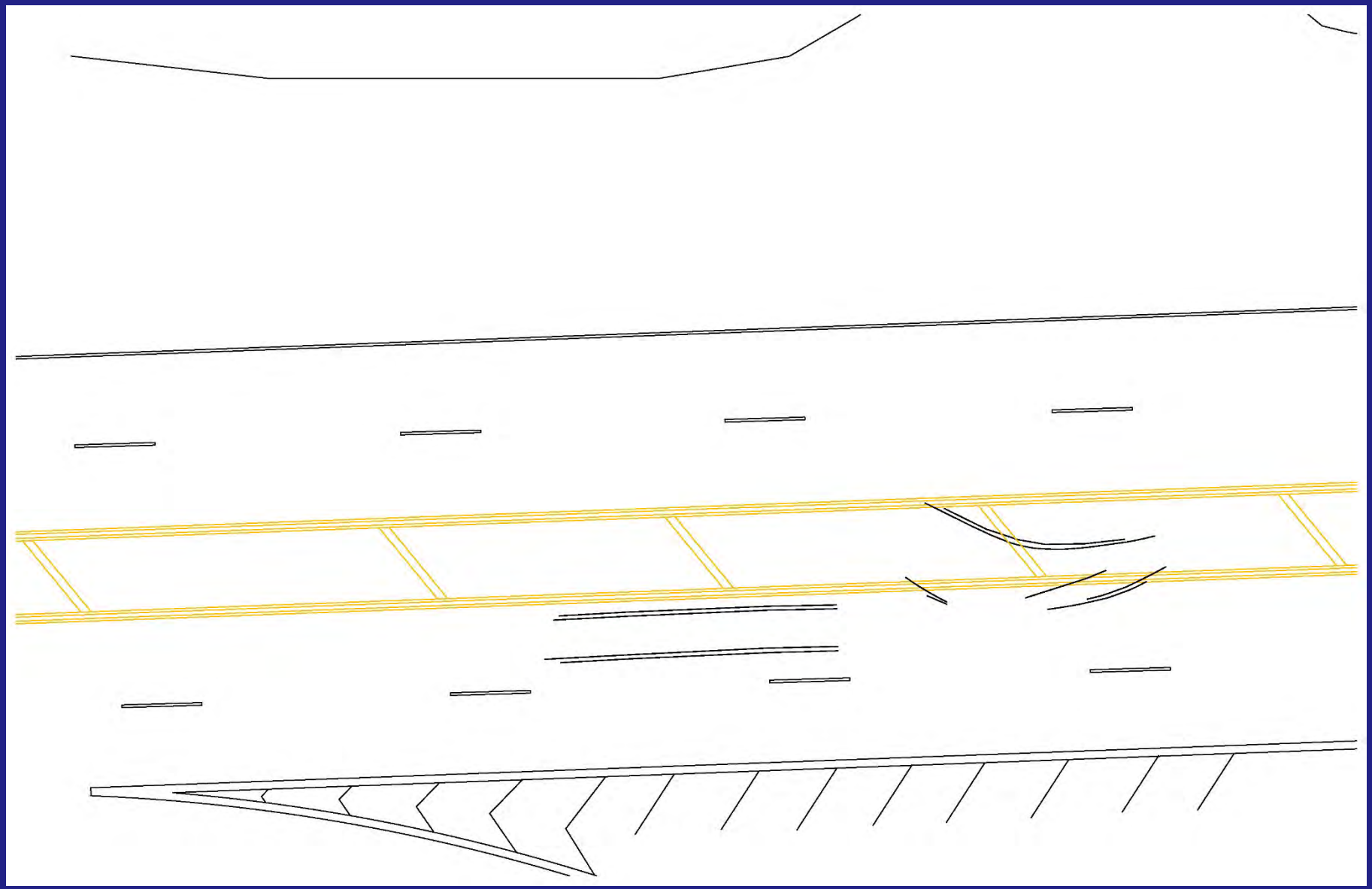




Utilize Geometry to Establish Dimensions



Utilize Geometry to Establish Dimensions



Computer Simulation

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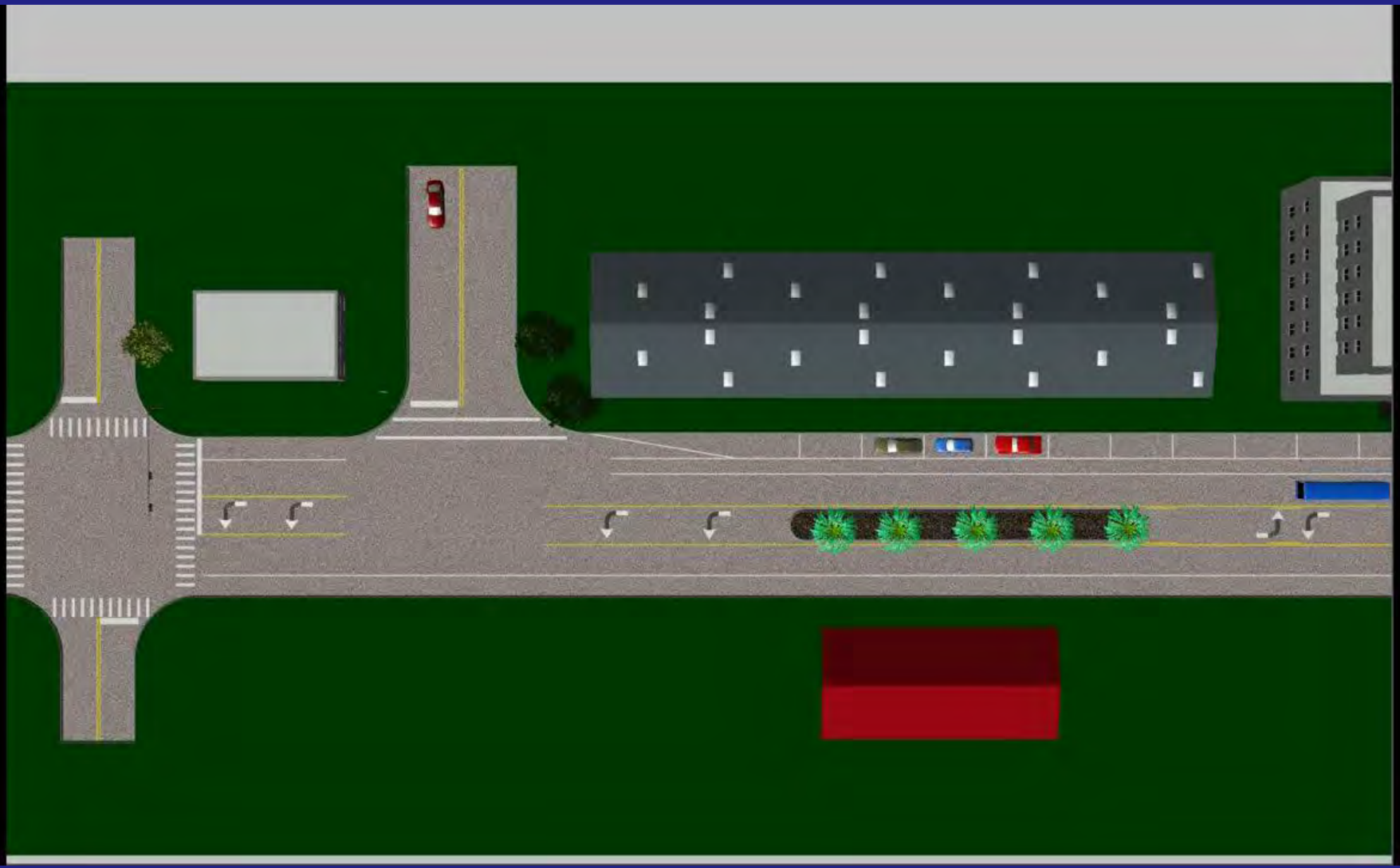

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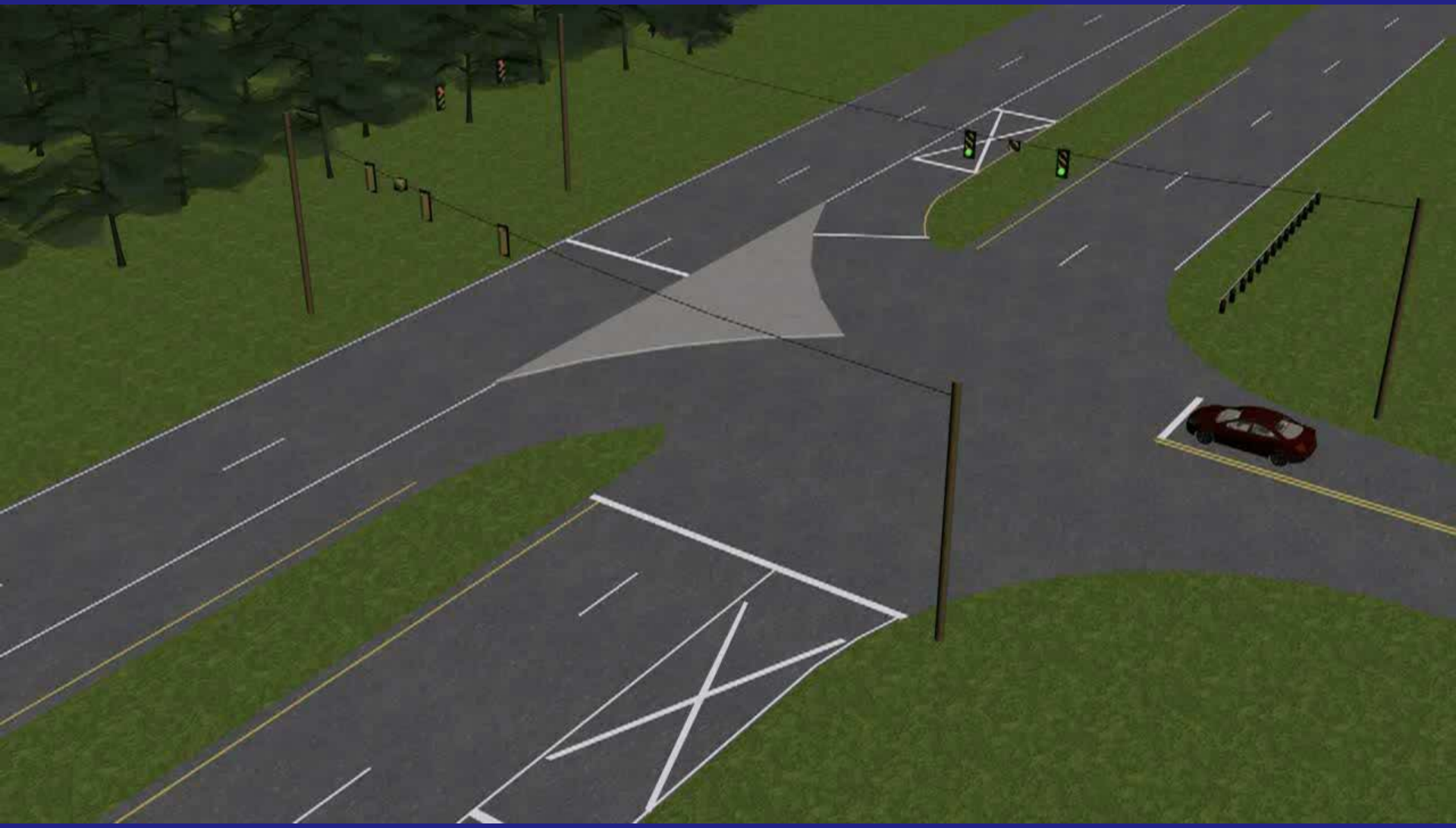
Animations



