IN THE SUPREME COURT OF BRITISH COLUMBIA

Citation: *More v. Bauer Nike Hockey Inc.,*
2010 BCSC 1395

Date: 20101001
Docket: 05-5004
Registry: Victoria

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Between:

Sucha More, Cindy More and
Darren More By his Litigation Guardian Sucha More

Plaintiffs

And:

Bauer Nike Hockey Inc., Bauer Hockey Corp.,
The Canadian Standards Association, and
The Emergency and Health Services Commission

Defendants

And:

Bauer Nike Hockey Inc., Nike Bauer Hockey Inc., Nike Bauer Hockey Corp.,
Sucha More, Cindy More, Corporation of the Township of Esquimalt,
Her Majesty the Queen in Right of the Province of British Columbia,
Emergency and Health Services Commission and
The British Columbia Ambulance Service

Third Parties

Before: The Honourable Mr. Justice Macaulay

Reasons for Judgment

Counsel for the Plaintiffs and Third Parties: Sucha More and Cindy More	J. A. Macaulay, Q.C., K. Affleck, Q.C. and P. W. R. Miller
Counsel for the Bauer Defendants and Third Parties:	V. R. K. Orchard, Q.C., L. Jackie, Q.C., S. Kerwin and L. Dineley

Counsel for the Defendant: Canadian Standards Association	M. D. Adlem and S. E. Foster
Counsel for the Third Party: Ministry of Attorney General	R. J. Meyer, J. D. Eastwood and C. Varden
Place and Dates of Trial:	Victoria, B.C. March 9-12, 2010; March 15-19, 2010; March 22-26, 2010; March 31, 2010; April 1, 2010; April 6-8, 2010; May 10-12, 2010; May 18-19, 2010; May 25-26, 2010; May 28 and 31, 2010; June 1-3, 2010; June 7, 2010; and June 14-16, 2010
Place and Date of Judgment:	Victoria, B.C. October 1, 2010

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[1] Darren More, now age 23, suffered a devastating brain injury playing organized ice hockey when he was 17. His accident occurred during a game on November 11, 2004, while he was playing for the Juan de Fuca Orcas, a AAA Midget team, at the Archie Browning Arena, a municipally owned rink in Esquimalt. Sucha More and Cindy More are respectively the father and mother of Darren.

[2] At the outset of the trial, all proceedings against Esquimalt were discontinued. Part way through the trial, all proceedings against Her Majesty the Queen in Right of the Province of British Columbia, the Emergency and Health Services Commission and the British Columbia Ambulance Service were also discontinued.

[3] The remaining defendants are Bauer Nike Hockey Inc. and Bauer Hockey Corp. (“Bauer”), the corporations responsible for the design and manufacture of the Bauer HH5000L hockey helmet that Darren was wearing at the time of his accident, as well as the Canadian Standards Association (“CSA”), the organization responsible, at the material time, for setting the minimum standards for impact resistance applicable to ice hockey helmets in Canada and for certifying helmets that meet the standard.

[4] All amateur hockey players playing organized hockey in Canada are required to wear a CSA approved helmet. Darren's helmet met or exceeded the applicable standard and was certified as such by the CSA.

[5] The remaining More claims are as follows:

> 15. Bauer at material times had a duty to consumers of HH5000L ice hockey helmets, including the Plaintiffs, to design, manufacture and distribute for sale only helmets that were adequate to provide protection to such consumers, including Darren More, from risk of serious head injury caused by foreseeable impacts by wearers of such helmets with the ice or boards at hockey arenas during ice hockey games.
>
> 16. Bauer knew, or ought to have known, at material times that, if it failed or neglected to carry out its duty referred to in paragraph 15 hereof, users of HH5000L helmets could suffer serious head injury.
>
> 17. Bauer breached its duty of care to the Plaintiffs and was negligent in the design and/or manufacture of Bauer HH5000L hockey helmets, including the Darren Helmet. Particulars of such negligence include, but are not limited to:
>
> a. Failing to design or manufacture a hockey helmet, including the Darren Helmet, that provided protection from serious head injury when used in ice hockey games;
>
> b. Failing to provide sufficiently effective liners or impact attenuation lining material for Bauer ice HH5000L hockey helmets, including the Darren Helmet, to provide such protection when the wearer of such a helmet collided with a hard object such as the boards surrounding the Archie Browning Sports Centre ice rink;
>
> c. Designing HH5000L and testing its ice hockey helmets, including the Darren Helmet, to meet CSA Standard criteria that it knew, or ought to have known, were inadequate to achieve protection from serious head injury;
>
> d. Manufacturing and distributing the Darren Helmet for sale that was inadequate to provide protection from serious head injury.
>
> …
>
> 21. At material times CSA knew, or ought to have known, that ice hockey helmet manufacturers, including Bauer, whose products were certified according to the 1990 Standard, designed such products to conform with the 1990 Standard, which CSA knew, or ought to have known, was inadequate.
>
> 22. CSA owed a duty to the Plaintiffs to develop, adopt and publish a standard for ice hockey helmets that would be adequate to provide protection to users of CSA certified helmets from risk of serious head injury, including the duty to adopt and publish sufficiently rigorous testing criteria having regard to the hazards that such users could foreseeably encounter during ice

