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KING COUNTY

SUPERIOR COURT CLERK

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CASE NUMBER: 10-2-20999-9 KNT

Judge Hollis Hill

Trial Date: 06-11-12

Noted for: 05-11-12

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.,<br><br>Plaintiffs,<br><br>v.<br><br>RECREATIONAL EQUIPMENT, INC., d/b/a REI, a Washington corporation,<br><br>Defendants. | NO. 10-2-20999-9 KNT<br><br>**DECLARATION OF JON O. JACOBSON, PhD, PE** |

I, Jon O. Jacobson, declare as follows:

1. I am over the age of 18 years, competent to testify, and make this declaration upon personal knowledge, depositions of eye witnesses to Mr. Osborne's June 14, 2007, injury when his REI bicycle failed, Defendant REI's produced documents, including but not limited to: A) blueprints, *see e.g., NO. 127, 127-A; B) frame failure investigation reports, excerpts of NOs. 106, 125 and 258 of Rider X and Ashmore incidents;* C) deposition transcripts of peloton riders Fitzpatrick, Brown, Zimmerman, Cannon, Brooks, Weiler, Nagode, Howlett, Leach, and, James Osborne, REI Speaking Agent and Fact Witness Gluckman, D) defendant's experts Bretting, Logan, Mitchell, and Broker, and their file materials including calculations; E) statement



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of James Osborne, NO. 29-A; F) broken frames of James Osborne, David Ashmore, Patricia Larson; G) exemplar Team Trionfo frame; H) exemplar 2005 Team Trionfo frame; I) photographs of the Larson, Ashmore, Osborne and Rider X frame failures; J) spoke testing data from Rainier Eckert, PhD, and, K) deposition testimony, file materials and calculations of Rick James, DrEng, and Ric Herjtberg.

2. I have a PhD and MS degree in Mechanical Engineering/Bioengineering and a BS in Mechanical Engineering. I am a licensed PE in the State of Washington and have been continuously since 1967. I have the approximate equivalent knowledge of a first year medical student from my graduate work and study of medicine as a part of my bioengineering background and experience. As a part of my forensic engineering I am experienced in Collision Analysis and Reconstruction including simulation of vehicle performance using: a) engineering physics and analytical computational methods; b) Bicycle Accident Reconstruction; c) Biomechanics of Injury, Engineering Design and Testing; and, d) Computer and Video Simulation. I also consult outside of litigation on industrial design problems and potential causes of machine failures. Attached as Ex. 1 is a true and correct copy of my CV which is incorporated by reference as if fully set forth.

3. I have been qualified and testified as an expert witness in state and federal courts at least 60 times.

4. I have reviewed an article written by the defendant's expert Gerald Bretting published in *SAE International* entitled: "**ANALYSIS OF BICYCLE PITCH-OVER IN A CONTROLLED ENVIRONMENT**" (April 12, 2010) (hereafter Bretting Experiment). The experiment arose out of his retention as an expert witness by the



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bicycle manufacturer TREK to defend against a lawsuit brought by Mr. Amesbury. Mr. Amesbury was a cyclist that was injured when his front wheel encountered a stick while riding. Mr. Amebury's bicycle frame did not catastrophically fail. Mr. Amesbury was thrown to the ground and seriously injured. I was retained by the plaintiff's attorney as a consultant expert witness in that case. In the materials that Mr. Bretting produced at his deposition in this case are high speed videos of his "dowel tests." In those tests Bretting attempted to initiate a pitch-over by using a device strapped to one fork of the bicycle and shooting an 11 inch dowel into the front wheel of a moving bicycle ridden by a stunt man. The dowel was intended to obstruct the wheel rotation and result in the skidding of the front tire. During the test, often the wheel spokes broke from the rotational force of the wheel pushing the spokes against the dowel positioned between the spokes and behind the front wheel fork blades. The linear motion of the bike and rider contributed to the force and energy breaking the spokes. Attached hereto as EX. 2 is a DVD which contains a true and correct excerpt from the Bretting Experiment high speed videotape showing this phenomenon, title "Spoke Failure No. 2."