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Initial Information to Obtain for review by Accident Reconstructionist

- Photographs of vehicles and scene
- Witness statements
- Available physical evidence
  - Preserve vehicles / ACM / EDR / Dash Cam / GPS Tracking if possible!
- Security Video
- TV / Newspaper documentation
- Deposition testimony
- Vehicle repair estimates
- Any and all law enforcement reports

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- Photographs of vehicles and scene
- Witness statements
- Available physical evidence
- Available Crash/Incident Data
  - Preserve vehicles/ACM/EDR/Conventional GPS/ Dash Cam/GPS Tracking/Fleet Management
  - Security Video- Vehicle & Surveillance
- TV/Newspaper documentation
- Deposition testimony
- Vehicle repair estimates
- Any and all law enforcement reports

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Ask your expert for help!

Most attorneys are not experts in accident reconstruction – work with your expert to develop an understanding of the technical issues specific to your case and develop questions for the opposing expert.

Also we don't have to be an expert to help you with a case. Sometimes you just need a few answers or some consultation… Call us!

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Role of ‘Black Boxes’ in Accident Reconstruction

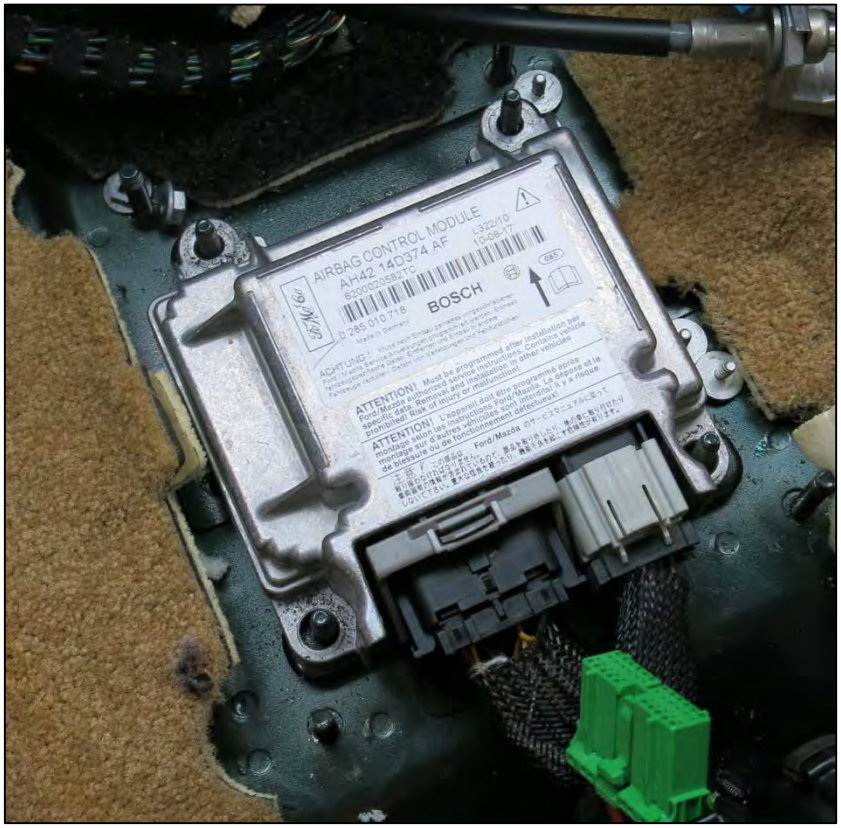
Passenger Vehicles

- Primary Purpose - Airbag Control Module (ACM)

Commercial Vehicles

- Primary Purpose - Engine Control Module (ECM)

Passenger Vehicle ‘Black Boxes’



Land Rover Airbag Control Module

Ford Rover Airbag Control Module

Passenger Vehicle ‘Black Boxes’

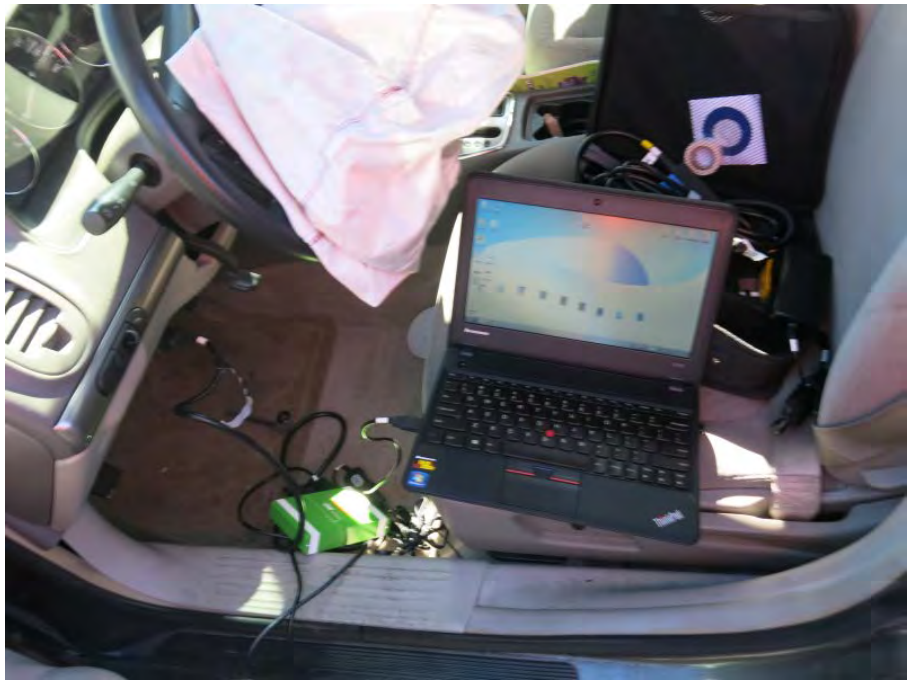
- Full list of covered vehicles by CDR:

  www.boschdiagnostics.com

- CDR:

  Acura, BMW, Buick, Cadillac, Chevrolet, Chrysler, Dodge, Fiat, Ford, GMC, Holden, Honda, HSV, Hummer, Infinity, Isuzu, Jeep, Lexus, Lincoln, Maserati, Mazda, Mercedes, Mercury, Mini, Mitsubishi, Nissan, Oldsmobile, Opel, Pontiac, Rolls-Royce, Saab, Saturn, Scion, Sterling, Suzuki, Toyota, Volkswagen, Volvo

- Hyundai, Kia, Saab, Tesla and Subaru are also downloadable through manufacture produced software



BLACK BOX EVENT-DATA RECORDERS

CRASH DATA RETRIEVAL (CDR) SUPPORTED VEHICLE LIST

FOCUS FORENSICS
MAIN | 888-330-6280
RACHEL KELLER | 813-528-2080

ACURA

MODEL	FIRST YEAR
ILX	2013
MDX	2012
RDX	2013
RL	2012
RLX	2014
TL	2012
TLX	2015
TSX	2012
ZDX	2012

ALFA ROMEO

MODEL	FIRST YEAR
ROMEO 4C	2015
A3	2015

AUDI

MODEL	FIRST YEAR
A4	2015
A5	2015
A6	2015
A7	2015
A8	2015
Q3	2015
Q5	2015

BENTLEY

MODEL	FIRST YEAR
MULSANNE	2016

BMW

MODEL	FIRST YEAR
228I	2014
2-SERIES	2015
320I	2014
328I	2014
335I	2013
3-SERIES	2015
428I	2014
435I	2014
4-SERIES	2015
528I	2013
535I	2013
550I	2013
5-SERIES	2015
640I	2013
650I	2013
6-SERIES	2015
740I	2013
750I	2013
760LI	2013
7-SERIES	2015
ACTIVE HYBRID 3, 5 & 7	2013
ALPINA B7	2014
I3	2015
I8	2015
M235I COUPE	2014
M5	2013
M6	2013
X1	2015
X3	2013
X4	2015
X5	2015
X6	2015
Z4	2015

BUICK

MODEL	FIRST YEAR
ALLURE	2005
CENTURY	1997
COMMERCIAL	1994
ENCLAVE	2008
ENCORE	2013
LACROSSE	2005
LE SABRE	1995
LUCERNE	2006
PARK AVENUE	1995
RAINIER	2004
REGAL	1995
RENDEZVOUS	2002
RIVIERA	1996
ROADMASTER	1994
SKYLARK	1996
TERRAZA	2005
VERANO	2012

CADILLAC

MODEL	FIRST YEAR
ATS	2013
COMMERCIAL	1994
CONCOURSE	1995
CTS	2003
DEVILLE	1995
DTS	2006
ELDORADO	1995
ELR	2014
ESCALADE	1999
EXT	2004
FLEETWOOD	1994
HEARSE (DTS)	2008
LIMO/FUNERAL COACH	2013
LIMOUSINE (DTS)	2008
SEVILLE	1995
SRX	2004
STS	2005
XLR ROADSTER	2003
XTS	2013

