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Judge Hollis Hill
Trial Date: 06-11-12

CASE NUMBER: 10-2-20999-9 KNT

IN THE SUPERIOR COURT OF WASHINGTON FOR KING COUNTY

JAMES H. OSBORNE and DIANE B. OSBORNE, husband and wife, KEVIN S. OSBORNE, a single person, and DIANE B. OSBORNE, as Guardian ad Litem for the minor child A.R.O.,

Plaintiffs,

v.

RECREATIONAL EQUIPMENT, INC., d/b/a REI, a Washington corporation,

Defendants.

NO. 10-2-20999-9 KNT

DECLARATION OF RICK JAMES, Dr. Eng., MS

I, Rick James, do declare as follows: I am over the age of 18 years, competent to testify, arid make this declaration upon my personal knowledge.

1. I am the Vice President of Consulting Services for the SimuTech Group-Seattle which primarily consults with industrial manufacturers and performs Finite Element Analysis (hereafter FEA) used to design and test new products or refinement of existing products.

2. I have a Dr.Eng., and BS and MS in Mechanical Engineering. Attached as EX. 1 is a true and accurate copy of my CV which is incorporated herein as if fully set

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forth. My CV describes my experience and expertise. I mentor and teach engineers on the use of computer software used to perform FEA.

3. I supervised and participated in the development of a Finite Element Analysis (hereafter FEA) of the James Osborne June 14, 2007, Novara Team Trionfo bicycle failure. The FEA of this bicycle is a three dimensional mathematical computer model of the bicycle geometry, tubing dimensions, and physical properties of the main triangle frame which failed. The computer model has programed within it the laws of physics including motion and energy equations. The FEA investigates the physics of failure of the bicycle frame by subjecting the frame to the forces and energy derived from sudden deceleration substantially equivalent to a stick catching in the front wheel obstructed the front wheel's rotation causing skidding. Attached as EX. 2 hereto and incorporated herein as if fully set forth is a true and accurate copy of the FEA simulation. The FEA that SimuTech and I developed in this case used engineering principles, methods, laws of physics, and computer programs generally accepted as valid and reliable by the engineering professional specialists in the field of Finite Element Analysis. These generally accepted engineering principles, methods, laws of physics, and computer programs are described below.

4. The three dimensional geometry and dimensions where created from actual measurements of the main triangle frame by Dr. Jacobson and by SimuTech Fung and from a Fung Tien Electric Co. blue print attached hereto as EX. 3 and the use of SOLIDWORKS[1] a generally accepted Computer Aided Design software. The bicycle frame was reduced to finite elements (mesh) using ANSYS software a generally

[1] Defendant REI's expert engineer Patrick Logan used the software program SOLIDWORKS in his FEA.

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accepted software for this purpose. The computer model of the bicycle was subjected to simulated forces and energy from sudden deceleration of the bicycle from obstructed front wheel rotation derived from a computer input (LS-DYNA) used to mimic the effect of a stick caught between a spoke and front wheel forks arresting wheel rotation. LS-DYNA is the physics software generally accepted by FEA engineers as an industry standard for this purpose. Attached as EX. 4 is a diagram of a representative bicycle with names for the bicycle parts.

5. In summary the FEA of the Team Trionfo bicycle frame shows that within 20 milliseconds following the obstructed rotation of the front wheel the main triangle frame of the bicycle suffers a catastrophic structural frame failure. Before the frame so fails the rear bicycle wheel slightly elevates off the ground. Any further acceleration of the rear wheel upward ceases with the separation of the front wheel, forks, head tube and handle bars. There is no longer an intact bicycle frame.

6. Another FEA model used the Fung Tien Electric Company design specifications for the main triangle frame tube thicknesses. The frame failed at the same places as the previous FEA model and actual Osborne frames failed. Therefore, the FEA models independently predict the same frame failure locations as actually sustained by the Osborne bicycle as well as the Ashmore bicycle. There are two additional bicycles with catastrophic structural frame failures with similar frame fractures as Osborne and Ashmore, namely Larson and an unidentified bicycle owner. These fractured frames are consistent with my FEA.

7. Patrick Logan performed a defense FEA for this case for the Defendant REI. Mr. Logan's deposition was taken and among the materials he produced was a

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2005 Columbus Tube Set catalog advertising main frames with various dimension tubes. I ran the Osborne FEA using the following tube thickness dimensions (only) from the 2005 Columbus Tube Set catalog with AN6 material properties. The first measurement is in millimeters closest to the head tube:

Down tube 1.9 1.0 1.3

Top Tube 1.4 0.8 1.3

Seat Tube same as the Team Trionfo design specifications.

