

CRASH RECONSTRUCTION 101

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INTRODUCTION TO RECON

- **TRAINING**
 - **INITIAL SCHOOL DIFFERENCES**
 - **ADDITIONAL TRAINING**
- **WHAT IS RECON**
- **EQUIPMENT USED**
 - **COMPUTATION INSTRUMENTS**
 - **CDR**
 - **ECM**
 - **MAPPING, CAD**



RECONSTRUCTION DEFINITION

- **THE SCIENTIFIC PROCESS OF INVESTIGATING, ANALYZING AND DRAWING CONCLUSIONS ABOUT THE CAUSES AND EVENTS DURING A MOTOR VEHICLE COLLISION.**
- **CONSIDERATIONS:**
 - **HUMAN FACTORS**
 - **VEHICLES**
 - **ENVIRONMENT**
 - **ROADWAY SURFACE**
 - **ROADWAY SIGNAGE**
 - **ROADWAY ENGINEERING**



CRASH RECONSTRUCTION AND RECONSTRUCTION OFFICERS DUTIES

- **THE WHO**
- **THE WHAT**
- **THE WHEN**
- **THE HOW**
- **AND THE WHY**
- **ABLE TO GIVE EXPERT OPINIONS AND CONCLUSIONS**



TRAINING

- **MAIN TRAINING VENUES COMMONLY FOR ILLINOIS OFFICERS**
 - **NUCPS- NORTHWESTERN UNIVERSITY**
 - **IPTM- NORTH FLORIDA UNIVERSITY**
 - **ILLINOIS STATE POLICE ACADEMY**
- **OTHERS INCLUDE**
 - **SAE**
 - **TEXAS A&M**
 - **MICHIGAN STATE UNIVERSITY**



TRAINING

- **CERTIFICATION OPTIONS IN ILLINOIS:**
 - **ILETSB- ILLINOIS LAW ENFORCEMENT TRAINING AND STANDARDS BOARD- SWORN OFFICERS ONLY**
 - **ACTAR- ACCREDITATION COMMISSION FOR TRAFFIC ACCIDENT RECONSTRUCTION**



EXPERT TESTIMONY-RECON

TIRE MARK EXAMINATION

SPEED ANALYSIS

LIGHT BULB EXAMINATION

VEHICLE & OCCUPANT DYNAMICS

FORENSIC MAPPING

EVENT DATA RECORDERS (EDRS)

ENGINE CONTROL MODULES (ECMS)

MOTORCYCLE CRASHES

COMMERCIAL MOTOR VEHICLE CRASHES

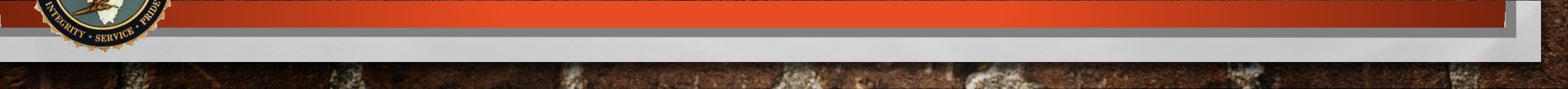
DUI ENFORCEMENT

CRIME SCENE PROCESSING

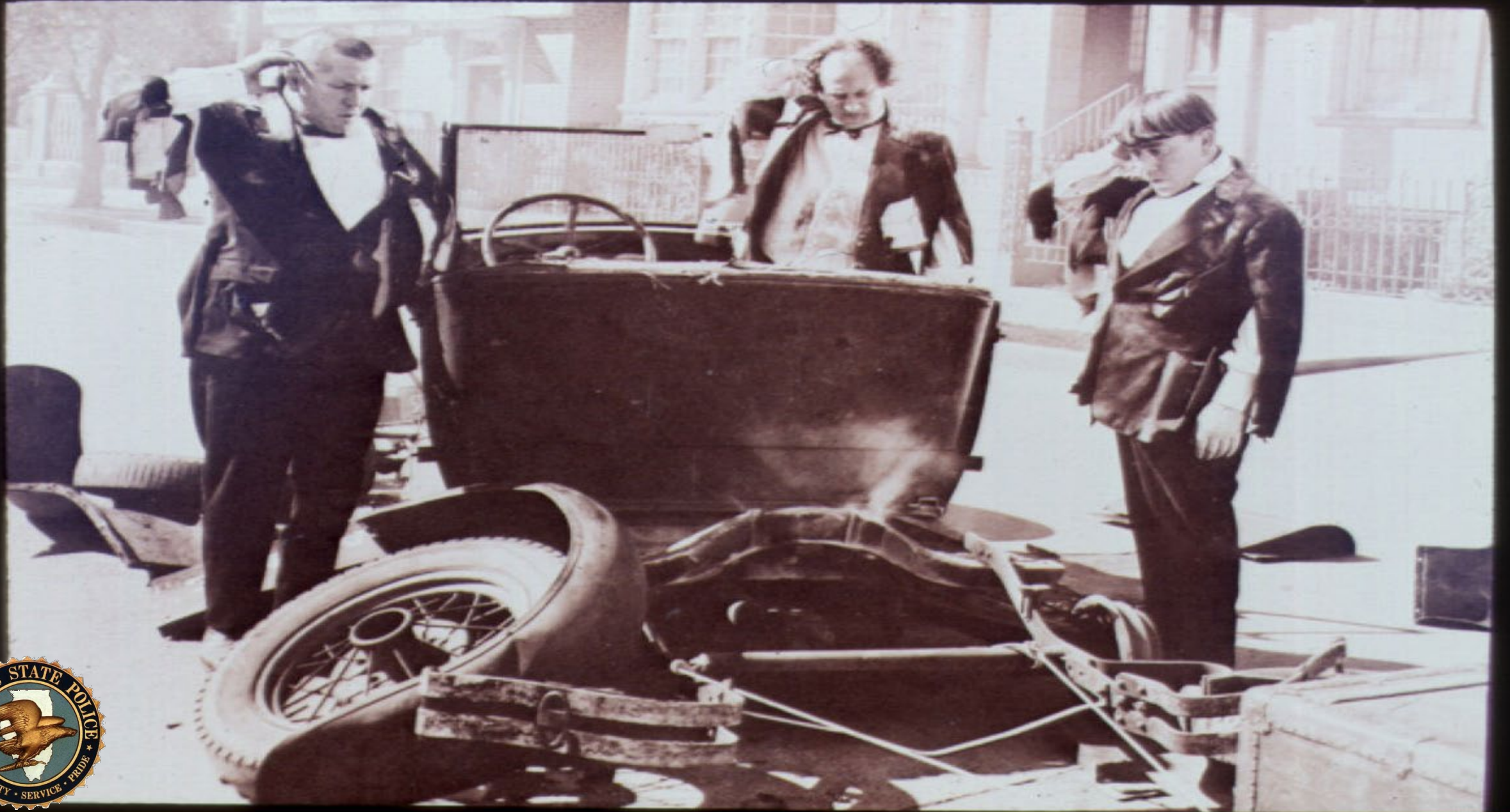
LEAD HOMICIDE/DEATH INVESTIGATION

INVESTIGATORS- BIC









COEFFICIENT OF FRICTION

$$S = \sqrt{30df}$$

$$f = \frac{S^2}{30d}$$

MOMENTUM

$$V_2 = \frac{W_1 V_3 \sin \theta}{W_2 \sin \psi} + \frac{V_4 \sin \phi}{\sin \psi}$$

$$V_1 = V_3 \cos \theta + \frac{W_2 V_4 \cos \phi}{W_1} - \frac{W_2 V_2 \cos \psi}{W_1}$$