CHEVROLET

MODEL	FIRST YEAR
ASTRO	1996
AVALANCHE	2002
AVEO	2009
BEAT	2014
BLAZER	1998
C/K PICKUP	1999
C/K TRUCK - SILVERADO, SUBURBAN, TAHOE	2014
CAMARO	1996
CAPRICE	1994
CAPRICE (POLICE)	2011
CAPTIVA SPORT	2010
CAVALIER	1996
CHEYENNE	2008
CITY EXPRESS	2015
CLASSIC	2004
COBALT	2005
COLORADO	2004
COMMERCIAL	1994
CORVETTE	1997
CRUZE	2010
EQUINOX	2005
EXPRESS	1996
HHR	2006
IMPALA	1995
KODIAK	2003
LUMINA	1995
MALIBU	1997
MATIZ	2012
METRO	1998
MONTE CARLO	1995
ORLANDO	2012
S10	1998
SILVERADO	1997
SONIC	2012
SPARK	2013
SS	2014
SSR	2003
SUBURBAN	1997
TAHOE	1997
TRACKER	1998
TRAILBLAZER	2003
TRAVERSE	2009
TRAX	2013
UPLANDER	2005
VENTURE	1997
VOLT	2011

CHRYSLER

MODEL	FIRST YEAR
200	2011
300	2006
ASPEN	2007
CIRRUS	2010
GRAND VOYAGER	2008
PACIFICA	2007
PT CRUISER	2007
SEBRING	2007
TOWN & COUNTRY	2008

DODGE

MODEL	FIRST YEAR
AVENGER	2008
CALIBER	2007
CARAVAN	2008
GRAND CARAVAN	2008
CHALLENGER	2008
CHARGER	2006
DAKOTA	2007
DART	2013
DURANGO	2005
JOURNEY	2009
MAGNUM	2006
NITRO	2007
RAM 1500	2009
RAM CAB CHASSIS	2006
RAM PICKUP	2006
VOYAGER	2008

FIAT

MODEL	FIRST YEAR
500	2012

FORD

MODEL	FIRST YEAR
500	2005
C-MAX	2013
CROWN VICTORIA	2001
ECONOLINE	2005
EDGE	2007
ESCAPE	2001
ESCORT	2001
EXCURSION	2001
EXPEDITION	2001
EXPLORER	2004
EXPLORER SPORT (2 DOOR)	2001
EXPLORER SPORT TRAC (PICKUP)	2001
F-150	2001
F-250, F-350, F-450, F-550 SUPER DUTY	2001
FIESTA	2011
FLEX	2010
FOCUS	2008
FREESTYLE	2005
FUSION	2006
MUSTANG	2001
RANGER	2001
TAURUS	2001
THUNDERBIRD	2002
TRANSIT	2015
TRANSIT CONNECT	2013
WINDSTAR	2001

GEO

MODEL	FIRST YEAR
METRO	1995
TRACKER	1996

GMC

MODEL	FIRST YEAR
ACADIA	2006
C/K PICKUP	1999
CANYON	2004
ENVOY	2002
EV1	1997
JIMMY	1998
SAFARI	1996
SAVANA	1996
SIERRA	1997
SONOMA	1998
SUBURBAN	1997
TOPKICK	2003
YUKON	1997

HOLDEN

MODEL	FIRST YEAR
ASTRA	2013
BARINA	2012
BARINA SPARK	2011
BERLINA	2007
CALAIS	2007
CALAIS V	2007
CAPRICE	2007
CAPTIVA	2007
COLORADO	2013
CRUZE	2010
INTERNATIONAL	2007
MALIBU	2013
OMEGA	2007
SS	2007
SS-V	2007
STATESMAN	2007
SV6	2007
VOLT	2013

HONDA

MODEL	FIRST YEAR
ACCORD	2013
CIVIC	2012
CROSSTOUR	2012
CR-V	2012
CR-Z	2012
FIT	2012
INSIGHT	2012
ODYSSEY	2012
PILOT	2012
RIDGELINE	2012

HSV

MODEL	FIRST YEAR
CLUBSPORT	2007
GRANGE	2007
GTS	2007
SENATOR	2007

HUMMER

MODEL	FIRST YEAR
H2	2003
H3	2006

INFINITI

MODEL	FIRST YEAR
EX	2013
FX	2013
G (ALL)	2013
G25 SEDAN	2012
JX35	2013
M	2013
Q40	2015
Q50	2014
Q60	2014
Q70	2014
QX	2013
QX50	2014
QX60	2014
QX70	2014
QX80	2014

ISUZU

MODEL	FIRST YEAR
ASCENDER	2003
HOMBRE	1998
I280 & I350	2006
I290 & I370	2007

JEEP

MODEL	FIRST YEAR
CHEROKEE	2014
COMMANDER	2006
COMPASS	2007
GRAND CHEROKEE	2006
LIBERTY/CHEROKEE	2008
PATRIOT	2007
WRANGLER	2007

LAMBORGHINI

MODEL	FIRST YEAR
HURACAN	2015

LOTUS

MODEL	FIRST YEAR
FLAVIA	2012
GRAND VOYAGER	2012
THEMA	2012

LEXUS

MODEL	FIRST YEAR
CT200H	2010
ES	2002
GS	2001
GX	2001
HS	2009
IS	2006
IS-F	2008
LFA	2011
LX	2003
NX	2014
RC F	2014
RC350	2014
RX	2004
SC	2002

LINCOLN

MODEL	FIRST YEAR
CONTINENTAL	2001
LS	2001
MARK LT	2006
MKC	2015
MKS	2010
MKT	2010
MKX	2007
MKZ	2007
NAVIGATOR	2001
TOWN CAR	2001
ZEPHYR	2006

MASERATI

MODEL	FIRST YEAR
GHIBLI	2014
GRAN TURISMO CABRIO & COUPÉ	2015
QUATTROPORTE	2014

MAZDA

MODEL	FIRST YEAR
CX-3	2016
CX-5	2013
CX-9	2011
MAZDA2	2011
MAZDA3	2012
MAZDA5	2012
MAZDA6	2011

MERCEDES-BENZ

MODEL	FIRST YEAR
B-CLASS	2014
C-CLASS COUPE	2015
C-CLASS SEDAN	2015
CLA-CLASS	2015
CLS-CLASS	2015
E-CLASS	2014
G-CLASS	2015
GLA-CLASS	2015
GL-CLASS	2015
GLK-CLASS	2015
GLK-CLASS	2014
ML-CLASS	2015
S-CLASS	2014
SL-CLASS	2014
SLK-CLASS	2014

MERCURY

MODEL	FIRST YEAR
GRAND MARQUIS	2001
MARAUDER	2003
MARINER	2009
MILAN	2006
MONTEGO	2005
MOUNTAINEER	2004
SABLE	2001

MINI

MODEL	FIRST YEAR
CLUBMAN	2014
CONVERTIBLE	2014
COUNTRYMAN	2014
COUPE	2014
HARDTOP	2014
PACEMAN	2014
ROADSTER	2014

MITSUBISHI

MODEL	FIRST YEAR
RAIDER	2007

NISSAN

MODEL	FIRST YEAR
370Z	2013
ALTIMA	2013
ARMADA	2013
CUBE	2013
FRONTIER	2012
GT-R	2014
JUKE	2013
LEAF	2013
MAXIMA SEDAN	2013
MICRA	2015
MURANO	2013
NV CARGO & PASSENGER	2014
NV VAN/BUS (1500, 2500, 3500)	2013
NV200	2013
NV200 TAXI & COMPACT CARGO	2014
PATHFINDER	2013
QUEST	2013
ROGUE	2013
SENTRA	2013
TITAN	2013
VERSA HATCHBACK	2013
VERSA NOTE	2014
VERSA SEDAN	2013
XTERRA	2012

OLDSMOBILE

MODEL	FIRST YEAR
ACHIEVA	1996
ALERO	1999
AURORA	1996
BRAVADA	1998
CUTLASS	1998
CUTLASS SUPREME	1995
EIGHTY EIGHT	1995
INTRIGUE	1998
LSS	1996
NINETY EIGHT	1995
REGENCY	1997
SILLOUHETTE	1997

OPEL

MODEL	FIRST YEAR
ASTRA	2013

PONTIAC

MODEL	FIRST YEAR
AZTEK	2001
BONNEVILLE	1995
FIREBIRD	1996
FIREFLY	1995
G3	2009
G5	2007
G6	2005
G8	2008
GRAND AM	1996
GRAND PRIX	1994
MONTANA	1999
MONTANA WITH RPO AW9	2006
MONTANA WITHOUT RPO AW9	2006
PERSUIT	2005
SOLSTICE	2006
SUNFIRE	1996
SUNRUNNER	1996
TORRENT	2006
TRANS SPORT	1997
VIBE	2003
WAVE	2009

RAM

MODEL	FIRST YEAR
1500, 2500, 3500, 4000, 4500 & 5500	2010
CARGO VAN	2012
PROMASTER® CITY	2015

ROLLS-ROYCE

MODEL	FIRST YEAR
GHOST (SEDAN)	2013
WRAITH	2014

SAAB

MODEL	FIRST YEAR
9-4X	2012
9-5	2010
9-7X	2005

SATURN

MODEL	FIRST YEAR
ALL MODELS	1995
AURA	2007
ION	2006
OUTLOOK	2007
RELAY	2006
SKY	2007
VUE	2006

SCION

MODEL	FIRST YEAR
FR-S	2013
IQ	2008
TC	2005
XA	2004
XB	2004
XD	2008

SMART

MODEL	FIRST YEAR
ALL	2015

SRT

MODEL	FIRST YEAR
VIPER	2013

SUBARU

MODEL	FIRST YEAR
BULLET	2008

SUZUKI

MODEL	FIRST YEAR
EQUATOR	2012
GRAND VITARA	2013
KIZASHI	2013
SIDEKICK	1996
SWIFT	1995
SX4	2013
VITARA	1999
XL-7	2007

TOYOTA

MODEL	FIRST YEAR
4RUNNER	2003
86	2012
ALLION	2007
ALPHARD	2005
AQUA	2011
ARISTO	2001
AURION	2012
AURIS	2007
AVALON	2003
AVENSIS	2005
AYGO	2006
BELTA	2007
BLADE	2008
BREVIS	2003
CAMRY	2001
CELSIOR	2001
CENTURY	2006
COMFORT	2014
COROLLA	2003
CROWN	2003
DYNA	2008
ECHO/YARIS	2003
ESTIMA	2008
EZ	2012
FJ CRUISER	2007
FUNCARGO	2006
HARRIER	2003
HIACE	2005
HIGHLANDER	2004
HILUX	2003
ISIS	2010
IST	2005
KLUGER	2003
LAND CRUISER PRADO	2002
LAND CRUISER	2003
MAJESTO	2011
MARK II	2001
MARK X	2006
MARK X ZIO	2008
MATRIX	2003
NOAH	2009
PORTE	2004
PRADO	2003
PREMIO	2004
PRIUS	2003
PROBOX	2001
PROGRES	2001
RACTIS	2005
RAUM	2003
RAV4	2003
REIZ	2006
RUKUS	2011
RUMION	2012
SAI	2010
SEQUOIA	2005
SIENNA	2004
SOARER	2001
SPADE	2012
SUCCEED	2004
SURF	2002
TACOMA	2005
TOYOACE	2008
TUNDRA	2005
VANGUARD	2003
VENZA	2009
VERSO-S	2009
VIOS	2008
VOXY	2007
WISH	2009
YARIS	2005
ZELAS	2011