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> hockey games, and further had a duty to certify and provide certification labels only for such ice hockey helmets as met the said sufficiently rigorous testing criteria.
>
> 23. CSA was negligent and was in breach of its said duty of care, particulars of such negligence include:
>
> a. Failing to adopt a standard for ice hockey helmets that would ensure protection to wearers of CSA certified ice hockey helmets from serious head injury;
>
> b. Failing to take any or any reasonable steps to develop and adopt a more rigorous standard for ice hockey helmets having regard to the hazards that ice hockey players could foreseeably encounter during ice hockey games;
>
> c. Issuing "Certified Hockey Helmet" labels to Bauer to be affixed on Bauer hockey helmets, including model HH5000L, when it knew, or ought to have known, that such labels would lead users, including the Plaintiffs, to believe that such helmets would protect users from the risk of serious head injury.
>
> 24. At material times Bauer, and other manufacturers of ice hockey helmets distributed in Canada, were active members of the CSA Technical Committee and participated in discussions and decisions regarding the content of the CSA hockey helmet standard and testing methods and criteria. As a consequence of these discussions and decisions Bauer knew or ought to have known of the inadequacies of the 1990 Standard.

[6] Of the various third party proceedings commenced by the defendants, only the claims as between Bauer and the CSA remain. By agreement of counsel, I am asked not to rule on those claims at this stage.

Organized ice hockey in Canada

[7] In Canada, ice hockey is so popular that it is sometimes referred to as “our game”. Ice hockey is fast, the action can go from end to end, seemingly in seconds. Experienced players skate fast, body check hard and shoot the puck at high speed. In part, because the game is played on ice, players may fall or collide with the boards surrounding the ice surface as a result of losing their balance or being body checked, or both.

[8] The popularity of the game is reflected in the number of players and the frequency of play. At the time of trial 600,000 players were registered with Hockey Canada. Dr. Charles Tator, a neurosurgeon with extensive experience dealing with

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catastrophic sports injuries, estimated that another 600,000 players are involved in unregistered hockey. The sheer number of games and practices in any given year in Canada is staggering evidence of the popularity of “our game”.

[9] For example, Darren began playing organized hockey when he was age 4. He played every season until age 17. In his last season, Darren was on a team that practiced at least once or twice per week and also played one or more games per week. Over the last few years before his accident, Darren also regularly attended power skating sessions, hockey camps, tryouts and tournaments.

[10] No witness estimated the number of times that Darren played full contact hockey but it must have been at least several hundred. His experience was typical for a competitive or Rep level player. Like all players of organized hockey in Canada, Darren was required to and did wear a CSA certified helmet and other protective equipment whenever he played the game.

[11] On the darker side, every ice hockey game is an opportunity for a serious injury to occur. Dealing specifically with head injuries, concussions are a serious risk in hockey. According to Dr. Tator there were about 25,000 concussions in the province of Ontario during the ten years ending in 1995. Within the same time frame, there were two subdural and one extradural hematomas.