Spin Analysis

Crash # 03-14-4390

| Interval | Distance Between Intervals | a_i | a_i+1 | a_avg | mu | Rolling Resistance | Sin | Grade (m) | f_adj | Departure | Speed |
|----------|----------------------------|---------|---------|---------|-------|--------------------|-------|-----------|-------|-----------|-----------|
| 1 | 71.25 ft | 0.000 | 12.00 | 6.000 | 0.800 | 0.060 | 0.105 | 0.000 | 0.137 | | 17.13 mph |
| 2 | 22.5 ft | 12.000 | 16.00 | 14.000 | 0.800 | 0.060 | 0.242 | 0.000 | 0.239 | | 12.7 mph |
| 3 | 19.5 ft | 16.000 | 27.00 | 21.500 | 0.800 | 0.060 | 0.367 | 0.000 | 0.331 | | 13.92 mph |
| 4 | 19.68 ft | 27.000 | 27.00 | 27.000 | 0.800 | 0.060 | 0.454 | 0.000 | 0.396 | | 15.29 mph |
| 5 | 15. ft | 27.000 | 70.00 | 48.500 | 0.800 | 0.060 | 0.749 | 0.000 | 0.614 | | 16.63 mph |
| 6 | 10.31 ft | 70.000 | 100.00 | 85.000 | 0.800 | 0.060 | 0.996 | 0.000 | 0.797 | | 15.7 mph |
| 7 | 12.18 ft | 100.000 | 89.000 | 94.500 | 0.800 | 0.060 | 0.997 | 0.000 | 0.798 | | 17.07 mph |
| 8 | 11.25 ft | 89.000 | 110.000 | 99.500 | 0.800 | 0.060 | 0.986 | 0.000 | 0.790 | | 16.33 mph |
| 9 | 15. ft | 110.000 | 112.000 | 111.000 | 0.800 | 0.060 | 0.000 | 0.000 | 0.060 | | 5.2 mph |
| 10 | 7.5 ft | 112.000 | 135.000 | 123.500 | 0.800 | 0.060 | 0.000 | 0.000 | 0.060 | | 3.67 mph |
| 11 | 13.12 ft | 135.000 | 129.000 | 132.000 | 0.800 | 0.060 | 0.000 | 0.000 | 0.060 | | 4.86 mph |

Heavy Vehicle Crash Reconstruction

Initial Speed (mph) = **75**

Roadway friction = **0.81**

Truck friction (80% of car) = **0.65**

Tire Efficiency = **0.8**

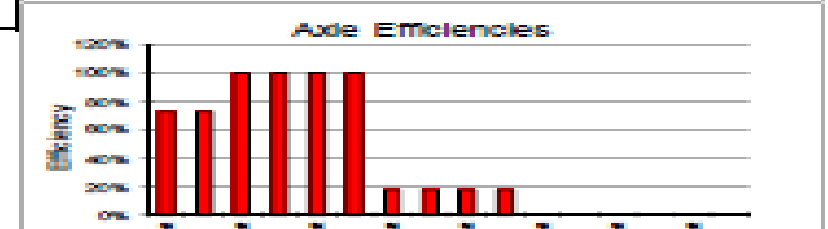
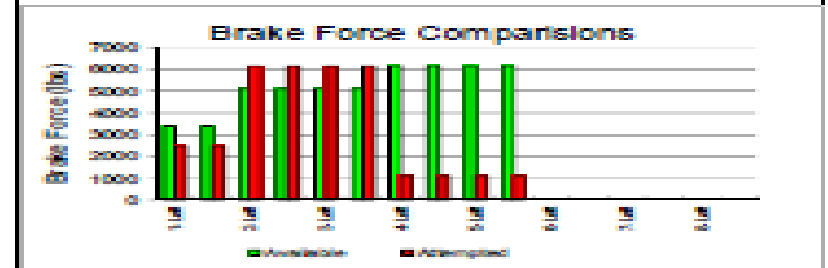
CALCULATED DECEL (g-units) = 0.37

| Axle/Wheel | Chamber Size | Brake Pres. (psi) | Cold Stroke | Dynamic Stroke Inc. | Total Stroke | Pushrod Force | Slack Length | Lining Friction | Drum Radius | Rolling Radius | Attempted Force |
|------------|--------------|-------------------|-------------|---------------------|--------------|---------------|--------------|-----------------|-------------|----------------|-----------------|
| 1-Left | 24 | 100 | 1.375 | 0.2292 | 1.604 | 2079 | 4 | 0.35 | 8.00 | 22.5 | 2484 |
| 1-Right | 24 | 100 | 1.375 | 0.2292 | 1.604 | 2079 | 4 | 0.35 | 8.00 | 22.5 | 2484 |
| 2-Left | 30 | 100 | 1.375 | 0.2292 | 1.604 | 2650 | 7 | 0.35 | 8.25 | 22.5 | 6145 |
| 2-Right | 30 | 100 | 1.375 | 0.2292 | 1.604 | 2650 | 7 | 0.35 | 8.25 | 22.5 | 6145 |
| 3-Left | 30 | 100 | 1.375 | 0.2292 | 1.604 | 2650 | 7 | 0.35 | 8.25 | 22.5 | 6145 |
| 3-Right | 30 | 100 | 1.375 | 0.2292 | 1.604 | 2650 | 7 | 0.35 | 8.25 | 22.5 | 6145 |
| 4-Left | 30 | 20 | 1.500 | 0.2292 | 1.729 | 450 | 7 | 0.35 | 8.25 | 20 | 1091 |
| 4-Right | 30 | 20 | 1.500 | 0.2292 | 1.729 | 450 | 7 | 0.35 | 8.25 | 20 | 1091 |
| 5-Left | 30 | 20 | 1.500 | 0.2292 | 1.729 | 450 | 7 | 0.35 | 8.25 | 20 | 1091 |
| 5-Right | 30 | 20 | 1.500 | 0.2292 | 1.729 | 450 | 7 | 0.35 | 8.25 | 20 | 1091 |
| 6-Left | | | | | | | | | | | |
| 6-Right | | | | | | | | | | | |
| 7-Left | | | | | | | | | | | |
| 7-Right | | | | | | | | | | | |
| 8-Left | | | | | | | | | | | |
| 8-Right | | | | | | | | | | | |