I sought to find a new set of thicknesses to attempt to find a collection of industry-standard thicknesses (all else being equal) that would possibly survive the impact from the stick in the spokes. I chose some tube sets from the 2005 Columbus Tube Set, and used the AN6 material properties since it was called out on the manufacturing drawings as the material property for the frame. With these new slightly thicker tubes, the bicycle main frame did not fail and the main frame stayed intact.

8. Mr. Logan used software for his FEA which must be bought to do a full review of his work. LS-DYNA used in the Osborne FEA has free viewer software which may be downloaded from the internet.

9. The Declaration of Jeffrey P. Broker, Ph.D., dated March 13th, 2012, makes a number of critical comments regarding the Osborne FEA without offering a countervailing FEA or quantitative analysis to show that these criticisms are in fact significant.

10. Dr. Broker states that "[b]ased on the damage to the Osborne bicycle, the accident clearly initiated as a pitch-over event." Declaration of Jeffrey P. Broker, Ph.D. (hereafter Broker Dec.), page 3, lines 21-22. Dr. Broker is correct in-so-far as within the

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first approximately 20 milliseconds (1/50 of a second) from when the front wheel rotation is stopped by a stick caught within the front wheel spokes and fork, the FEA of this event shows that the back tire of the Osborne bicycle compresses very slightly, then starts to elevate from the pavement by an insignificant amount. By 300 milliseconds (20 times longer than it took to fracture the frame), the rear tire has risen by just under 2 inches and is no longer rising. The frame suffers a catastrophic structural failure within the first approximate 20 milliseconds of this event. In between the upward movement of the rear tire and the catastrophic frame failure, the spoke breaks from the rotational force of the wheel pushing a spoke into a stick positioned between the spoke and front wheel forks. The energy acting upon the spoke also comes from the linear motion of the bike and rider. The FEA and the physical evidence of Mr. Osborne's broken frame show that after approximately 20 milliseconds, the front wheel, fork, head tube, handle bars and a small portion of the front part of the bicycle's main triangle frame fracture into separate pieces away from the rear part of the bike, which is no longer structurally connected. Therefore, no classically defined pitch over is possible.

11. From the point in time when the frame catastrophically fractures, no pitch over occurs where "Mr. Osborne and his bicycle rotat[e] rapidly forward about the front wheel/ground contact point." Broker Dec. page 3, line 25. Since the front wheel is not structurally connected after approximately 20ms, there is no intact bicycle frame to rotate about the front wheel. Therefore, Dr. Broker's criticism is without significance.

12. Dr. Broker opines that "[t]he simulation ignores basic laws of physics in that it fails to account for the interactions between the rider and the bicycle in developing forces and counter-forces that eventually caused the frame to fail." Broker

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Dec. page 4, lines 10-12. Dr. Broker is in error to imply that the FEA model does not account for interaction between the rider and bicycle. The lack of visual movement of the rider with respect to the bicycle is limited by the 20 milliseconds it takes for the catastrophic structural failure of the frame. Mr. Osborne's feet at the time of his injury were clipped into the pedals and were in a sense fixed to the pedals. Mr. Osborne's hands were grasping the handle bars and the FEA model programed a 44 pound per hand force by using a mathematical limit before the hands are released from the handlebars, as can be seen in the animations provided where the hands do eventually release from the handlebars. The pelvis was similarly constrained to the seat by 100kg in the horizontal direction and 200kg in the vertical direction on the seat and is then free to move after either of these loads is exceeded. The LS-Dyna computer program applied the physics to this model with the forward motion of the bicycle and effects of a stick stopping front wheel rotation. The complete laws of Newtonian physics are programed into the LS-Dyna computer program. I am familiar with and have confirmed that the proper equations of motion and energy are programed into LS-Dyna software. I teach and mentor engineers who seek expertise to effectively use LS-Dyna. I train users of ANSYS software. ANSYS is one of the largest FEA software companies in the world. ANSYS mathematically models the frame by using representative frame elements (mesh) for purposes of FEA. The FEA I used employed—not ignored—the basic laws of physics significant to determining the physics of failure of this bicycle main triangle frame. The FEA I employed is recognized by the engineering profession as an industry standard used for product development and the "virtual prototyping" for many industrial

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and consumer products in the Automotive, Electronics, Nuclear, and many other industries.

13. Dr. Broker is correct that within the first approximate 20 milliseconds time period motion of the rider forward or backward will increase or decrease the peak stress on the bicycle frame. The exact location of Mr. Osborne on the bicycle seat is not significant to these FEA conclusions given that the time involved in this event is approximately 20 milliseconds for catastrophic frame structural failure. Mr. Osborne moves no more than 0.16 inches relative to the actual bicycle seat within the time it takes to fracture the frame. This is an insignificant amount of movement on my conclusions and is within any reasonable about of uncertainty about where Mr. Osborne actually was sitting on his seat at the time of the accident. Dr. Broker omits the fact that the FEA shows that the peak stress on the frame far exceeds the minimum stress necessary to cause frame (aluminum material) failure. Therefore the post-impact or post-failure movement of the rider does not significantly affect the frame failure for this specific case (accident reconstruction).

