AUTOMOTIVE ENGINEERING CONSULTANTS, INC.

P.O. Box 7391 Ann Arbor, Michigan 48107-7391 734 994-0494 800 924-0494 www.automotive-engineers.com

August 22, 20__

Mr. _____
Attorney at Law
_____ & Associates
_____, Suite ___
_____, TX _____

Re: Style: _____.
Court: In the ___ Judicial District Court of Harris County, Texas.
Claim #: _____.
Subject: Preliminary report.
File No.: Ours. _____. Yours. _____.

Dear Mr. _____:

On February 19, 2005, at 7:36 p.m., after sunset, a collision occurred in the _____ block of Highway ___ approximately 500 feet south-east of the intersection with _____ Drive. The collision involved a 2000 Honda Civic driven by Mr. _____ ____ Z_____ and a 2000 International tractor-1992 Trailmaster trailer driven by Mr. _____ ___ K_____. Mr. Z_____ died as a result of the collision.

Your office asked me to investigate the circumstances of the collision. The following is my report.

CONTENTS

AUTHOR'S QUALIFICATIONS

The author's qualifications are found in his curriculum vitae located in the appendix beginning on page 21 of this report.

ABSTRACT

This report presents a distillation of data related to an auto/tractor-trailer collision that took place on February __, 200_, at 7:36 p.m., about an hour and twenty minutes after sunset, in the_____ block of Highway ___ in Harris County, Houston, Texas.

Documents examined in preparation of this report included: the Texas Peace Officers Accident Report; the Detail Report for Harris County Law Enforcement including narratives and vehicle data; one hundred fifty-nine 8 ½" x 11" color photographs of the accident scene and vehicles; the Texas Manual on Uniform Traffic Control Devices (TMUTCD); the Texas Drivers Handbook; the Texas Commercial Motor Vehicle Drivers Handbook; statements, deposition transcripts and interview transcriptions; a report of findings on the accident; a reconstruction report; and a reconstruction video.

The geometry of the highway at the location of the accident is described as well as weather and light conditions at the time of the accident.

The report describes the development of the collision through the movement of the southbound automobiles, including two vehicles racing, to the northbound tractor-trailer truck preparing to turn left across the southbound lanes of the highway. Excerpts of witness statements are included.

The analyses in the report include the possible speeds and stopping distances for the Honda automobile that collided with the trailer of the truck and are examined for 60 m.p.h., 90 m.p.h. and 120 m.p.h. The possibilities of each of the speeds being in the area of the pre-impact speed of the Honda are discussed. The speed and times for the truck crossing the highway lanes are developed. The relative maneuverability of the automobile and the tractor-trailer truck is described.

Selected photographs of the accident scene and accident vehicles are included for graphic description of the force of the collision.

The Honda automobile was traveling well in excess of the 55 m.p.h. speed limit prior to the collision and was traveling at approximately 60 m.p.h. at the point of impact. The driver of the Honda failed to control his vehicle in a manner so as to avoid a collision with the tractor-trailer making a turn in compliance with the law. The driver of the truck mis-judged the closing rate of the approaching automobiles due to their high speed in the night time lighting conditions.

The driver of the Honda died as a result of injuries sustained in the collision.

FACTUAL INFORMATION

1. DESCRIPTION OF THE ACCIDENT LOCATION

The police report states the accident occurred after sunset at 7:36 p.m. in Harris County in Houston, Texas, in the _____ block of Highway ___ at a point approximately 500 feet east of the intersection of Highway ___ with _____ Drive.

Highway ___ in this area is a seven-lane blacktop highway: three lanes in either traveled direction, with a turning median or a designated turn lane in the median area at various locations. The lanes are delineated by paint.

Highway ___ at this location is transitioning from a compass north-west/south-east heading to an east/west heading through a very large radius curve. The speed limit is 55 m.p.h. Two private driveways are located on the west side of Highway ___. The police report lists the surface condition as dry.

The police accident report lists the light condition as “Dark-Not Lighted”. The collision occurred approximately one hour and twenty minutes after sunset.

There was a nearly full moon above, 83% and waxing, with clouds varying from broken to overcast. Visibility in the area at the time was ten miles.

Figure 1, next page, is a schematic drawing of the accident scene from the Detail Report for Harris County Law Enforcement.