VOLKSWAGEN

MODEL	FIRST YEAR
BEETLE	2015
EOS	2014
GOLF, EGOLF	2015
JETTA	2015
PASSAT	2015
ROUTAN	2009
TOUAREG	2015

VOLVO

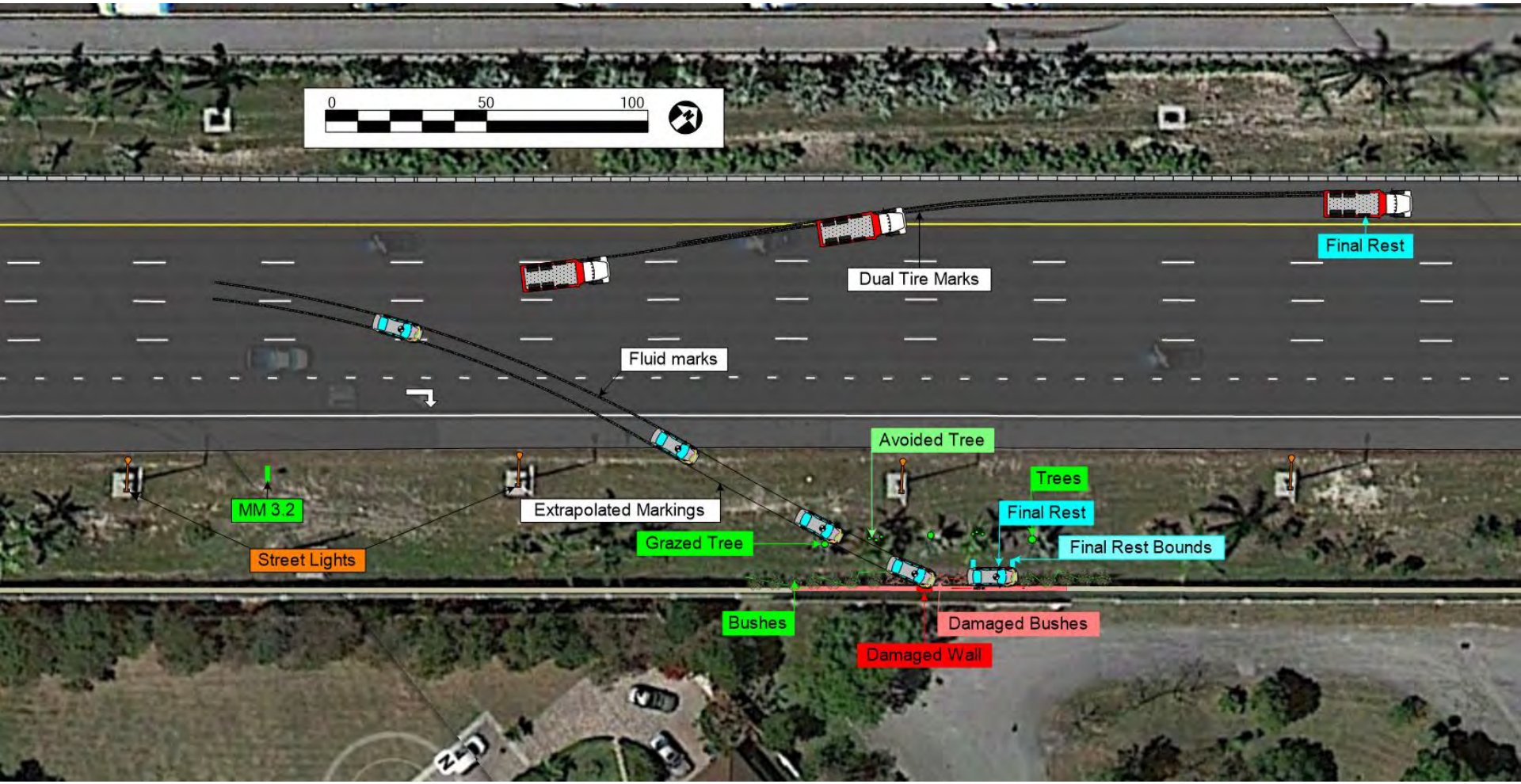
MODEL	FIRST YEAR
S60	2011
S80 & S80L	2013
V60	2011
V70	2013
XC60	2013
XC70	2013

ECM Downloads: Electronic Control Module Download List

Engine Manufacturer	First Year	Sudden Deceleration	Last Stop**
Caterpillar	1999	Yes	----
Cummins	2002	Yes	----
Detroit Diesel	1998	Yes	Yes
International/Maxxforce	2010	Yes	Yes
Mack	1998	Yes	Yes
Mercedes	2000	Yes	Yes
Paccar	2000	Yes	----
Volvo*	2010	Yes	Yes

*Volvo Engines dating back to 2002 could contain some collision-related data.**Important to leave vehicle off until download is performed since data can easily be overwritten.

FOCUS FORENSICS
MAIN | 888-330-62
RACHEL KELLER | 813-528-20


0
50
100
Final Rest
Dual Tire Marks
Fluid marks
Avoided Tree
Trees
Final Rest
Final Rest Bounds
MM 3.2
Extrapolated Markings
Grazed Tree
Street Lights
Bushes
Damaged Bushes
Damaged Wall

Toyota Damage

Toyota Damage

Toyota Damage

Toyota Damage

Toyota Damage

Toyota Damage

Toyota Damage

Interior Body Contact


Passenger Seatbelt

CDR Report

DTCs Present at Time of Event (Most Recent Event, TRG 5)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (Most Recent Event, TRG 5)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	400
Buckle Switch, Driver	Unbuckled
Buckle Switch, Passenger	Buckled
Occupancy Status, Passenger	AM50
Seat Position, Driver	Rearward
Shift Position	Drive

Pre-Crash Data, -5 to 0 seconds (Most Recent Event, TRG 5)

Time (sec)	-4.4	-3.4	-2.4	-1.4	-0.4	0 (TRG)
Vehicle Speed (MPH [km/h])	68.4 [110]	68.4 [110]	67.1 [108]	67.1 [108]	67.1 [108]	65.9 [106]
Brake Switch	OFF	OFF	OFF	OFF	OFF	ON
Accelerator Rate (V)	1.09	1.05	1.05	1.09	1.09	0.78
Engine RPM (RPM)	2,000	2,000	2,000	2,000	2,000	1,600

Toyota Damage after dump truck

Legend

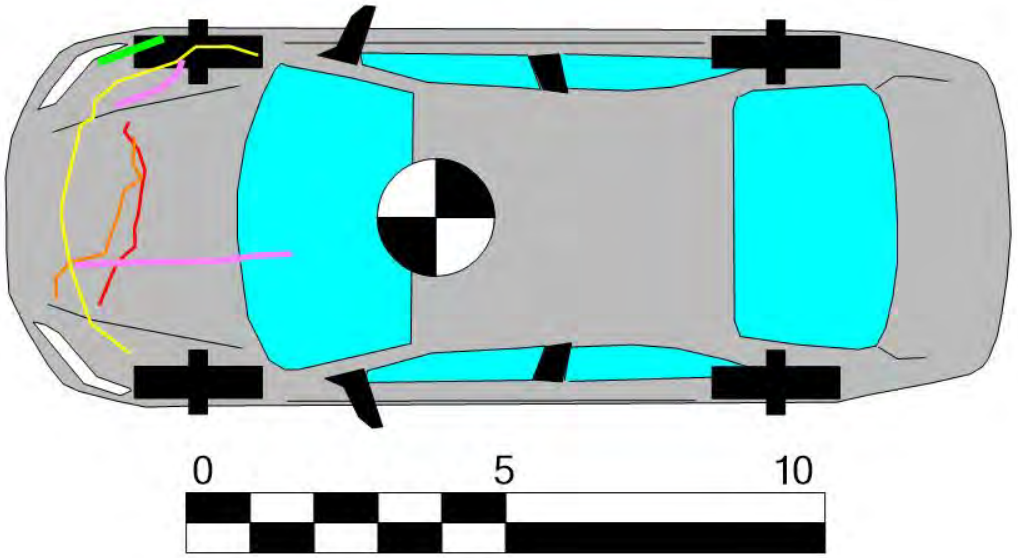
Hood

Bumper

Rad. Sup.