14. Dr. Broker suggests that the "[f]orward motion of the rider ... across the saddle and towards the handlebars ...shifts the center of mass of the rider forward over the bike—into a more unstable position." Broker Dec. page 4, lines 15-18. After the approximately first 20 milliseconds of this event, the forward movement of the rider is associated with a frame without a structurally connected front wheel. Dr. Broker states that "Dr. James' failure to account for this motion is a major mistake." Broker Dec. page4, lines 21-22. The forward movement does not change the outcome of my FEA

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because the stress necessary to fail the frame catastrophically was reached without any movement of the rider.

15. The FEA model did not use the effects of human actuated front wheel braking to stop the front wheel rotation as contended by Dr. Broker. Broker Dec. page 4, lines 23-24. The FEA modeled the effects of a stick immediately stopping front wheel rotation when a spoke comes into contract with the stick equivalent at the front wheel forks. This is not the equivalent of a gradual human application of the front wheel brakes but was instantaneous.

16. Dr. Broker infers that I did not know the external forces acting upon the bicycle. Broker Dec. page 5, lines 6-7. The FEA model contains a measure of the vertical and normal forces acting on the bike through time. Rather than rely upon my memory in the deposition I referred to the FEA model. The FEA model's vertical peak force was approximately 1200 lbs and the peak frictional force (horizontal force at the contact patch of the front wheel) was approximately 750 lbs.

17. Dr. Broker states that "Dr. James' model does not predict pitch-over, counter to what is universally known." Broker Dec. page 5, lines 16-17. Dr. Broker uses the customary definition of a pitch over which is a "bicycle rotat[ing] rapidly forward about the front wheel/ground contact point." The FEA model does not predict a pitch over using Dr. Broker's customary definition for the simple reason that there is no customary frame to pitch over after approximately 20 milliseconds because the Osborne frame has suffered a catastrophic structural failure because it is too weak. Therefore Dr. Broker arrives at his "universally known" pitch-over statement by ignoring the timing

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of these physical events and assuming that the stick remains indefinitely stuck in the wheel.

18. Dr. Broker's opinions regarding pitch-over are not based upon theories that are generally accepted in the engineering community because Dr. Broker does not factor in time (duration of forces and stresses) into his calculation. It is a generally accepted and well-established principal that time is a required component of quantifying dynamic forces. Dynamic forces are forces which change over time (as opposed to, for example, static forces which remain constant over time). The Osborne bicycle failure clearly involves dynamic forces because the forces on the bicycle changed when a stick entered the spokes, when the stick caused a spoke to break, when the stick caused a second spoke to slightly bend, and yet again when the frame broke apart. It is not accepted methodology to completely disregard time as a factor when calculating dynamic forces as Dr. Broker has done. By failing to account for time (duration of forces) in calculating the purported pitch-over of Osborne's bicycle, Dr. Broker has failed to employ generally accepted scientific and engineering theories and has produced unreliable opinions.

19. In addition, Dr. Broker's opinions regarding pitch-over are unreliable because they are based upon flawed embedded assumptions. The most critical and fundamentally flawed assumptions made by Dr. Broker in his calculations are (1) in using an in-tact frame model and (2) ignoring the timing of the physical events. First, by opining that a pitch-over occurred in the Osborne bicycle failure, Dr. Broker presumes that the frame is strong enough to remain in-tact based upon his reliance on the classical definition of pitch-over as the rear wheel rotating over the front wheel fulcrum

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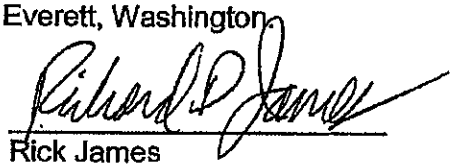
as described above. This assumption ignores the physics and description of the accident by the rider, Mr. Osborne himself, as well as the description of several other riders which describe that the bike separated underneath Mr. Osborne before his body left the bicycle. Second, Dr. Broker ignores the timing of these dynamic structural events. For example, the forces required to pitch over in the classical definition and also to fracture the frame are both directly dependent upon how fast a bike decelerates. These events both require that time be taken into account in order for any calculation or estimation of forces, deceleration, velocity, motion, or stresses. Therefore, since Dr. Broker ignores the time of physical events his criticisms of my assumptions and my work are without merit.

I certify and declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct:

Dated this 3rd day of May, 2012, Everett, Washington.



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