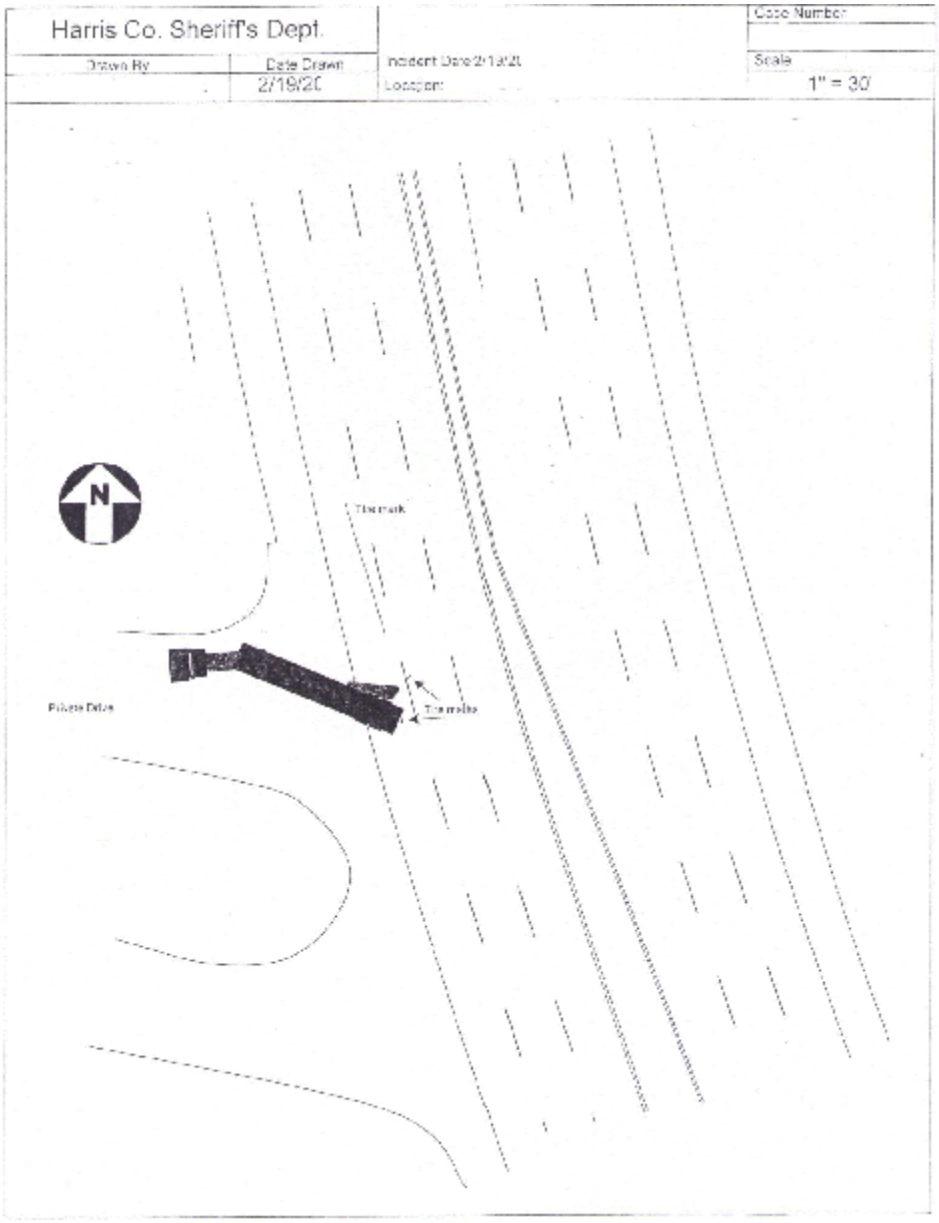


Figure 1

Schematic drawing of the accident scene.

THE VEHICLES INVOLVED IN THE ACCIDENT

2. Vehicle 1, the striking vehicle, was a 2000 Honda Civic two door hardtop, silver in color.

The police weight data show this vehicle to weigh, post accident, 1,650 pounds. These vehicles typically have a curb weight of up to 2,500 pounds.

Photograph 1 is a photo of the Honda Civic accident vehicle taken by the police.