5. The Bretting Experiment high speed video clearly shows in those cases when multiple spokes were broken when the first spoke breaks, the rear wheel of the bicycle slightly lifts off the ground (less than the width of the tire (one inch or less))which coincides with the skidding front tire. Then the rear wheel settles back towards the ground. After the spoke breaks and the front wheel is again free to rotate then the next set of spokes contacts the dowel. This sequence is replayed with at least four spokes eventually breaking when the test is done with a 10 pair spoke wheel. It is only when a



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spoke fails to break that the dowel stops the wheel rotation and cause the rider to pitch over in this controlled experiment.

6. Bretting's study shows that at approximately 350 milliseconds, the point of no return was reached. Average total time for the pitch-over was 700 milliseconds with the 10 pair spoke wheel. There is no report or description of the 7 pair spoke damage.

7. In reaching my opinions, I used engineering principles and methods; laws of physics; and, computer programs generally accepted as valid and reliable by the engineering profession. This includes equations of motion and energy generally accepted as valid and reliable by the engineering profession. Further, the conclusions I have reached from this methodology are the type of conclusions that are accepted and applied in industry to assess not only the suitability, durability, and safety of products, but also the root cause of product failures and accidents. For example, this type of analysis is relied upon by corporations producing aluminum products used in aircraft, trains, and bicycles; I have applied all of these methods and reached conclusions that have been relied upon by manufacturers of those aluminum products listed above as well as products using metal not exclusively aluminum. These engineering principles and methods, laws of physics, computer programs, equations of motion and energy are identified below and discussed.

8. I used the PC-Crash 9 analysis program for simulation of the initial dynamics of a bicycle in the pitch over sequence. I chose a motorcycle model to represent the phenomenon of the front wheel skidding and rear wheel lifting. The results obtained pursuant to this choice are identical to the bicycle model when the identical parameters representing a bicycle are used. When this was raised as an issue, I spoke



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to Brad Heinrichs of MEA which is the North American distributor of PC Crash software and he endorsed my election of themotorcycle model to simulate the motion of a bicycle. PC-Crash software is generally accepted by accident reconstruction engineers as a valid and reliable tool for analysis and reconstruction of vehicular accidents. A bicycle is a vheicle to the program. The bicycle software model of PC-Crash visually presents a bicycle without wheels for demonstrative purposes the bicycle depiction is too abstract for non-engineers, *See,* Ex. 3. I selected the PC-Crash motorcycle model with wheels and used bicycle parameters for the input variables. I further explain the choice of PC-Crash in paragraph 7, *infra*. My decision to use the motorcycle v. bicycle visual is also generally accepted by my profession. PC-Crash is based on a four wheel vehicle which the user modifies with inputs to represent a bicycle or motorcycle. There is no difference between the two vehicle models if the input variables are the same.

**BRETTING'S CRITICISMS**

9. Mr. Bretting criticizes my decision to use the motorcycle model in PC-Crash rather than the bicycle model. The software for PC-Crash for Motorcycles permits adjustment of parameters to duplicate a bicycle. For this case, I have run the same inputs for motorcycles on PC-Crash 9 bicycles side by side and have received the identical results. The two models are essentially the same model. However, the PC-Crash 9 bicycle model shows a geometric shape depicting the bicycle without wheels so I selected the more visually appropriate software and adjusted the inputs to reflect the bicycle. An example of the PC-Crash 9 images of a motorcycle and bicycle is attached as Ex. 3 for illustration of the visual differences. Both bicycles and motorcycles share common traits when adjusting for example, the center of mass, wheel base, and


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height, and when the same input variables are used, give identical results. This is a semantic argument. Mr. Bretting's comment is a distinction without a difference.

10. I ran many scenarios using the PC-Crash 9 (hereafter PC-Crash) with various inputs—from the extreme to the more conservative and realistic. I adjusted the suspension and made it stiff or more identical to a bicycle. The ABS feature on the motorcycle model and the bicycle model had no effect on the pitch over calculatio.