Shaded cells are user input values

| Axle/Wheel | Vertical Load | % of Total | Brake Force Available | Brake Force Attempted | Efficiency | % of Total | Wheel Lockup? |
|------------|---------------|------------|-----------------------|-----------------------|------------|------------|---------------|
| 1-Left | 5,250 | 6.56% | 3402 | 2484 | 73.02% | 4.79% | NO |
| 1-Right | 5,250 | 6.56% | 3402 | 2484 | 73.02% | 4.79% | NO |
| 2-Left | 7875 | 9.84% | 5103 | 6145 | 100.00% | 9.84% | YES |
| 2-Right | 7875 | 9.84% | 5103 | 6145 | 100.00% | 9.84% | YES |
| 3-Left | 7875 | 9.84% | 5103 | 6145 | 100.00% | 9.84% | YES |
| 3-Right | 7875 | 9.84% | 5103 | 6145 | 100.00% | 9.84% | YES |
| 4-Left | 9500 | 11.88% | 6156 | 1091 | 17.73% | 2.11% | NO |
| 4-Right | 9500 | 11.88% | 6156 | 1091 | 17.73% | 2.11% | NO |
| 5-Left | 9500 | 11.88% | 6156 | 1091 | 17.73% | 2.11% | NO |
| 5-Right | 9500 | 11.88% | 6156 | 1091 | 17.73% | 2.11% | NO |
| 6-Left | | | | | | | |
| 6-Right | | | | | | | |
| 7-Left | | | | | | | |
| 7-Right | | | | | | | |
| 8-Left | | | | | | | |
| 8-Right | | | | | | | |

| | |
|----------------------------|--------|
| (mu x tn) truck mu = | 0.65 |
| Max Truck Decel Rate (F) = | 0.37 |
| Braking Efficiency = | 57.38% |
| Overall Efficiency (n) = | 0.46 |
| F1 = | 0.32 |
| F2 = | 0.05 |



GVW (lbs)
80,000

Minimum total brake force (lbs)
29,746

Truck Stopping Distance = 293.0 feet

(does not account for brake lag or reaction time)

car stopping distance (car mu) = 173.8 feet
 car stopping distance (truck mu) = 217.3 feet



FORENSIC MAPPING

SOKKIA TOTAL STATION (4130)

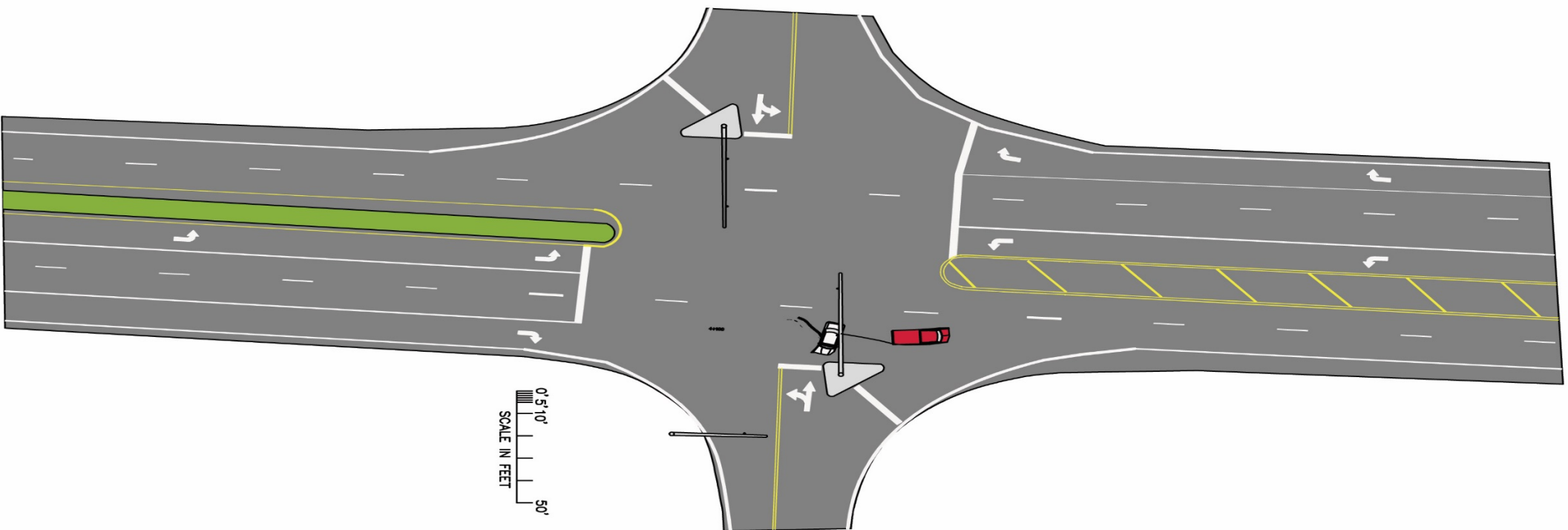


FORENSIC MAPPING LEICA ROBOTIC TOTAL STATIONS

207
261
FENCE

| | | | | |
|---------------|-------------------|------------------|-------------------|--------------|
| 255 N: | 77.891 E: | 106.158 E1: | 107.631 D: | BLDG |
| 256 N: | 67.508 E: | 123.981 E1: | 107.185 D: | BLDG |
| 257 N: | -29.910 E: | 14.796 E1: | 99.994 D: | UTILITYP |
| 258 N: | -21.259 E: | 8.515 E1: | 100.998 D: | WOODPO |
| 259 N: | -16.870 E: | 8.527 E1: | 100.552 D: | WOODPO |
| 261 N: | -25.970 E: | 8.389 E1: | 107.174 D: | FENCE |
| 262 N: | -25.387 E: | -42.762 E1: | 107.996 D: | FENCE |
| 263 N: | -25.273 E: | -76.992 E1: | 110.542 D: | FENCE |
| 264 N: | -19.067 E: | -82.672 E1: | 104.868 D: | UTILITYP |
| 265 N: | 42.097 E: | 2.202 E1: | 102.200 D: | DM |



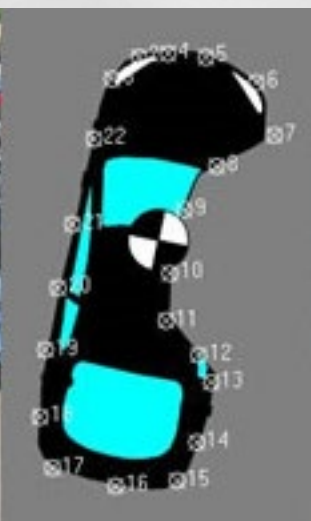


0' 5' 10'
SCALE IN FEET
50'

CRASH NO.: _____ ILLINOIS STATE POLICE
 CRO NO.: _____
 INVESTIGATING OFFICER: _____
 DATE: _____ TRF. OFF.
 LOCATION: _____ SATURDAY, NOVEMBER
 IL. RT. _____
 TRAFFIC CRASH RECONSTRUCTION OFFICER: _____
 DIAGRAM PREPARED BY: _____ TRF. DANIEL L. _____



3D SCANNING



UAS- UNMANNED AERIAL SYSTEMS



Not this one!