Photograph 1.
2000 Honda Civic Coupe

3. Vehicle 2 was a 2000 International tractor and 1992 Trailmaster trailer.

Weight data on this unit provided to Deputy _____ by the _____ Company indicate the tractor to weigh 17,160 pounds and the trailer to weigh 14,100 pounds, empty.

Photograph 2 is of the 2000 International tractor and 1992 Trailmaster trailer accident vehicle.

Photograph 2.
2000 International tractor and 1992 Trailmaster trailer

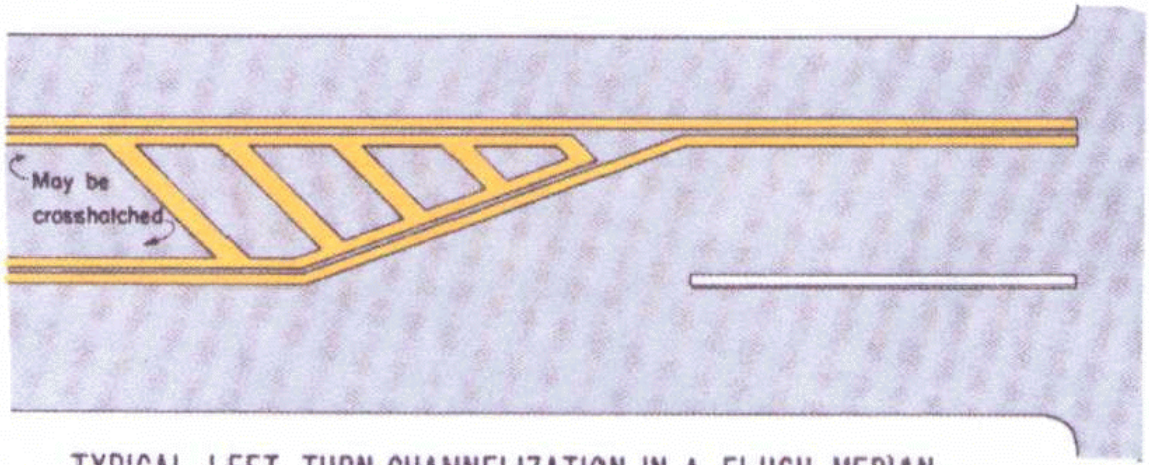
ADDITIONAL INFORMATION

4. TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD)

3B-10.1 Left-Turn Channelization Markings

Pavement markings for left-turn channelization may be accomplished by the use of paint, thermoplastic, traffic buttons or jiggle bar tiles. The choice of material will usually depend upon several conditions such as location, traffic volumes, maintenance and degree of crossing restriction desired.

When the channelization is intended to be non-restrictive and turns are permitted across it into or out of driveways, the pavement markings should be paint, thermoplastic or traffic buttons. When the channelization is intended to be restrictive and turns are discouraged or prohibited across it into or out of driveways, the pavement markings should be jiggle bar tiles. Channelization is formed by two double yellow lines when paint, thermoplastic or traffic buttons are used; however, when jiggle bar tiles are used, only single lines of tiles are required, since jiggle bar tiles simulate curbs.



TYPICAL LEFT-TURN CHANNELIZATION IN A FLUSH MEDIAN

TX 3B-14 (Rev. 1/83)

ANALYSIS

5. THE DEVELOPMENT OF THE COLLISION

The collision occurred about an hour and twenty minutes after sunset in the _____ block of Highway ___, approximately 500 feet south-east of the intersection with _____ Drive.

A southbound 2000 Honda Civic driven by Mr. _____ ____ Z_____, struck the rear trailer tandems of the 2000 International tractor-trailer driven by Mr. _____ ___ K_____ as the tractor-trailer was turning across the southbound lanes.

A witness stated that the Honda was racing another vehicle. Mr. Z_____ died as a result of the collision.

6. THE SOUTHBOUND AUTOMOBILES

The genesis of this wreck rests in the origins of the racing activities of the driver of vehicle 1, Mr. Z_____ in his silver Honda, and an unknown driver in a green vehicle referred to in witness _____ J_____'s deposition.

A couple of traffic lights or so north of the accident scene witness _____ J_____ was driving her automobile in a group of cars in the traffic. Ms. J_____ first saw the drivers of two vehicles engaged in an exchange and stated "they was taking off. And then they started to go faster.". . . "I know they was going more that 60." . . . "the race had began."