Crush Lines

Green Paint Transfer



Dump Truck Damage

Dump Truck Damage

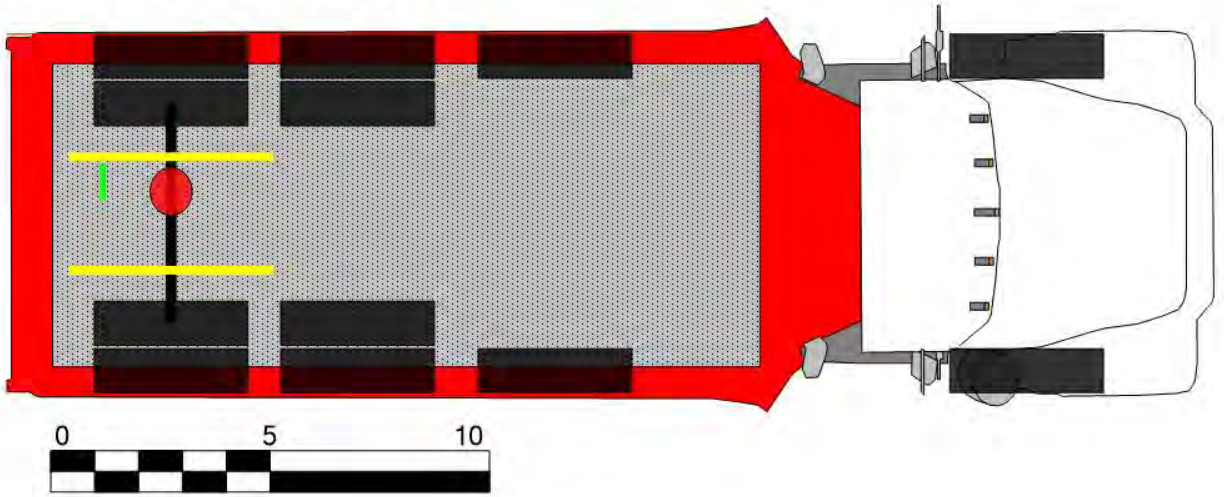
Dump Truck Damage

Dump Truck Damage

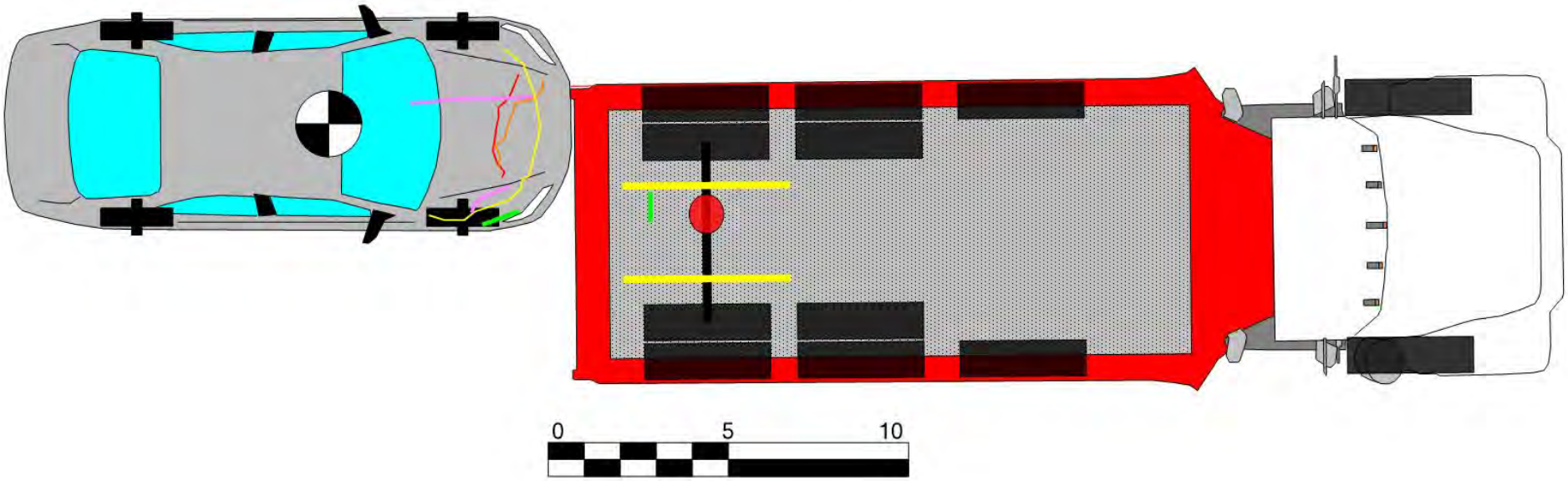
Dump Truck Damage

Dump Truck

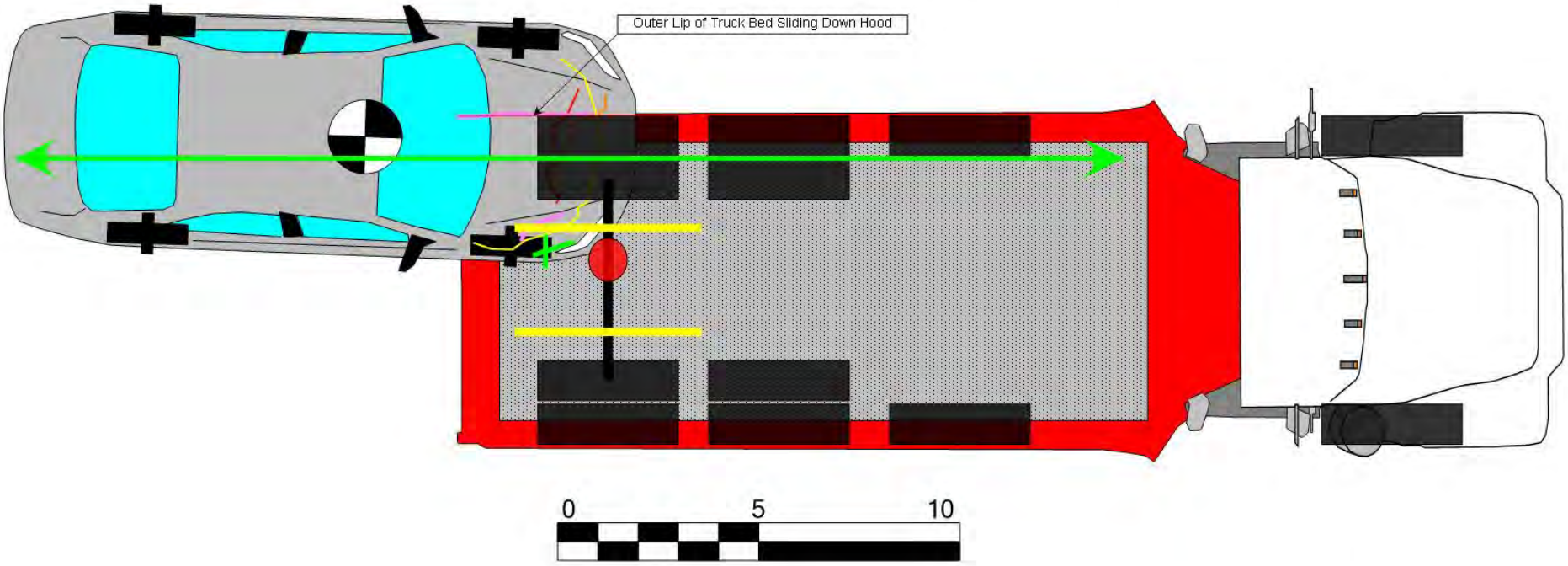
Legend
Frame Rail
Rear Differential
License Plate



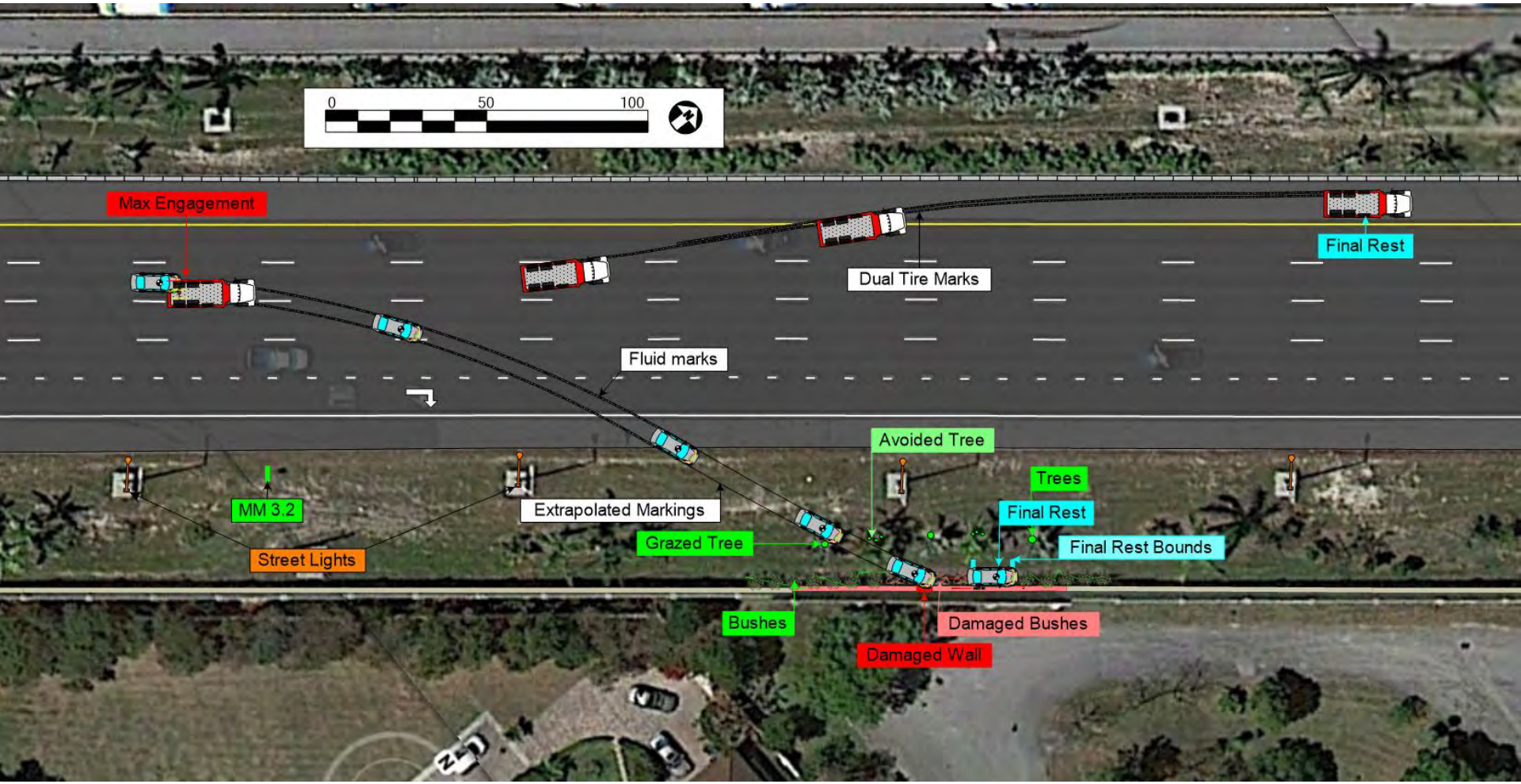
First Contact



Maximum Engagement



Different Story?