Damage/ Speed loss from the impact with the tree

A crush analysis was completed to account for the damage associated with the impact of the tree. Measurements were completed of the face of the driver side.

C1: 15.0 inches

C2: 20.5 inches

C3: 46.0 inches

C4: 29.5 inches

C5: 17.0 inches

C6: 10.0 inches

The length of the damage was 113 inches.

The distance off set was measured to be 12 inches.

The center of mass is documented to be 42.56 inches behind the front axle.

Using 4N6XPRT StifCalcs (print out attached as an addendum) the average stiffness coefficients were calculated to be $A = 127.1$, $B = 189.2$ and $G = 45.1$. A summary was used and accounted for the elimination of limited skewed tests from the National Highway and Transportation Safety Administration. The average crush factor was 32.2 inches. A magnification factor of 1 was used.

The curb weight of the Oldsmobile was 3,803 lbs. An estimated weight of 4,300 lbs was used to account for the curb weight and the weight of occupants. Limited cargo was found and not considered in the calculations

$$E_r = \frac{L}{5} \left(\frac{A}{2} (C_1 + 2C_2 + 2C_3 + 2C_4 + 2C_5 + C_6) + \frac{B}{6} [C_1^2 + 2C_2^2 + 2C_3^2 + 2C_4^2 + 2C_5^2 + C_6^2 + C_1C_2 + C_2C_3 + C_3C_4 + C_4C_5 + C_5C_6] + 5G \right)$$

$$E_r = \frac{113}{5} \left(\frac{127.1}{2} (15 + 2(20.5) + 2(46) + 2(29.5) + 2(17) + (10)) + \frac{189.2}{6} [15^2 + 2(20.5^2) + 2(46)^2 + 2(29.5)^2 + 2(17)^2 + 10^2 + (15)(20.5) + (20.5)(46) + (46)(29.5) + \right.$$

$$\left. (29.5)(17) + (17)(10) \right] + (5)(45.1) = 683,436 \text{ ft/lbs}$$

Kinetic energy (KE) associated with the impact was computed to be 683,436 ft/lbs.
Associated speed loss is 69 mph.

$$S = \sqrt{\frac{30Ke}{W}}$$

$$S = \sqrt{\frac{(30)(683,436)}{4300}}$$

$$S = \sqrt{\frac{20503080}{4300}}$$

$$S = \sqrt{4768.15}$$

$$S = 69.05 \approx 69mph$$

$$S = \sqrt{30df}$$

$$S = \sqrt{(30)(372)(0.80)}$$

$$S = \sqrt{8928}$$

$$S = 94mph$$

A higher coefficient of friction sometimes ranged to a traveled asphalt surface would show a 94 mph speed.

If we combine the 81 mph (calculated above) and the impact speed of 69 mph we have a total beginning speed of:

$$S_c = \sqrt{S_1^2 + S_2^2}$$

$$S_c = \sqrt{69^2 + 81^2}$$

$$S_c = \sqrt{4761 + 6561}$$

$$S_c = 106mph$$

If we use kinetic energy to show the total speed:

Impact with the tree = 683,436 ft/lbs

Skidding =

$$Ke = \frac{(W)(S^2)}{30}$$

$$Ke = \frac{(4300)(81^2)}{30}$$

$$Ke = \frac{28212300}{30}$$

$$Ke = 940,410 ft./lbs$$

Total Kinetic Energy = 940,410 + 683,436 = 1,623,846 ft./lbs

$$S = \sqrt{\frac{30Ke}{W}}$$

$$S = \sqrt{\frac{(30)(1623846)}{4300}}$$

$$S = \sqrt{\frac{48715380}{4300}}$$

$$S = \sqrt{11329.15953}$$

$$S = 106mph$$

These calculations do not consider the speed loss from the vehicle spinning while traveling across the roadway given it was approximately 450 degrees in rotation across 500 feet of travel. Also it does not consider the travel across the grass area and the impact with the first tree.

CRASH DATA RETRIEVAL (CDR) OR EVENT DATA RECORDER (EDR)



Pre-crash data

| Parameter | -1.0 sec | -0.5 sec |
|---|----------|----------|
| Reduced Engine Power Mode | OFF | OFF |
| Cruise Control Active (If Equipped) | No | No |
| Cruise Control Resume Switch Active (If Equipped) | No | No |
| Cruise Control Set Switch Active (If Equipped) | No | No |
| Engine Torque (foot pounds) | 88.67 | 36.88 |

Pre-Crash Data

| Parameter | -2.5 sec | -2.0 sec | -1.0 sec | -0.5 sec |
|--------------------------------------|----------|----------|----------|----------|
| Accelerator Pedal Position (percent) | 11 | 12 | 12 | 0 |
| Vehicle Speed (MPH) | 43 | 43 | 43 | 43 |
| Engine Speed (RPM) | 1152 | 1088 | 1152 | 1408 |
| Percent Throttle | 26 | 27 | 27 | 12 |
| Brake Switch Circuit Status | OFF | OFF | OFF | ON |



ISP Web Sample

EDRS- IMPORTANCE

- **MORE THAN APPROXIMATELY 62% OF REGISTERED PASSENGER VEHICLES IN ILLINOIS HAVE SOME FORM OF EDR DATA AVAILABLE.**
- **EDRS CAN ANSWER QUESTIONS WE MAY NOT HAVE FIRM ANSWERS DUE TO THE LACK OF PHYSICS AND PHYSICAL EVIDENCE OF THE CRASH SCENE.**



Manufacturer Phase In by Model Year (Data incomplete on smaller volume manufacturers with no public tool)