Ms. J_____ was behind the two vehicles as they zig-zagged through traffic and as she approached the location of the impending accident she stated, "I slowed down because I saw what was fixing to happen. And I wasn't fixing to get near it." . . . "I saw the whole accident." . . .

7. The sight lines approaching the accident scene exceed 2,500 feet, approximately a half mile. This sight distance was available to both the driver of the tractor-trailer truck looking north, before he turned, as well as the drivers of the approaching southbound automobiles going towards the turning truck.

8. THE NORTHBOUND TURNING TRUCK

Truck driver Mr. _____ K_____ approached the accident scene from the south. The roadway was divided by a double yellow line and hash marks between.

Mr. K_____ was preparing to turn left across the three lanes of highway to enter a driveway to a gas station, a legal maneuver. He saw the oncoming traffic and judged he had clearance to make the turn. He thought the cars were "over a quarter of a mile" away.

9. A driver judges the distance of an oncoming vehicle at night by the separation of the headlights and the speed of the vehicle by the rate of spread of the separation of the headlights as the vehicle approaches.

In the night, a vehicle's headlights far away provide distance information first and speed information second. Speed information develops as the vehicle approaches and the headlights appear to spread. The faster the lights spread, the faster the vehicle is moving.

The truck had its headlights and marker lights on and a long length of highly reflective conspicuity tape along the length of the side of the trailer. The conspicuity tape can be seen in photograph 3, page 16.

The highway in this area is not lighted. There was a nearly full moon (83%) above with clouds in the sky. The moon was two hours short of being directly overhead.

The front of Mr. K_____'s tractor was across the roadway and entering the driveway of the gas station when he saw "two sets of lights coming at me at a high rate of speed at that point." The rear of the trailer was in the middle lane or the outside lane when struck by the Honda. See Figure 1, page 6 and accident photograph 3, page 16 for the location of the two vehicles at rest.

10. The turning time for the tractor trailer to cross and completely clear the southbound lanes would have been approximately 7.7 seconds at a speed of about 10 m.p.h. It takes approximately 2.3 seconds for the front bumper of the truck to cross the first lane, 3.1 seconds to cross the first two lanes and 4 seconds to cross all three lanes. The length of the trailer follows, completely clearing the southbound lanes in 7.7 seconds.

This would indicate a crossing time to impact of approximately 6.2 seconds. Plus the time for the approximate 10 feet to the end of the trailer to clear the last 12 feet of lane, about an additional 22 feet, at 10 m.p.h. (14.67 ft/sec) for about 1.5 seconds additional to clear for a total of 7.7 seconds.

11. THE APPROACHING Z_____ HONDA AND ITS SPEED

Considering three separate situations of the approaching Z_____ Honda traveling at speeds of 60 m.p.h., 90 m.p.h. and 120 m.p.h. and examining the time and distances available for the driver to avoid a collision by taking evasive maneuvers such as emergency braking or changing of lanes:

CALCULATIONS FOR VARIOUS SPEED / STOP DISTANCES FOR HONDA.

Time *(t)* to collision for Honda with truck when a quarter mile away (1,320 ft):

		t
At 60 mph	(88 ft/sec) =	15.0 secs
At 90 mph	(132 ft/sec) =	10.0 secs
At 120 mph	(176 ft/sec) =	7.5 secs

Distance *(d)* traveled by the Honda during the approximate 6.2 secs turning time of the truck to impact:

		d
At 60 mph	(88 ft/sec) =	546 ft
At 90 mph	(132 ft/sec) =	818 ft
At 120 mph	(176 ft/sec) =	1,091 ft

Distance *(d)* traveled by the Honda during the approximate 3.1 secs turning time of the truck to cross the second traffic lane, to the 2-1 lane divider:

		d
At 60 mph	(88 ft/sec) =	273 ft
At 90 mph	(132 ft/sec) =	409 ft
At 120 mph	(176 ft/sec) =	546 ft

Distance *(d)* traveled by the Honda during the approximate 2.3 secs turning time of the truck to cross the first traffic lane, to the 3-2 lane divider:

		d
At 60 mph	(88 ft/sec) =	202 ft
At 90 mph	(132 ft/sec) =	304 ft
At 120 mph	(176 ft/sec) =	405 ft