11. The purpose for running PC-Crash was, in part, to study the movement of the bicycle during a skid similar to the situation Mr. Osborne would have experienced if a stick obstructed the front wheel rotation. This event was modeled by having the front wheel develop instantaneous full braking. After numerous trials, runs and experiments using PC-Crash, the models showed the bicycle pitching forward with the rear wheel slightly lifting from the simulated breaking of the initial spoke. The simulation then showed the bicycle settle towards the ground after the spoke had broken. Just as is depicted in Mr. Bretting's video of the dowel insertion tests, Ex. 2.

12. If no other spoke was contacted, or the stick fell from the bicycle 's front wheel, the rear wheel will settle back to the ground after the spoke breaks. In PC-Crash the rear wheel slightly rises off the ground then settles back to the ground following the breaking of a spoke. This is corroborated and verified by the videotape of Mr. Bretting's own experiment. Mr. Bretting used high speed videotaping of pitch over experiments he performed and published. *See,* Ex. 4. In those experiments a dowel was shot through the front wheel spokes of a forward moving bicycle. The videotape shows the rear wheel slightly lifting when the dowel contacts the spoke of the front



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wheel and rotation of the rear wheel rises p then settles down towards the ground after the spoke broke. When the trailing spoke hits the dowel the rear wheel slightly lifts again from the ground then settles back towards the ground as the next spoke breaks. In the 10 pair spoke wheels, Bretting broke at least four spokes. The dowel used in the Bretting experiment is 11 inches long and one inch in diameter bounces around during the process of spoke striking and breaking. Mr. Bretting and Dr. Broker both rely on these experiments for their opinions in this case. The Finite Element Analysis (FEA) performed by Dr. James of SIMUTECH also shows this same phenomenon of the rear wheel slightly elevating. *See,* Ex. 2, Bretting Experiment video excerpt and Ex. 5, Dr. James FEA simulation animation summary.

13. At the time of my March 5, 2012 deposition, I had run PC-Crash scenarios using the following parameters which Mr. Bretting criticized in paragraph 3of his declaration, attached as Ex. 6; wheelbase 42"; distance of the center of gravity from the front of the bicycle 29.5"; and, center of gravity height from the ground 33".

14. However, I also used many other inputs over the course of at least 100 simulations, many of which I did not save. I have run Bretting's figures he claims for the Subject Bike and there was no significant difference in outcome from my results.

15. Mr. Bretting claims that by "us[ing] the appropriate distance for the center of gravity behind the front hub of the subject bicycle, his [Mr. Jacobson] PC-Crash simulation would have resulted in a pitch-over." Ex. 6 Bretting Declaration, ¶ 3.b. That is incorrect. Bretting says 22" is appropriate, I calculated 23.5" with Rick James. Using 22" does not change the result. .



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16. Mr. Bretting appears to use a skid time of 10 seconds. Ex. 7 shows Mr. Bretting's inputs produced at his deposition with the time highlighted in yellow. Timing is crucial as to whether there is sufficient time for the rear wheel to elevate off the ground and reach the point of pitch over. The Bretting video, Ex. 2, appears to show that skid time before the first spoke breaks is approximately .02 seconds, far shorter than the 10 seconds he used in the PC-Crash simulation. The appropriate skid time depends on the length of the time the stick obstructs the front wheel rotation before breaking the spoke. Mr. Bretting is inconsistent with his own experiment which shows multiple spokes breaking before initial of pitch-over. Only when the situation is reached where a spoke is unbroken, does the bicycle pitch over.

17. Mr. Bretting suggests that the PC-Crash model should use braking that results in a 3.6 g deceleration. There was no evidence given to support that this indeed was the deceleration that occurred during his tests. In his article, he states that he applied gaffers' tape to the road surface to achieve a coefficient of friction of approximately 1.0.

. Once again the duration of the force to develop and break spokes is critical to the model. The Bretting Experiment video demonstrates clearly the absence of pitch over with broken spokes. The 3.6 Gs suggested is unsupported by any calculations or analysis or testing.