| Make | Market Share | Market | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------|---------------|----|----|----|--------------------------------------|----|---|------------------------------|----------------------|---|---|-----------------------------|----------------------|-----------------------------|------|-----|-----|----|----|----|----|----|--|
| | | 94 | 95 | 96 | 97 | 98 | 99 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| GM (CADILLAC,CHEVY,BUICK,GMC) | 17.9% | SOME have EDR | | | | All have EDR readable with Bosch CDR | | | | | | | | | | | | | | | | | | |
| FORD (LINCOLN) | 15.5% | | | | | Some, Not CDR | | | Some readable with Bosch CDR | | | | | | All | | All | | | | | | | |
| TOYOTA (LEXUS, SCION) | 14.4% | | | | | | | | | Some | | | All readable with Bosch CDR | | | | | | | | | | | |
| CHRYSLER (DODGE, JEEP, RAM, FIAT, LANCIA) | 11.4% | | | | | | | | | | | | Some | | All readable with Bosch CDR | | | | | | | | | |
| HONDA (ACURA) | 9.8% | | | | | | | | | | | | | | | ? | | ? | | | | | | |
| NISSAN (INFINITI) | 7.9% | | | | | | | | | | | | | Not Bosch CDR - some | | | | | | | | | | |
| HYUNDAI | 4.9% | | | | | | | | | | | | | ? | | some | | all | | | | | | |
| VOLKSWAGEN (AUDI, BENTLEY) | 4.0% | | | | | | | | | | | | | freeze frame data ? | | | | | | | | | | |
| KIA | 3.9% | | | | | | | | | | | | | ? | | some | | all | | | | | | |
| BMW (MINI, ROLLS ROYCE) | 2.3% | | | | | | | | | | | | | | | | | ? | | | | | | |
| SUBARU | 2.3% | | | | | | | | | | | | | | | | | ? | | | | | | |
| DAIMLER(MERCEDES, MAYBACH, SMART) | 2.0% | | | | | | | | | | | | | freeze frame data ? | | | | | | | | | | |
| MAZDA (Former Ford partner) | 1.9% | | | | | | | | | Non Bosch CDR - some | | | | ? | | some | | | | | | | | |
| VOLVO (Former Ford) | 0.5% | | | | | | | | | Non Bosch CDR - some | | | | ? | | ? | | | | | | | | |
| MITSUBISHI | 0.4% | | | | | | | | | | | | | ? | | | | | | | | | | |
| JAG/LAND ROVER (Tata Motors India - Former Ford) | 0.4% | | | | | | | | | Non Bosch CDR - some | | | | | | | | | | | | | | |
| PORSCHE (part of VW) | 0.2% | | | | | | | | | | | | | | | | | | | | | | | |
| SUZUKI | 0.2% | | | | | | | | | | | | | GM clone | | | | | | | | | | |
| MASERATI | 0.0% | | | | | | | | | | | | | | | | | | | | | | | |
| FERRARI | 0.0% | | | | | | | | | | | | | | | | | | | | | | | |
| SAAB | 0.0% | | | | | | | | | | | | | | | | | | | | | | | |

SOME have EDR ALL have EDR, CDR tool

SOME EDR CDR All have EDR but not CDR tool

GUARDRAIL CRASH



Pre-Crash Data -5.0 to -0.5 sec (Event Record 2)

| Times (sec) | Accelerator Pedal, % Full (Accelerator Pedal Position) | Service Brake (Brake Switch Circuit State) | Engine RPM (Engine Speed) | Engine Throttle, % Full (Throttle Position) | Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h]) |
|-------------|--|--|---------------------------|---|---|
| -5.0 | 0 | Off | 2240 | 39 | 65 [105] |
| -4.5 | 0 | Off | 2240 | 39 | 65 [105] |
| -4.0 | 0 | Off | 2240 | 39 | 65 [105] |
| -3.5 | 0 | Off | 2240 | 39 | 65 [105] |
| -3.0 | 0 | Off | 2240 | 39 | 65 [105] |
| -2.5 | 0 | Off | 2240 | 39 | 65 [105] |
| -2.0 | 0 | Off | 2240 | 40 | 65 [105] |
| -1.5 | 0 | Off | 2240 | 40 | 65 [104] |
| -1.0 | 0 | Off | 2240 | 41 | 65 [104] |
| -0.5 | 0 | Off | 2240 | 41 | 65 [104] |



Speed at Impact EDR Worksheet

| | MIN | MAX |
|---|-----|-----|
| Last Data Sample Before Impact | | |
| Braking between last data sample and time of impact (Time Interval X Braking Rate) (subtract 0.5 if still on accelerator pedal) | | +0 |
| Slip of wheel in ABS braking +5% (if in continuous braking) | | |
| Speedometer Error (+/- 4%) | | |
| Range of Speeds at Impact | | |
| | MIN | MAX |

Example Calculations of Speed at Impact Range for different EDR intervals between data points in hard braking:

Reference EDR data interval once every

1 sec

0.5 sec

0.2 sec

0.1 sec

Last Data Point recorded before impact by EDR:

For braking already applied and past initial engagement:

1. Braking between last data sample and time of impact (if any)

(Time Interval X Braking Rate) for 0.7g, 15 mph/s

0-15 mph

0-7.5 mph

0-3.0 mph

0-1.5 mph

2. Slip of wheel in ABS Braking

(5% * speed of 70 = 3.5)

+3.5

+3.5

+3.5

+3.5

3. Speedometer Error 4%

+/- 2.8

+/- 2.8

+/- 2.8

+/- 2.8

Range- High End 70+0+3.5+2.8=76.3

76.3

76.3

76.3

76.3

Range- Low End 70-15+3.5-2.8=55.7

55.7

63.2

67.7

69.2

Midrange

66.0

69.8

72.0

72.8

Since you do not know that the driver is applying MAX braking, the low end should be taken as a MINIMUM, the actual speed at impact may be higher. This method results in a CONSERVATIVE estimate of minimum speed.