Stopping distance *(d)* and stopping time *(t)* for Honda at various speeds:

$d = v^2 / (2 \times 32.2 \times \mu)$ and $t = v / (32.2\ \mu)$ where $\mu = 0.75$ from the police drag test.

		d	*t*
At 60 mph (88 ft/sec)	=	160 ft	3.64 secs
At 90 mph (132 ft/sec)	=	361 ft	5.47 secs
At 120 mph (176 ft/sec)	=	641 ft	7.29 secs

12. The Honda at 60 mph.

The tractor-trailer truck took approximately 6.2 seconds to cross the roadway to the point where the Honda collided with its trailer's rear tandems.

At 60 m.p.h.(88 ft/sec), the Honda would have been 546 feet north of the truck when the truck began its turn.

_____ intersection is about 300 feet north of the point of impact. At 60 m.p.h., that would place the Honda about 246 feet north of the intersection when the truck began to turn.

At 60 mph, the Honda driver could have noticed the truck beginning to cross the road ahead and safely delayed braking until as late as when the front bumper of the truck crossed beyond all three lanes and still stopped safely, by beginning braking 160 feet short of the truck, avoiding the impact with the trailer rear tandems completely. That would have allowed Mr. Z_____ to delay braking action for 386 feet and 4.4 seconds after the truck began its turn.

If Mr. Z_____ were traveling 60 mph (88 ft/sec) he could have avoided the collision at any time up to two seconds before impact by braking fully and bringing his vehicle to a complete stop in the roadway.

He could also have avoided the collision in the last two seconds by steering left and crossing the one lane to his left and into the outside lane (lane 3). That two lane change could be accomplished in two seconds as a quick lane change or less than two seconds as an emergency maneuver.

Any combination of emergency braking and emergency steering by the driver of the Honda would have avoided the collision in the last two seconds before impact, traveling at 60 m.p.h.

For this accident to have happened at 60 m.p.h, the driver of the Honda would have had to take no evasive action; no braking or steering, just simply driving forward nearly to the point of impact.

The Honda at 90 mph.

The tractor-trailer truck took approximately 6.2 seconds to cross the roadway to the point where the Honda collided with its trailer's rear tandems.

At 90 m.p.h. (132 ft/sec) the Honda would have been 818 feet north of the truck when the truck began its turn.

_____ intersection is about 300 feet north of the point of impact. At 90 m.p.h., that would place the Honda a little over 518 feet north of the intersection when the truck began to turn.

At 90 mph, the Honda driver could have noticed the truck beginning to cross the road ahead and safely delayed braking until as late as when the front bumper of the truck had crossed two lanes of the roadway and still stopped safely, by beginning braking 361 feet short of the truck and avoiding the impact with the trailer rear tandems completely. That would have allowed Mr. Z_____ to delay braking action for about 457 feet and 3.5 seconds after the truck began its turn.

If Mr. Z_____ were traveling 90 mph he could have avoided the collision at any time up to three seconds before impact by braking fully and bringing his vehicle to a complete stop in the roadway.

He could also have avoided the collision in the last three seconds by steering left and crossing the one lane to his left and into the outside lane (lane 3). That two lane change could be accomplished in three seconds as a quick lane change or in less than two seconds as an emergency maneuver.

Any combination of emergency braking and emergency steering by the driver of the Honda at 90 m.p.h. would have avoided the collision in the last three seconds before impact.

For this accident to have happened at 90 m.p.h, the driver of the Honda would have had to have taken no evasive braking or steering, for about 4.7 seconds after the truck began its turn and approximately 200 feet before impact.

At that point he could only have slowed down to about 60 m.p.h. by impact. There was still time to make an emergency lane change if the lane next to the Honda were open.

13. The Honda at 120 mph, approximately the top speed of the Honda.

The tractor-trailer truck took approximately 6.2 seconds to cross the roadway to the point where the Honda collided with its trailer's rear tandems.

At 120 mph (176 ft/sec) and 6.2 seconds prior to impact and as the truck began to cross the road, the Honda would be about 1,091 feet north of the truck.

It is unlikely a driver at 120 m.p.h. would immediately notice the truck beginning its turn some distance away with the truck positioned in the oncoming lanes on the other side of the double yellow lines.