Commercial Vehicle "Black Box"

ECM Terminology per Manufacturer

- CAT
  - Engine Control Module (ECM)
- Cummins
  - Engine Control Module (ECM)
- International and Paccar
  - Engine Control Module (ECM)
- MACK
  - Vehicle Electronic Control Unit (VECU)
  - Engine Electronic Control Unit (EECU)
- Volvo
  - Vehicle Electronic Control Unit (VECU)
  - Engine Electronic Control Unit (EECU)
  - Instrument Cluster
- DDEC / MBE
  - Motor Control Module (MCM)
  - Common Powertrain Controller (CPC)
- DDEC ECM NUMBERS
  - DDEC X (CPC, MCM, ACM)
  - DDEC VI (CPC, MCM)
  - DDEC V (MCM)
  - DDEC IV (MCM)
  - MBE (VCU, MCM)

Commercial Vehicle Black Box Data

Electronic Control Module Quick Reference Guide

Engine Manufacturer	Engine or ECM Model	Year Introduced	Configuration Data	Quick Stop Data	Last Stop Data	Diagnostic Record	Preventing Data Loss
Caterpillar	ADEM II	1994	Yes	See Note 1	No	Yes	Apply parking brake, then turn ignition to the off position. Wait at least one minute before disconnecting battery.
Caterpillar	ADEM III	1999	Yes	Yes	No	Yes	
Caterpillar	ADEM IV	2007	Yes	Yes	No	Yes	
Cummins	Celect	1993	Yes	No	No	Freeze Frame	
Cummins	Celect Plus	1996	Yes	No	No	Freeze Frame	
Cummins	ISB, ISC, ISL	1998	Yes	See Note 2	No	Freeze Frame	
Cummins	ISM, ISX	1998	Yes	See Note 3	No	Freeze Frame	
Detroit	DDEC III	1993	Yes	No	No	No	
Detroit	DDEC IV	1998	Yes	Yes	Yes	Yes	
Detroit	DDEC V	2004	Yes	Yes	Yes	Yes	
Detroit	DDEC VI	2007	Yes	Yes	Yes	No	
Detroit	DDEC 10	2010	Yes	Yes	Yes	Yes	
Hino	Med. Duty	Undetermined	Yes	No	No	Freeze Frame(s)	
International	Maxxforce 11 - 15	2010	Yes	See Note 4	See Note 4	Freeze Frame	
Mack	V-Mac III	1998	Yes	Yes	See Note 5	Freeze Frame	
Mack	V-Mac IV	2006	Yes	Yes	Yes	Freeze Frame	
Mercedes	PLD w/ VCU	2000	Yes	See Note 6	See Note 6	See Note 6	
Mercedes	DDEC VI	2007	Yes	Yes	Yes	No	
Paccar	PX-6, PX-8	2007	Yes	Yes	No	Freeze Frame	
Paccar	MX	2010	Yes	No	No	Yes	
Volvo	Heavy Duty Engines	2002	Yes	See Note 7	See Note 7	Freeze Frame(s)	
Volvo	Heavy Duty Engines	2010	Yes	Yes	Yes	Freeze Frame(s)	
Bendix	EC60 ABS Controller	2005	Yes	No	No	Freeze Frame	

Note 1 - ECM Must Have Software Revision After November 1995
Note 2 - Sudden Deceleration Data Available Starting in 2007
Note 3 - Sudden Deceleration Data Available Starting in 2002, with ECM Software Revisions from Late 2004
Note 4 - Data Available with ECM Software Revisions 3.8.1 or Higher
Note 5 - Data Available with ECM Step 12 Software Revision
Note 6 - Data Available with ECM Software Revisions 12.09 or Higher
Note 7 - Data Available with EPA 2007 Engines having Updated Software

Rev. 08-01-12

Two potential types of events on commercial vehicle engine control modules (ECM)

- Hard brake event
  - Each engine manufacture's threshold can be different (if turned on)
  - Typical is 7 to 9 mph/s deceleration threshold to write an event
  - Can be overwritten by subsequent events
  - DO NOT DRIVE THE TRACTOR AFTER THE COLLISION. Have it towed and stored.
- Last stop event
  - Each time the tractor comes to a complete stop, data is temporarily written to the module.
  - Can be overwritten
  - Each engine has different definitions of a “last stop”
    - Ex. Must stop from initially traveling 30+ mph, be stopped for 2+ seconds, activate the parking brake, and turn the key to the off position with power supplied to vehicle for at least 30 seconds after key is turned off, etc. for data to record.
  - DO NOT DRIVE THE TRACTOR AFTER THE COLLISION. Have it towed and stored.

Commercial Vehicle “Black Box” Data

Incident Time: Incident Odometer: 355611.

Time	Vehicle Speed (mph)	Engine Speed (rpm)	Brake	Clutch	Engine Load (%)	Throttle (%)	Cruise
-1:00	40.0	1684	No	No	81.00	76.40	No
-0:59	40.0	1547	No	No	0.00	0.00	No
-0:58	40.5	1279	No	No	0.00	0.00	No
-0:57	41.0	1267	No	No	21.50	33.60	No
-0:56	41.5	1288	No	No	40.50	48.80	No
-0:55	42.0	1307	No	No	61.50	64.80	No
-0:54	43.0	1329	No	No	75.00	72.80	No
-0:53	43.5	1347	No	No	65.50	67.20	No
-0:52	44.0	1359	No	No	78.00	76.00	No
-0:51	44.0	1377	No	No	76.50	75.20	No
-0:50	44.5	1381	No	No	75.00	74.00	No
-0:49	44.5	1387	No	No	74.50	73.60	No
-0:48	45.0	1392	No	No	75.00	74.40	No
-0:47	45.5	1413	No	No	73.50	72.40	No
-0:46	46.0	1421	No	No	72.00	72.40	No
-0:45	46.5	1446	No	No	72.50	73.20	No
-0:44	47.0	1460	No	No	71.50	72.40	No
-0:43	47.5	1475	No	No	68.50	70.80	No
-0:42	47.5	1477	No	No	71.00	74.40	No
-0:41	48.0	1489	No	No	85.50	82.00	No

Fixed Time Progression

- GPS DATA = Fleet telematics with 1 second increments, 4-decimal XY reporting, with speed reported

Time	MPH	Lat.	Long.	Time	MPH	Lat.	Long.
6:58:08	0	40.69071	-88.65994	6:58:28	11.5	40.68599	-88.6552
6:58:09	1.5	40.68986	-88.65974	6:58:29	12.5	40.68578	-88.655
6:58:10	3	40.68954	-88.65964	6:58:30	13.5	40.68521	-88.6547
6:58:11	5	40.68921	-88.65921	6:58:31	15	40.68506	-88.6546
6:58:12	7	40.68896	-88.65905	6:58:32	16.5	40.68498	-88.654
6:58:13	8	40.68864	-88.65895	6:58:33	18	40.68475	-88.654
6:58:14	9.5	40.68843	-88.65863	6:58:34	18	40.68424	-88.6539
6:58:15	10.5	40.68825	-88.65849	6:58:35	19	40.68419	-88.6538
6:58:16	12	40.68811	-88.6581	6:58:36	20.5	40.68397	-88.6536
6:58:17	12.5	40.68794	-88.65809	6:58:37	22	40.68379	-88.6533
6:58:18	13	40.68784	-88.65795	6:58:38	22.5	40.68356	-88.6532
6:58:19	14	40.68776	-88.65753	6:58:39	23.5	40.68326	-88.653
6:58:20	14	40.68743	-88.65713	6:58:40	25	40.68311	-88.6528
6:58:21	14	40.68759	-88.65698	6:58:41	25.5	40.68295	-88.6528
6:58:22	13.5	40.68718	-88.65657	6:58:42	26.5	40.68258	-88.6527
6:58:23	12.5	40.68691	-88.65642	6:58:43	23	40.68249	-88.6525
6:58:24	11.5	40.68684	-88.65641	6:58:44	8.5	40.68208	-88.6523
6:58:25	10.5	40.68665	-88.65598	6:58:45	2.5	40.68196	-88.6522
6:58:26	10	40.68621	-88.65572	6:58:46	0	40.68169	-88.6519
6:58:27	10.5	40.68609	-88.65551	6:58:47	0	40.68169	-88.6519

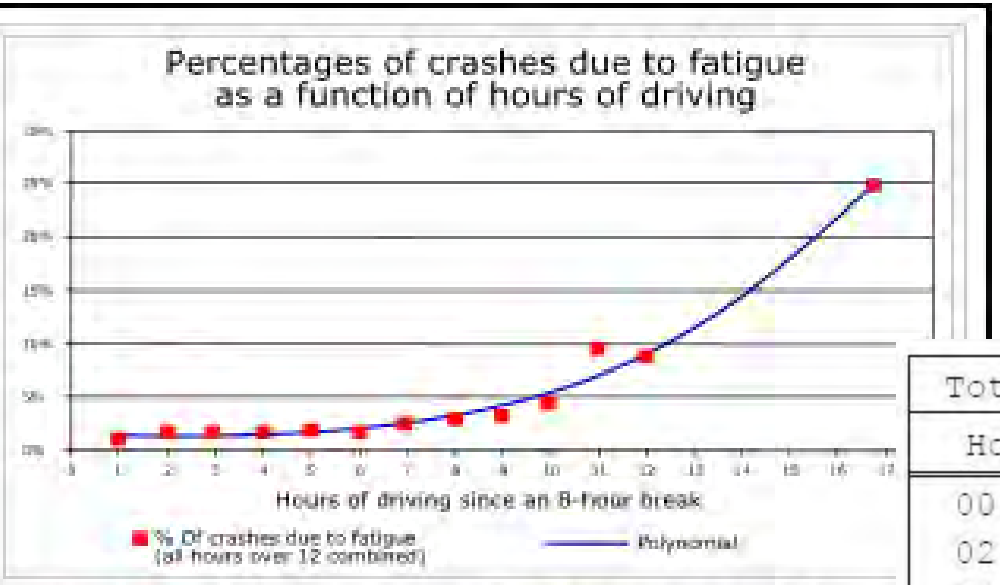
Driver Factors

In 2009, 31% of fatal tractor-trailer crashes reported driver-related factors as contributing to the collision, including:

- Driving too fast for conditions/Driving in Excess of the posted speed limit
- Failure to keep in proper lane
- Inattentive (talking, eating, etc.)
- Failure to yield right-of-way
- Failure to obey traffic signs

Federal Motor Carrier Safety Administration
National Highway Traffic Safety Administration
Fatality Analysis Reporting System

Driver Factors



A graph outlining the relationship between number of hours driven and the percent of crashes related to driver fatigue.