INTERSECTION EXAMPLE



INTERSECTION EXAMPLE



INTERSECTION EXAMPLE



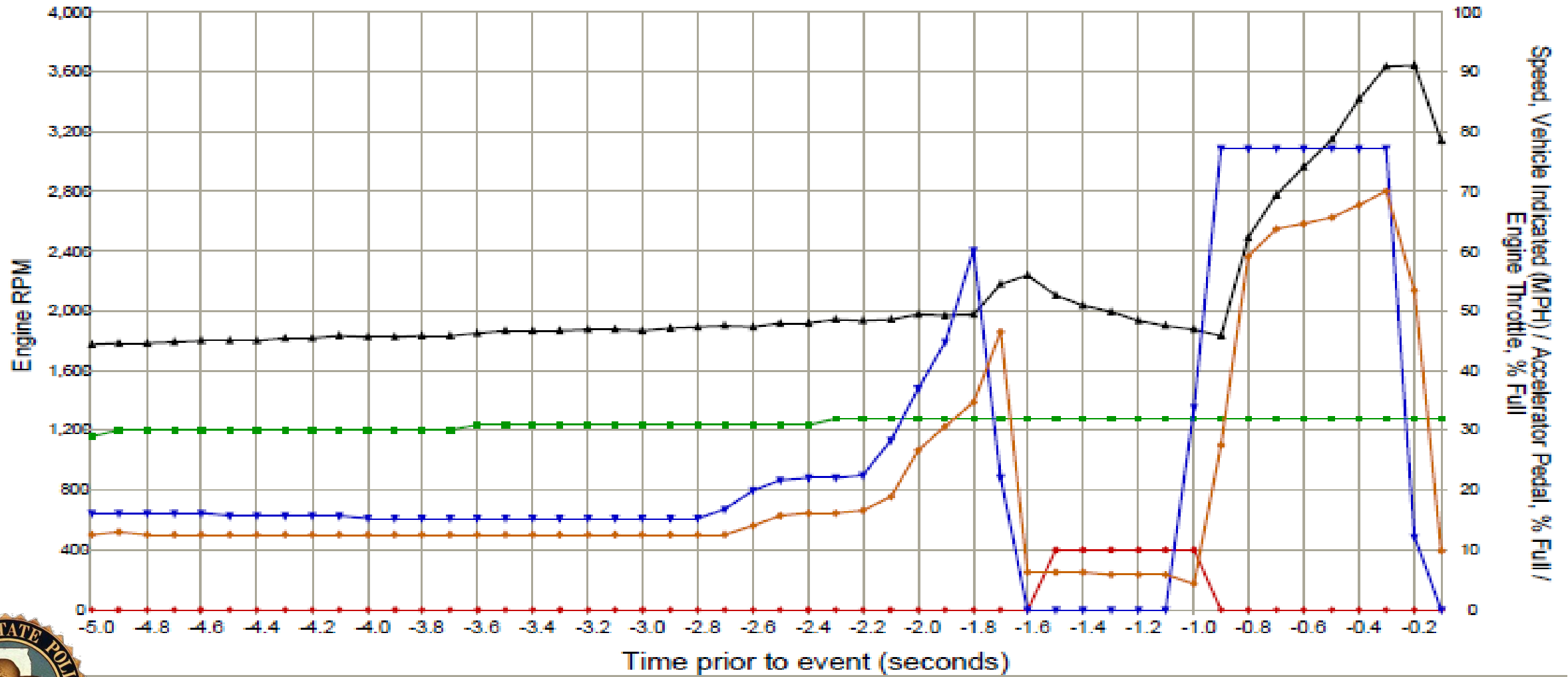
INTERSECTION EXAMPLE



INTERSECTION EXAMPLE



Pre-Crash Data (Event Record 2)



Engine RPM
Accelerator Pedal, % Full

Speed, Vehicle Indicated (MPH)
Engine Throttle, % Full

Service Brake (0=Off/10=On)

KIA AND HYUNDAI EDR ACCESS- 2013 MY+



HYUNDAI SAMPLE

EDR Data Limitations

Tools for downloading the EDRs in Hyundai vehicles have been developed only for vehicles produced after September 1, 2012. Currently, there is no tool for downloading accurate data from the EDRs in Hyundai vehicles produced prior to this.

The retrieval of his EDR data has authorized by the vehicle's owner, or other legal authority.

The airbag ECU can store up to two events. Deployment events cannot be overwritten or cleared from airbag ECU. Non-deployment events(which did not qualify as deployable events) can be overwritten by subsequent events.

The specifications for EDR are designed to be compatible with NHTSA 49 CFR Part 563 rule. The EDR data recording specifications of airbag ECU are divided into the following four categories.

- For the Event#1: Event#1-1 Event#1-2 Event#1-3 Event#1-4 Real-Time Data.
- For the Event#2: Event#2-1 Event#2-2 Event#2-3 Event#2-4 Real-Time Data.

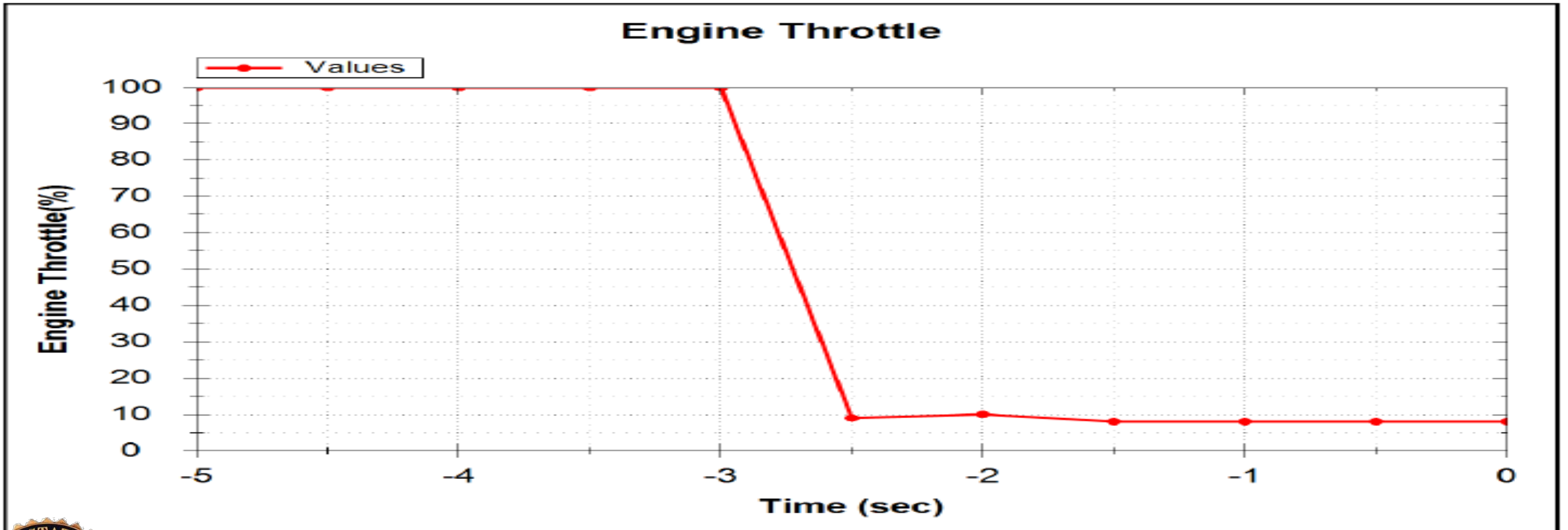
The airbag ECU records data for all or some of the following crash(event)

But, depending on the installed airbag ECU, data for side crash and/or rollover crash(event) may not be recored.