At 2.3 seconds into the truck's turning across the road the truck's front bumper would be crossing the 3-2 dashed white line markings and 3.9 seconds prior to impact. The Honda would be about 686 feet north of the truck.

At the point of the truck's front bumper crossing the second lane 2-1 dashed white line markings the position of the 120 mph Honda would be about 545 feet north of the truck.

The crossing of the road by the truck would be noticeable at this point if Mr. Z_____ were looking at the truck. Stopping is no longer possible as 641 feet are required to stop at 120 m.p.h.. At 120 m.p.h. approximately 481 feet are required to slow the vehicle to 60 m.p.h.

14. MANEUVERABILITY OF THE HONDA VS. TRACTOR-TRAILER TRUCK

In these developing situations the Honda automobile has high maneuverability and the tractor trailer has low maneuverability.

The short wheelbase Honda can execute a lane change avoidance maneuver rapidly with a small steering input and decrease speed drastically with emergency braking, to avoid the truck.

The truck cannot quickly make a speed change avoidance maneuver as it is slow to accelerate and has the long length of both the tractor and the trailer to move forward.

The truck cannot make a steering maneuver to avoid collision as it is presenting itself broadside and would take a far greater amount of distance and time to turn clear by turning than the time and distance required to accelerate forward and clear the roadway.

15. ACCIDENT SCENE PHOTOGRAPHS

Photograph 3 shows the accident vehicles in their final rest positions after the collision. Red and white conspicuity tape is visible along the length of the side of the trailer.

Photograph 3
The tractor-trailer truck with the Honda coupe against the trailer tandems.

Photograph 4 is of the Honda coupe in its final rest position, wedged against the trailer's tandem wheels and under the trailer tank.

The right side sheet metal of the Honda is torn and wrapped forward of the trailer's dual tires. This shows that the Honda impacted the truck at a high rate of speed and penetrated the area of the truck. The truck did not impact and penetrate the Honda.

Photograph 4
Honda coupe against trailer tandems and under the tank trailer.

OBSERVATIONS AND CONCLUSIONS

16. The Z_____ Honda was south-bound at a high rate of speed in excess of the 55 m.p.h. speed limit, prior to the collision with the tractor trailer unit.

The impact of the Honda with the truck was so severe as to damage virtually every body panel on the Honda, including the panels on the side of the vehicle opposite the point of impact. The induced damage throughout the vehicle was extreme.

The damage to the Honda was such that, when asked to reconstruct the crash, Deputy _. _____ opined that it "would not be appropriate."

The impact of the Honda to the trailer moved the trailer tandem 12 inches, requiring a considerable energy transfer from the lightweight automobile to the relatively heavy trailer.

Based on the damage to the Honda and the tractor-trailer truck the impact speed on the Honda was at least in the 60 m.p.h. range.

17. The driver of the Honda would have had ample opportunity at a speed of 60 m.p.h. to see the truck moving across the road ahead and to evade collision by simply stopping in the road, changing lanes or a combination of the two.

The driver of the Honda would have had sufficient opportunity at a speed of 90 m.p.h. to see the truck moving across the road ahead and to evade collision by stopping in the road or changing lanes.

The driver of the Honda would have had little opportunity at speeds approaching 120 m.p.h. to see the truck moving across the road ahead and to evade collision by stopping in the road or changing lanes.

Based on the relative ease of successful evasive maneuvers by the Honda in the 60 m.p.h. range and the declining possibility of successful evasive maneuvers by the Honda as its speed approached 90 m.p.h. and beyond; the physical damage to the Honda; and witness testimony: the pre-impact speed of the Honda was well in excess of 60 m.p.h. and likely in the 90 m.p.h range.

Mr. Z_____, the driver of the Honda, failed to control his vehicle in a manner to avoid a collision with the truck crossing the southbound portion of the roadway.

18. The truck made a turn in compliance with the law by crossing the double yellow lines and yellow channelization diagonal line markings and south-bound lanes of the highway, to enter the private driveway across the road.

The truck driver mis-judged the speed of the oncoming Honda and its companion vehicle due to the high rate of speed of the two vehicles in the night-time lighting conditions.

There was no negligence on the part of the truck driver in this collision.