Source: Federal Motor Carrier Safety Administration[1]

Total(hh:mm)	04:08	01:52	18:00
Hour (EST)	Drive(min)	Idle(min)	Off(min)
00:00-02:00	0	0	120
02:00-04:00	0	0	120
04:00-06:00	0	0	120
06:00-08:00	2	8	110
08:00-10:00	66	19	35
10:00-12:00	94	26	0
12:00-14:00	47	54	19
14:00-16:00	39	5	76
16:00-18:00	0	0	120
18:00-20:00	0	0	120
20:00-22:00	0	0	120
22:00-24:00	0	0	120

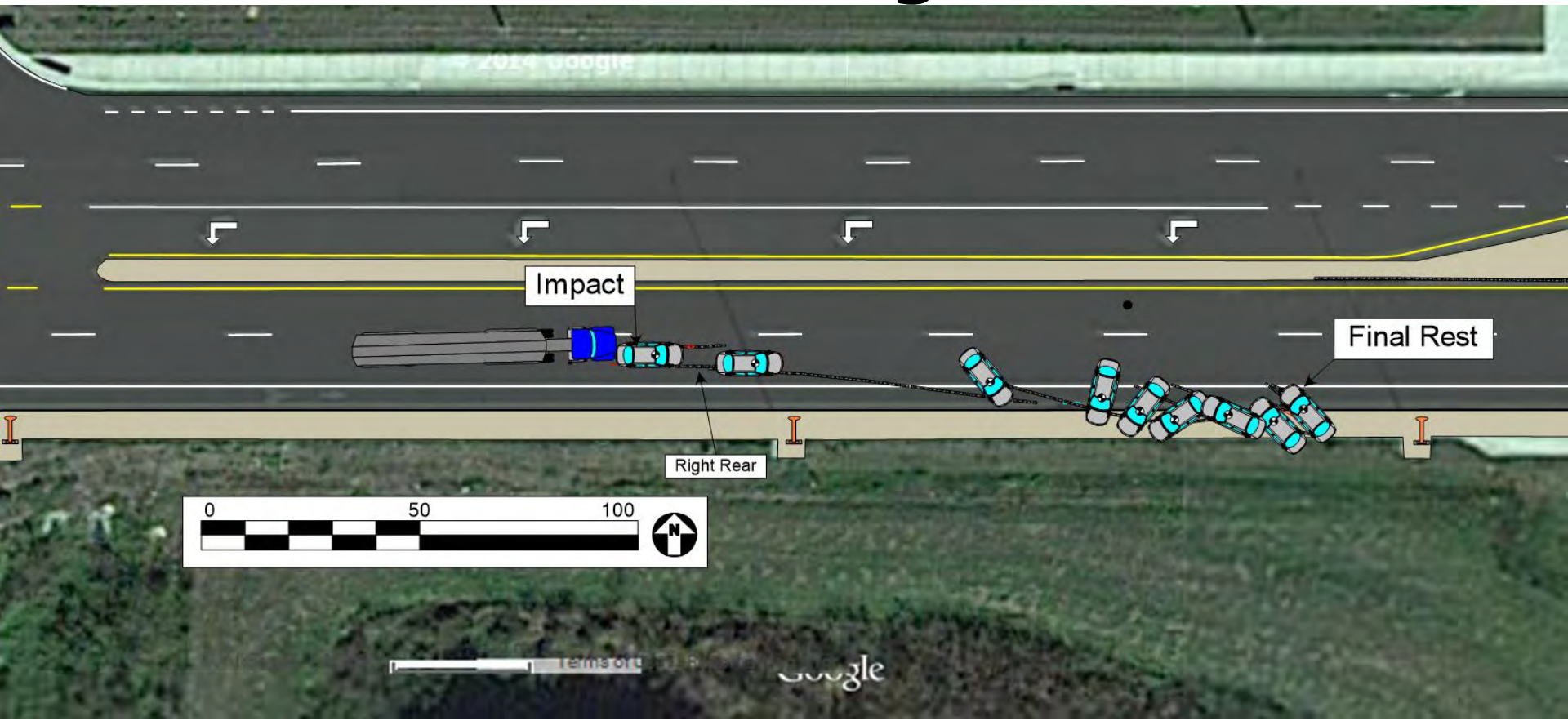
Other Sources of Data Event Data

- Video Camera
- GPS
- Infotainment
- Cell Phones
- Driver's electronic

Case Details

- 12:30 a.m.
  - Dark, dry and clear
- Driver of tractor-trailer states he saw taillights ahead.