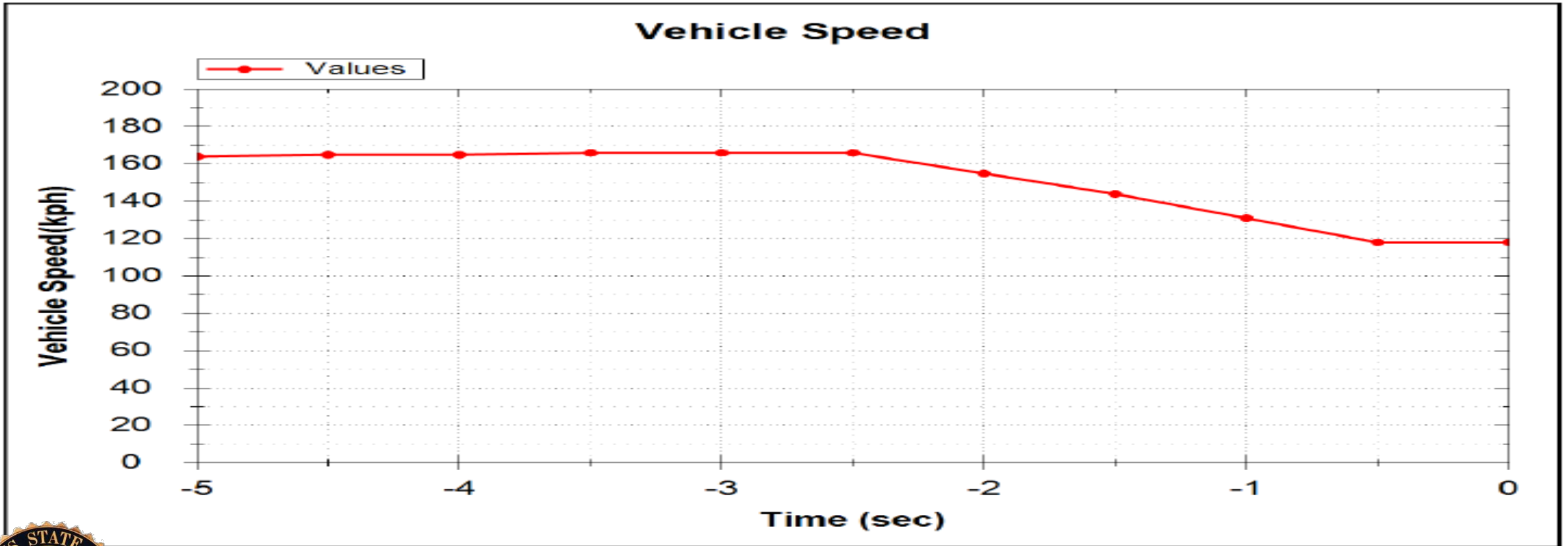
Ignition cycle counter(download) will increment by 1 every time when the power mode cycles is changed from OFF/Accessory to IGN/RUN or EDR data is downloaded by using the retrieval tool.



HYUNDAI

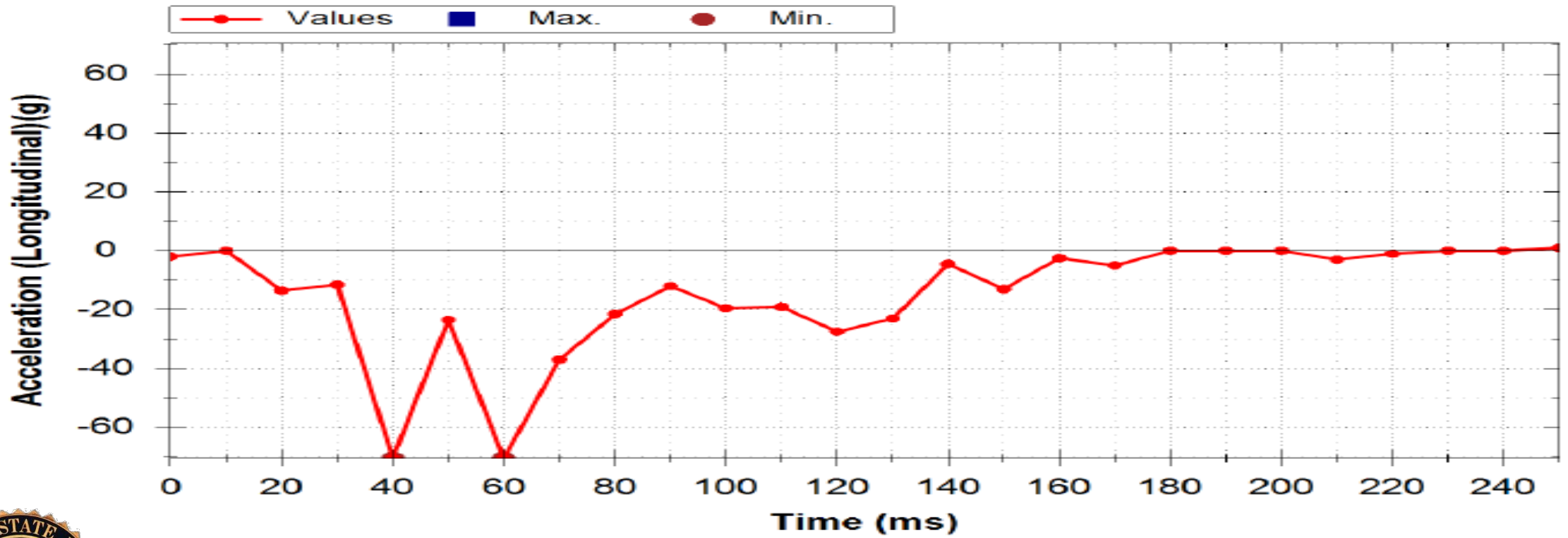


HYUNDAI



HYUNDAI

Acceleration (Longitudinal)



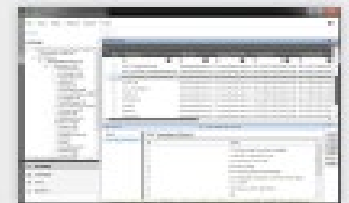
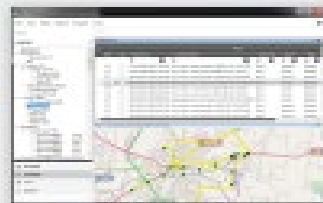
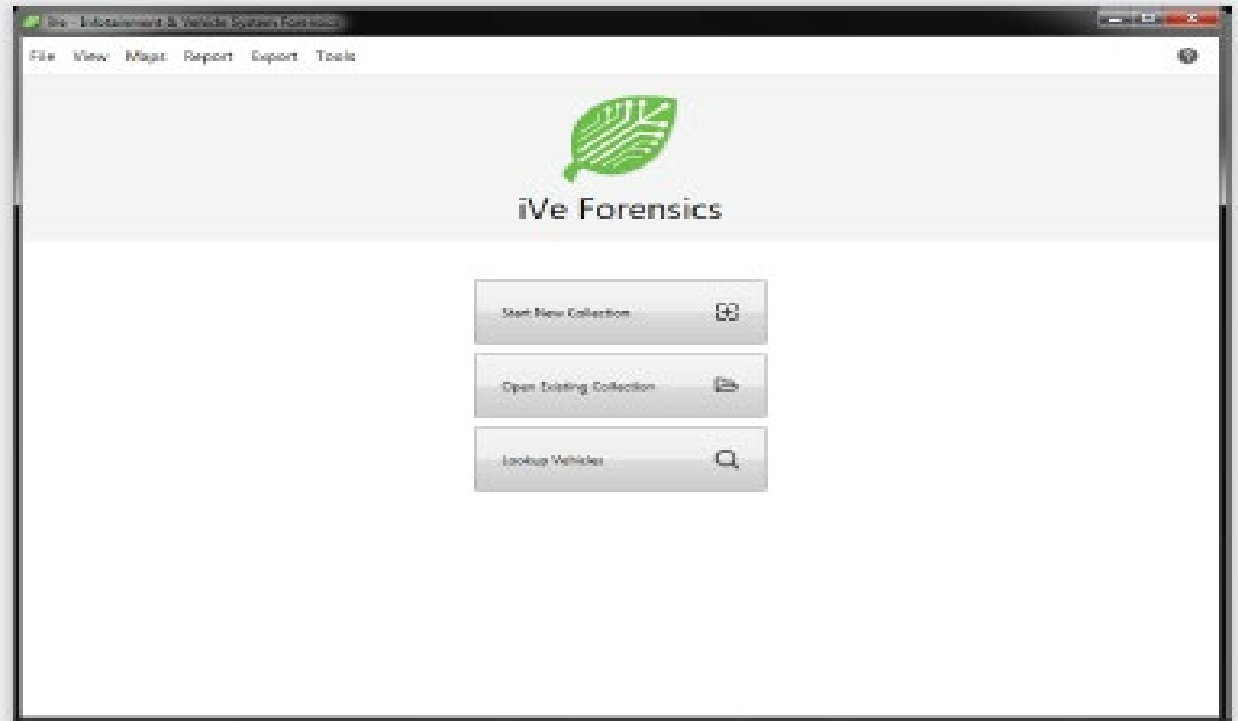