BASIS OF OPINIONS

In the course of my investigation, I examined the following documents:

1. Texas Peace Officers Accident Report by Deputy _____ _____, Jr.
    - A Voluntary Statement of witness _____ _____ J_____.
    - B. Voluntary Statement of truck driver _____ ___ K_____.
2. Detail Report for Harris County Law Enforcement.
    - A. Scene Summary Narrative.
    - B. Weight of Honda by Deputy _. _____.
    - C. Honda crush measurements by Deputy _. _____.
    - D. Supplement of Harris County Medical Examiner's Office.
    - E. Post accident interview with witness _____ _____ J_____.
    - D. Weight of the 2000 International truck and 1992 Trailmaster trailer.
    - E. Response to request for an accident reconstruction by Deputy _. _____.
    - F. Supplement Number 12 by Deputy _. _____.
    - G. Schematic Drawing of Accident Scene by Deputy _. _____.
3. One hundred fifty-nine 8 ½" x 11" color photographs of the accident scene and accident vehicles taken by police and others.
4. Texas Manual on Uniform Traffic Control Devices (TMUTCD), 2003.
5. Texas Manual on Uniform Traffic Control Devices (TMUTCD), 1983.
6. Texas Drivers Handbook, October 2004.
7. Texas Commercial Motor Vehicle Drivers Handbook, February 2004.
8. U.S. Naval Observatory Sun and Moon Data for Houston, Harris County for 19 February, 20__.
9. U.S. Department of Commerce NO&AA Climatological Data, G Bush Intercontinental AP/Houston 19/02/20__.
10. Transcribed telephone interview with witness _____ J_____.
11. Deposition transcript and exhibits of witness _____ J_____.
12. Deposition transcript and exhibits of truck driver _____ ___ K_____.
13. Report of Findings by _____ _. _____, P.E. of the _____ Group.
14. Reconstruction Report by _____ _. _____ of ___ _____.
15. Reconstruction Video of ___ _____.
16. Vehicle Data - EDCRASH, _____ _____ _____.
17. _____ _____ _____ Corp. Data Sheet on the accident truck.

Of my own work product:

18. Color maps of the accident scene and area by De Lorme.
19. Satellite views of the accident scene and area by Google.

APPENDIX

Donald B. H. Jeffers, P.E. Curriculum vitae

A graduate of the University of Michigan with experience in the automotive, aerospace and chemical industries, Mr. Jeffers has a broad background in the design and failure analysis of transportation vehicles and industrial machinery.

Mr. Jeffers is a strong practical engineer with a scientific background. His hands-on experience ranges from research, design and development to manufacture, testing and the solution of machinery problems in the field. He is a versatile professional with skills in the mechanical, structural, electrical and aerodynamic areas. An expert diagnostician and accomplished mechanic, he thoroughly understands procedures used by field service personnel. His specialties are automotive engineering and industrial machinery.

His vehicular product liability and accident reconstruction experience includes trucks ranging from small pickups to multiple unit tractor-trailers; automobiles including sports cars, sedans, station wagons and sport utility vehicles; bicycles, motorcycles, all terrain vehicles, motorhomes, recreational vehicles, buses, farm machinery, skidders, self-propelled cranes, trains, pleasure boats, deep water boats, light aircraft and pre- and post accident fire. Mr. Jeffers' expertise in vehicle systems allows for the precise determination of systems failure and accident causative elements.

Mr. Jeffers completed his basic engineering studies at the University of Texas in Austin and went on to the University of Michigan at Ann Arbor for specialized studies and research in automotive engineering, internal combustion engines, machine design and aerospace structures.

EDUCATION AND PROFESSIONAL ASSOCIATIONS

The University of Michigan	MSE (Mechanical Engineering) 1976	Shell Fellow
The University of Michigan	BSE (Mechanical Engineering) 1974	cum laude

Member of the Society of Automotive Engineers.

Licensed Professional Engineer in the States of Michigan and Texas.

EMPLOYMENT HISTORY

Omitted from this exemplar report. Contact our office for a complete c.v.

DONALD B. H. JEFFERS, P.E.
AUTOMOTIVE ENGINEERING CONSULTANT

PROFESSIONAL EXPERIENCE

Omitted from this exemplar report. Contact our office for a complete c.v.