Scaled Diagram



Tanker Truck

Front Bumper of Tanker

Pontiac Damage

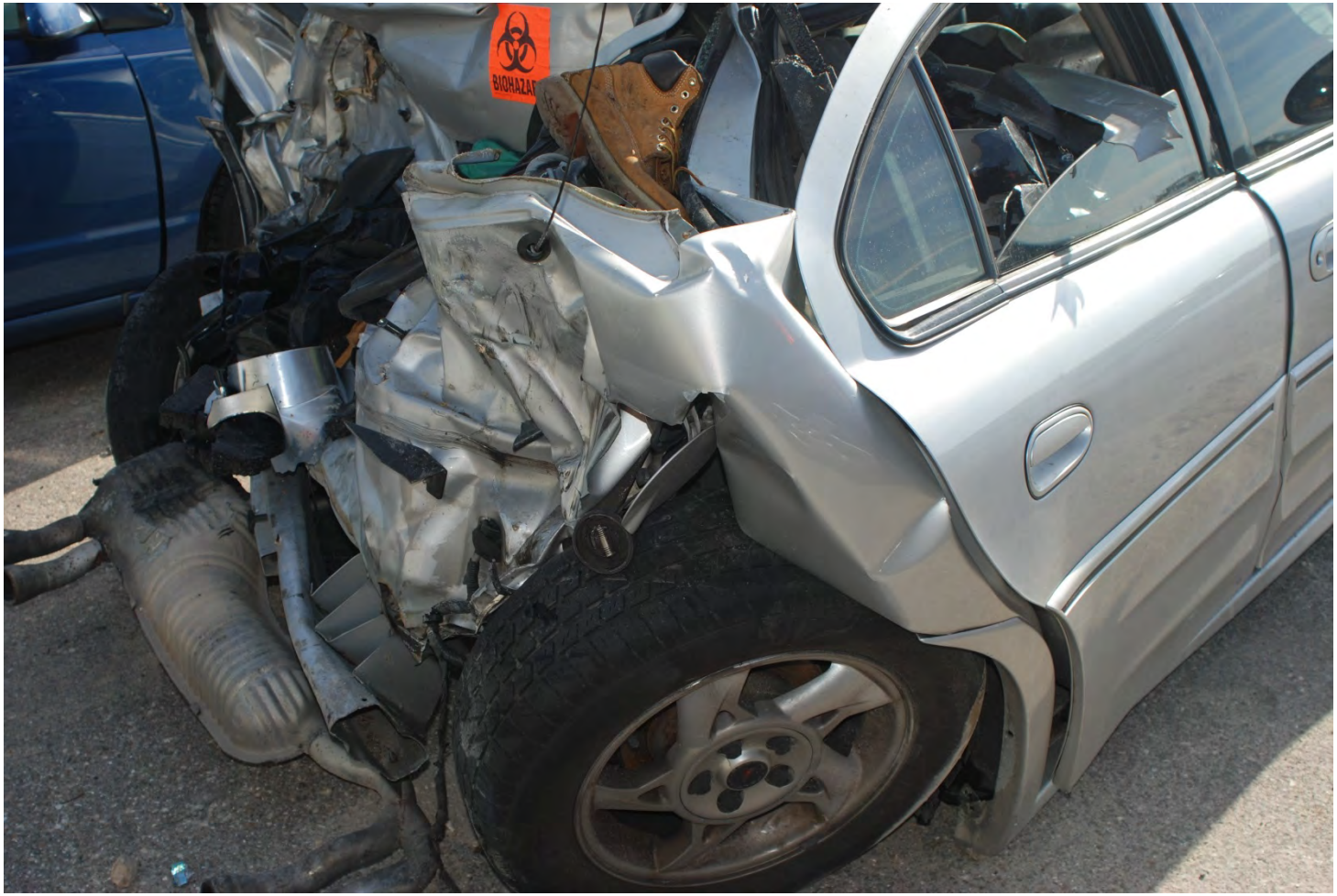
Pontiac Damage

Pontiac Damage

Pontiac Damage

Pontiac Damage

Pontiac Damage



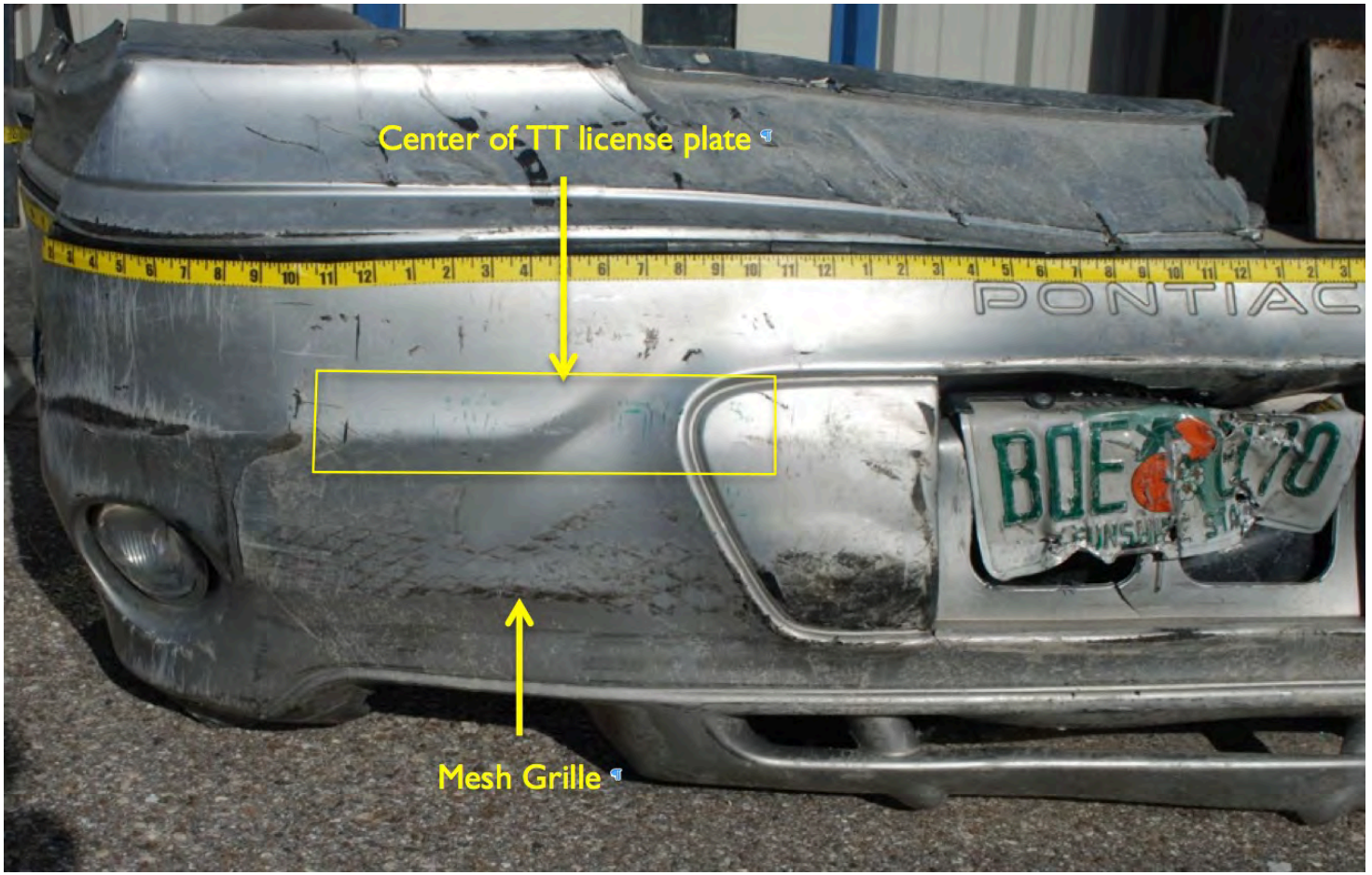
Pontiac Damage

Pontiac Damage

Pontiac Damage

Pontiac Damage

License Plate Transfer



Calculations

Tractor-Trailer

- Impact Speed = 45 mph
- Speed Limit = 50 mph

Pontiac

- Impact Speed = 0 mph

DDEC Reports

DDEC® Reports - Last Stop Record

Print Date: 7/23/2013 9:16 AM
DDC

, -
( ) -

Trip: 10/03/11 08:16:00 To 07/23/13 (EST)
Vehicle ID:
Driver ID:
Odometer: 279898.8 mi
Engine S/N: 471903S0096231

Last Stop Time: 7/22/2013 1:53:28 AM (EST) Last Stop Odometer: 279898.8 mi

Time	Vehicle Speed (mph)	Engine Speed (rpm)	Brake	Clutch	Engine Load (%)	Throttle (%)	Cruise	Diag. Code
-0:24	47.0	1347	No	No	63.50	68.80	No	No
-0:23	47.5	1355	No	No	49.50	56.00	No	No
-0:22	47.5	1356	No	No	35.50	44.80	No	No
-0:21	47.5	1358	No	No	37.00	46.80	No	No
-0:20	48.0	1360	No	No	36.50	46.00	No	No
-0:19	48.0	1369	No	No	43.00	52.40	No	No
-0:18	48.0	1362	No	No	45.00	53.60	No	No
-0:17	47.5	1361	No	No	42.50	51.20	No	No
-0:16	47.5	1353	No	No	37.00	46.40	No	No
-0:15	47.5	1350	No	No	23.00	36.40	No	No
-0:14	47.0	1348	No	No	26.00	38.00	No	No
-0:13	45.5	1195	Yes	No	0.00	0.00	No	No
-0:12	42.0	1175	Yes	No	0.00	0.00	No	No
-0:11	40.5	1139	No	No	0.00	0.00	No	No
-0:10	39.0	1053	Yes	No	0.00	0.00	No	No
-0:09	34.5	906	Yes	No	0.00	0.00	No	No
-0:08	30.0	804	Yes	No	0.00	0.00	No	No
-0:07	25.5	634	Yes	No	0.00	0.00	No	No
-0:06	21.0	592	Yes	Yes	10.50	0.00	No	No
-0:05	16.5	596	Yes	Yes	11.00	0.00	No	No
-0:04	11.5	598	Yes	Yes	11.50	0.00	No	No
-0:03	7.0	604	Yes	Yes	10.00	0.00	No	No
-0:02	3.5	605	Yes	Yes	8.50	0.00	No	No
-0:01	1.5	601	Yes	Yes	9.00	0.00	No	No
0:00	0.5	602	Yes	Yes	8.50	0.00	No	No

CDR Report

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger SIR Suppression Switch Circuit Status (if equipped)	Air Bag Not Suppressed
Ignition Cycles At Non-Deployment	25480
Ignition Cycles At Investigation	25483
Maximum SDM Recorded Velocity Change (MPH)	-2.11
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	100

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	0	0	0
-4	0	0	0
-3	0	0	0
-2	0	0	0
-1	0	0	0

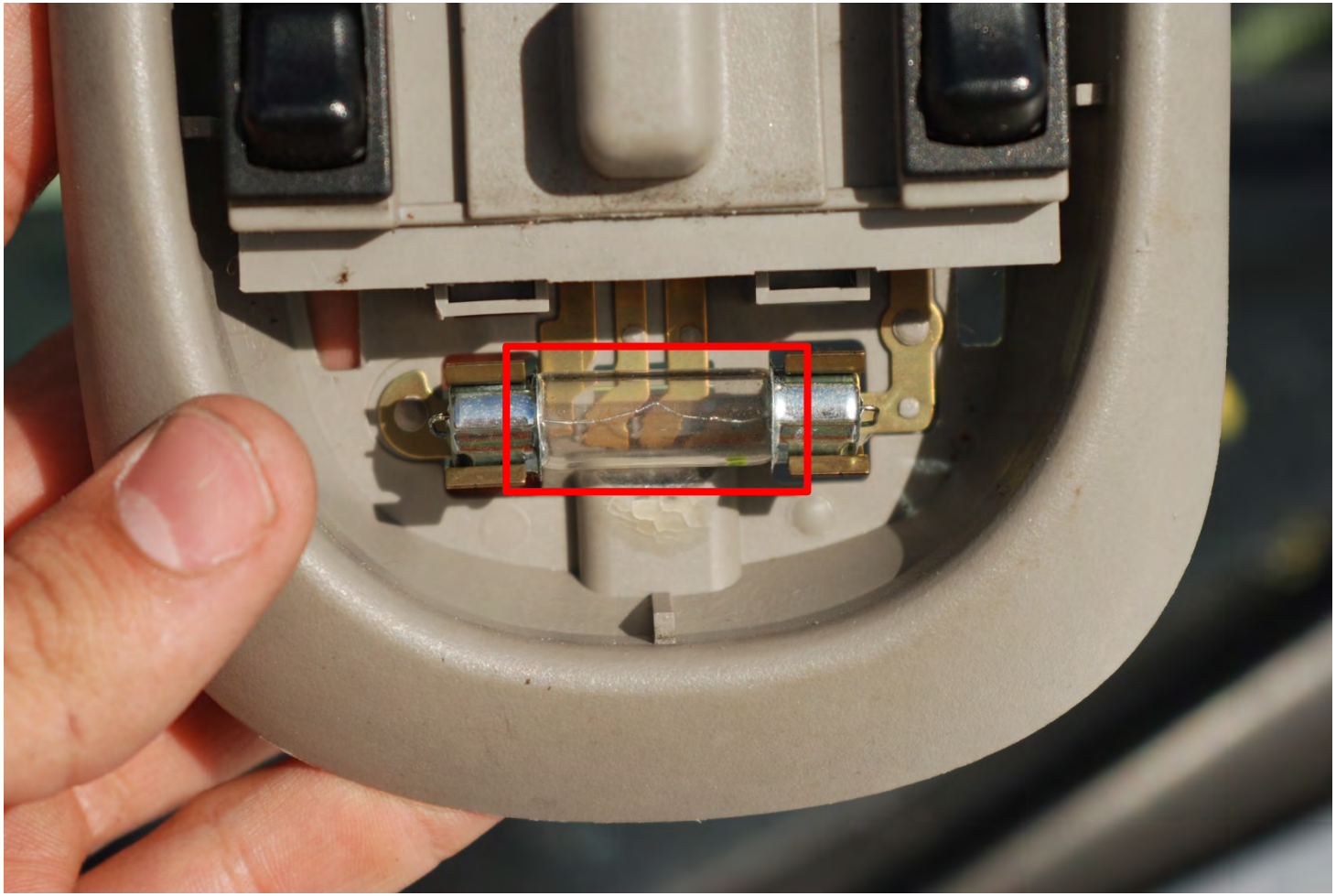
Seconds Before AE	Brake Switch Circuit State
-8	OFF
-7	OFF
-6	OFF
-5	OFF
-4	OFF
-3	OFF
-2	OFF
-1	OFF

No Fuel

Driver Door
Left rear door
BIOHAZARD

Interior Dome Lights

Hot Shock!



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July 5, 2018

Reference Number:	1805213N
Title:	Use Of Accident Reconstructionalist (Forensic Engi
Level:	Intermediate
Approval Period:	08/09/2018 - 02/09/2020

CLE Credits

General	2.0

Certification Credits

Civil Trial	2.0