**BROKER CRITICISMS**

18. Dr. Broker is critical of the inputs in Dr. James' FEA simulation and presumably the PC-Crash analysis. Dr. Broker did not run his own FEA simulations or



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PC-Crash analysis and does not say whether the input changes that he advances would significantly alter the outcomes of the FEA simulation or PC-Crash analysis. Dr. Broker has not analyzed the timing of the Osborne spoke breaking and skidding or the catastrophic frame collapse. These are critical and crucial elements of his opinions. Dr. Broker has no foundation for testifying that the skidding of the bicycle's front wheel is of long enough duration to induce a pitch over rather than the wheel settling back to ground as shown in the Bretting Experiment video and Dr. Jacobson's PC Crash analysis.

20. Dr. Broker criticizes the alleged use of a static rider in simulations explaining that "[i]t is the movement of the rider forward and loading of the wheel which is critical to the forces at play upon the wheel, spoke and frame." Declaration of Jeffrey P. Broker, page 5, lines 19-20. Contrary to Dr. Broker's claim he himself uses a static rider in a computer simulation of a pitch over in his book: CYCLING ACCIDNENT: BIOMECHANICS, ENGINEERING AND LEGAL ASPECTS (2006). Attached as Ex. 8 is page 60 (Page 113 is a duplicate of page 60) of Mr. Broker's book highlighted by me showing no movement of the rider (*i.e.,* static) during pitch over.

21. I have calculated the movement of an unrestrained rider of a bicycle with sudden deceleration similar to that experienced by Mr. Osborne on June 14, 2007, as he sat on the 9 – 10 inch long bicycle saddle. By employing engineering professionly accepted and valid equations of motion (attached as Ex. 9) the deceleration of a bike traveling originally at 24.6 MPH for the approximately 15 milliseconds that the spoke obstructs front wheel rotation before spoke breakage, moves the rider 0.035 inches forward on the bicycle saddle. The speed change of the bike caused by breakage of the


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spoke in this scenario is 0.26 MPH. These numbers are so low that the bicycle and Jamie do not perceptibly slow or change position. After the spoke breaking, Mr. Osborne testified that his feet were clipped into the bicycle pedals and he had a firm grip on the handle bars. This would constrain him to the bicycle. To opine otherwise would mean that a bicyclist would fall off his bike upon applying his bicycle brakes.

22. Dr. Broker's final claim is a conclusion without supporting analysis that Mr. Osborne could not ride out the deceleration of four spoke failures. In the Bretting Experiment tests 7, 8 and 12, f six spoke failures occured before pitch-over.

23. A breaking spoke snaps back towards the spoke's center and away from the top of the front bicycle forks. i have calculated the effect of breaking a spoke upon a stick obstructing front wheel rotation. When the spoke snaps it contracts from its stretched position and moves the stick down and away from the forks. Attached as Ex. 10 are my mathematical calculations which use valid and accepted engineering profession formulas for this purpose. With multiple spoke fractures and the inherent bouncing of the stick subject to the action and reaction forces described by f basic physics threshold was reached, ) It is probable that the stick would fall out of the front wheel before pitch over. Viewing the Bretting videos shows that the dowel drops and moves about in the interval after breaking the spoke and before contacting the following spoke. It is my opinion that the stick does not stay in a fixed position against the back of the fork blades after a spoke has broken.

24. Examination of the back of the right fork blade on the Osborne bicycle show definitive scratches that would support my opinion that the stick was probably



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dragged downward after the spoke fractured and would probably bounce out of or through the forks.

25. On a more probable than not basis, Mr. Osborne would have ridden through this event had the frame not catastrophically failed.

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

Dated at Seattle, Washington this 3rd day of May, 2012.

JON O. JACOBSON, PhD, PE

**CERTIFICATE OF SERVICE**

I certify under penalty of perjury under the laws of the State of Washington that I caused this pleading in the manner shown.

Via Efiling to:

King County Superior Court Clerk

Via Efiling to Judge Hollis Hill, King County Superior Court

and via ~~Legal Messenger~~ and Email to: hand delivery

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Dated: May 3, 2012.

By [signature]



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