DONALD B. H. JEFFERS, P.E.
AUTOMOTIVE ENGINEERING CONSULTANT

PROFESSIONAL EXPERIENCE

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MACHINERY EXPERIENCE

AUTOMOTIVE

All systems and components including brakes, tires, wheels, suspension, steering; hydraulic systems; vehicle computer controls including anti-skid braking, electronic fuel injection, electronic ignition, cruise control; electrical, lighting; air bags, seats, seat belts, supplemental restraint systems; diesel and spark ignition engines, manual and automatic transmissions, differentials; engine and chassis dynamometer testing, emissions testing; fuel tanks, crash-worthiness, automotive structures, chassis development, hybrid automobiles, articulated vehicles and the construction of unique vehicles.

INDUSTRIAL

Steam and gas turbines; centrifugal, reciprocating, hyper-reciprocating, rotary, and diaphragm compressors; axial, centrifugal, vane, and roots blowers; vibration and control systems, lube/seal oil systems, hydraulic systems, pumps, gearboxes, large and small electric motors and generators, blenders, extruders, packers, belt and screw conveyors, cranes, hammer mills, heat exchangers, chillers, cooling towers, HVAC systems, elevators, deep space vacuum systems, clean rooms, medical prostheses, sea going barges; plant emissions systems, bag houses, electrostatic scrubbers, and others.

EDUCATION ABSTRACT

BRIEF DESCRIPTION OF GRADUATE DEGREE WORK: Vehicle Dynamics; Automotive Chassis Design; Internal Combustion Engines; Aerospace Structures (Statics and Dynamics of Monocoques, Beams, Plates, Composites, Elastic and Plastic Deformation, Creep, and Visco-elasticity); Stress, Strain, and Fatigue Considerations in Design; Dynamics of Mechanical Systems; Machine Design; Advanced Thermodynamics; Fourier Series; Matrix Algebra.

GRADUATE RESEARCH: Modeling by Semi-monocoque Methods; Stress Analysis, Dynamic Considerations and Design Optimization of a Composite Automotive Chassis Structure.

SUBSIDIARY SUBJECTS: Studies in Automotive Engineering and Aerospace Structures focusing on Engine Design, Chassis Design and Vehicle Structures with undergraduate courses in Automotive Engineering, Vehicle Dynamics, Internal Combustion Engines, Machine Design, Aerodynamics, Structural Mechanics, Materials Sciences and Manufacturing Processes.

ELECTRICAL-COMPUTER ENGINEERING: Included circuit analysis, logic circuitry, electro-mechanical devices, instrumentation, and automatic control.

DIRECTED STUDIES: The Effects of Combustion By-products and Noise on Plant and Animal Life from the Medical, Natural Science, and Legal Perspectives; Similitude in Machinery and Nature; Reciprocating Crank Train Dynamics; Centrifugal-Axial Compressor Flow and Surge.

PROFESSIONAL DEVELOPMENT COURSES: Roadway Engineering Concepts - Texas A & M University; Rotor Bearing Dynamics of Turbo Machinery - University of Virginia; Rotor Characterization, Balance and Spectrum Analysis - Hewlett Packard; Rotating Machinery Symposium - West Virginia University.

CONTINUING EDUCATION COURSES: Hybrid Vehicle Technologies; Biofuels, Compressed Natural Gas (CNG) and Liquified Petroleum Gas (LPG) as Alternative Energy Fuels, Combustion; Diesel Engines; Batteries, Fuel Cells, Photovoltaics, Solar Power, New Energy for the Future; Matter, Energy and Electricity; Electrical Science, Fiberoptics; Structure of Metals; Materials Science; Electrochemistry of Corrosion; Unique Properties of Water; Procedures for Failure Analysis; Types of Failure and Stress; Wear Failures; Fatigue Failure; Ductile and Brittle Fractures; Failures of Shafts and Bearings; Failures of Gears; Thermal Shock; Brittle Fracture; Failure of Cast and Wrought Metals; Failures of Welded, Brazed and Soldered Joints; Lubricating Oils.

This report is based on the information made available to me at this time. Should additional information become available, I reserve the right to determine the effect, if any, of the new information on my opinions and conclusions, and to revise my opinions and conclusions if necessary and warranted by the discovery of additional information.

Should you have any questions or require additional assistance, please do not hesitate to call.

Sincerely,

P.E. Seal

Donald B. H. Jeffers, P.E. RPT16937._____