PHONE TECHNOLOGY- CELLEBRITE



IVE FORENSICS CAN BUS/INFO-TAINMENT ACCESS- GPS (BLACKTHORN)



ENGINE CONTROL MODULES (ECM)



DDEC® Reports - Last Stop Record

Print Date: Jun 15, 2011 04:14 PM (CDT)

Illinois State Police
 9511 W. Harrison
 Des Plaines, IL 60016
 (847) 294-4400

Trip: 09/24/05 10:51 AM (CST) to 06/15/11 (CST)
 Vehicle ID: STERLING
 Driver ID:
 Odometer: 910943.6 mi

Last Stop Time: 05/18/2011 11:33:24 (CST)

Last Stop Odometer: 910943.6 mi

| Time | Vehicle Speed (mph) | Engine Speed (rpm) | Brake | Clutch | Engine Load (%) | Throttle (%) | Cruise | Diagnostic Code |
|-------|------------------------|-----------------------|-------|--------|--------------------|-----------------|--------|--------------------|
| -0:19 | 60.5 | 1458 | No | No | 16.00 | 28.80 | No | No |
| -0:18 | 60.5 | 1455 | No | No | 15.50 | 28.00 | No | No |
| -0:17 | 60.5 | 1453 | No | No | 13.00 | 24.00 | No | No |
| -0:16 | 60.5 | 1448 | No | No | 12.00 | 22.00 | No | No |
| -0:15 | 60.5 | 1455 | No | No | 0.00 | 0.00 | No | No |
| -0:14 | 60.0 | 1441 | Yes | No | 0.00 | 0.00 | No | No |
| -0:13 | 53.0 | 1262 | Yes | No | 0.00 | 0.00 | No | No |
| -0:12 | 47.5 | 1128 | Yes | No | 0.00 | 0.00 | No | No |
| -0:11 | 42.5 | 1022 | Yes | No | 0.00 | 0.00 | No | No |
| -0:10 | 37.0 | 884 | Yes | No | 0.00 | 0.00 | No | No |
| -0:09 | 31.0 | 742 | Yes | No | 0.00 | 0.00 | No | No |
| -0:08 | 27.0 | 641 | Yes | No | 0.00 | 0.00 | No | No |
| -0:07 | 22.5 | 535 | Yes | No | 86.00 | 0.00 | No | No |
| -0:06 | 17.5 | 602 | Yes | Yes | 17.00 | 0.00 | No | No |
| -0:05 | 14.0 | 599 | Yes | Yes | 19.00 | 0.00 | No | No |
| -0:04 | 13.0 | 600 | No | Yes | 17.50 | 0.00 | No | No |
| -0:03 | 13.0 | 597 | Yes | Yes | 21.00 | 0.00 | No | No |
| -0:02 | 7.0 | 604 | Yes | Yes | 18.50 | 0.00 | No | No |
| -0:01 | 3.5 | 597 | Yes | Yes | 20.50 | 0.00 | No | No |
| -0:00 | 4.5 | 598 | Yes | Yes | 20.00 | 0.00 | No | No |
| -0:00 | 0.0 | 599 | Yes | Yes | 18.50 | 0.00 | No | No |



DDEC® Reports - Hard Brake #1

Print Date: Jun 15, 2011 04:14 PM (CDT)

Illinois State Police
 9511 W. Harrison
 Des Plaines, IL 60016
 (847) 294-4400

Trip: 09/24/05 10:51 AM (CST) to 06/15/11 (CST)
 Vehicle ID: STERLING
 Driver ID:
 Odometer: 910943.6 mi

Incident Time: 05/18/2011 11:33:10 (CST)

Incident Odometer: 910943.5 mi

| Time | Vehicle Speed (mph) | Engine Speed (rpm) | Brake | Clutch | Engine Load (%) | Throttle (%) | Cruise | Diagnostic Code |
|-------|------------------------|-----------------------|-------|--------|--------------------|-----------------|--------|--------------------|
| -0:20 | 60.0 | 1437 | No | No | 16.50 | 30.00 | No | No |
| -0:19 | 60.0 | 1439 | No | No | 32.00 | 46.00 | No | No |
| -0:18 | 60.0 | 1438 | No | No | 30.00 | 44.40 | No | No |
| -0:17 | 59.5 | 1431 | No | No | 13.00 | 22.40 | No | No |
| -0:16 | 59.5 | 1434 | No | No | 22.50 | 39.20 | No | No |
| -0:15 | 59.5 | 1433 | No | No | 40.50 | 50.80 | No | No |
| -0:14 | 60.0 | 1437 | No | No | 38.50 | 50.40 | No | No |
| -0:13 | 60.0 | 1439 | No | No | 34.50 | 48.00 | No | No |
| -0:12 | 60.0 | 1441 | No | No | 34.00 | 47.60 | No | No |
| -0:11 | 60.0 | 1443 | No | No | 35.50 | 48.80 | No | No |
| -0:10 | 60.5 | 1445 | No | No | 36.00 | 49.20 | No | No |
| -0:09 | 60.5 | 1453 | No | No | 36.00 | 49.20 | No | No |
| -0:08 | 60.5 | 1458 | No | No | 32.50 | 46.80 | No | No |
| -0:07 | 60.5 | 1455 | No | No | 16.50 | 30.00 | No | No |
| -0:06 | 60.5 | 1458 | No | No | 16.00 | 28.80 | No | No |
| -0:05 | 60.5 | 1455 | No | No | 15.50 | 28.00 | No | No |
| -0:04 | 60.5 | 1453 | No | No | 13.00 | 24.00 | No | No |
| -0:03 | 60.5 | 1448 | No | No | 12.00 | 22.00 | No | No |
| -0:02 | 60.5 | 1455 | No | No | 0.00 | 0.00 | No | No |
| -0:01 | 60.0 | 1441 | Yes | No | 0.00 | 0.00 | No | No |



QUESTIONS, COMMENTS?

DAVE KELTNER- ILLINOIS STATE POLICE

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DAVIDKELTNER5295@GMAIL.COM

(708)764-0021