[12] A subdural hematoma (SDH) is of particular importance in this case as Darren’s severe brain damage occurred when Darren suffered bleeding into the space between the dura, which covers the brain, and the brain itself. The ensuing SDH overlays almost the entire surface of the right cerebral hemisphere. Dr. Tator reviewed and described the CT scan taken at the hospital the day of Darren’s accident, as follows:

> There was a 6 mm thick subdural hematoma over the right cerebral hemisphere extending from the frontal to the occipital region and also extending along the falx. There was a shift of the midline structures to the left by about 5 mm. There was blurring of the grey-white interface diffusely. There was virtually no CSF [cerebral spinal fluid] surrounding the cerebral hemispheres or brainstem, and the ventricles were all small indicating raised intracranial pressure.

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In lay terms, the increased pressure associated with the presence of blood resulted in generalized brain swelling and some shifting and compressing of the brain down into the brain stem. The compression of the brain stem affects critical breathing and cardiovascular functions.

Darren the hockey player

[13] Several witnesses described Darren as a strong, fast skater. Two were particularly knowledgeable. Denise Bowles is a power skating instructor. She teaches skating to hockey players and taught Darren before his accident. Ms. Bowles described him as a very strong skater. Darren also played brief stints in Junior B, a higher competitive level than midget involving older, stronger, faster players. Morgan Baldwin, one of Darren's coaches at that level, also described him as a strong skater.

[14] In spite of the evidence that Darren was a strong skater, there is no evidence as to his actual skating speeds, or the average skating speed of amateur ice hockey players, whether AAA Midget level, Junior B, or otherwise. The only information respecting skating speeds at any level of ice hockey is an Internet source that Dr. Stalnaker, the plaintiffs' biomechanical engineer, relied on. The accuracy of that information is not proven and, in any event, as I set out later, Dr. Stalnaker largely misconstrued it.

The accident

[15] It is little surprise that the witnesses vary in their descriptions of what preceded Darren's injury in the hockey game on November 11, 2004. In part, that is due to the speed at which events occurred but also because the attention of other players, coaching staff, fans and watchers was, for the most part, not fixed on the minutiae of the event as it unfolded. Nothing unusual appeared to be happening and it was only later, after it became apparent that Darren was seriously injured, that many of the witnesses began to reconstruct the event.

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[16] The game in which Darren was injured took place during a tournament and was between Darren's team, the Juan de Fuca Orcas, a AAA Midget Rep team, and the Westside Grizzlies, an up-Island team. The accident occurred in the Westside end of the rink on the left side of the offensive zone boards, from the perspective of the Orcas players. Darren was playing right wing at the time. Although the witnesses did not all do so during their evidence, I will describe their observations using the orientation of the Orcas players. For example, I refer to the left of the goal in the offensive zone as the left wing or left side.

[17] In the result, there is some commonality in the broad recollections of the witnesses but less as to the specific details such as whether Darren received a check, caught an edge of a skate blade, or both, and also, whether he became airborne or rotated and, if so, in which direction. No matter how well intentioned, I found the attempt by some of the witnesses to provide precise details on such points less than reliable.

[18] Darren More's mother sat across from the players' benches while she watched the game. Her view was unobstructed. According to Mrs. More she saw Darren carry the puck into the offensive zone, dump it to the left side of the net and chase very hard. As Darren tried to pass by one of the Grizzlies' defensemen, the player hip checked him and tugged on his jersey. Darren crashed into the boards, hitting his back and the back of his head creating a loud thump. Darren then struggled to get up, finally got up and skated to the bench on his own.

[19] Earlier, on examination for discovery, Mrs. More denied that Darren fell on the ice and slid backwards into the boards. She also testified in cross-examination at trial that the hip check occurred very close to the net just beyond the goal line and that Darren rotated counter clockwise, became airborne and hit the end boards as he was falling. Mrs. More described the point of contact with the end boards as closer to the goal than the corner of the rink.

[20] Matthew Pane was a player on Darren's team and on the ice at the time of the incident. He testified that Darren chased the puck after it was dumped into the

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left side, that a defenseman clipped Darren, and Darren caught an edge. According to Mr. Paone, Darren hit the back of his head on the boards. Darren eventually got up and made it to the bench on his own.

[21] In cross-examination Mr. Paone testified that Darren was attempting to follow the puck behind the goal when the defenseman hit him. At that point, Darren was about two to three feet from the side of the goal. Mr. Paone agreed that Darren rotated clockwise in the air before hitting his back and head against the boards. The hit against the boards caused a “huge bang”.

[22] Kyle Smith was a defenceman on Darren’s team. He was also on the ice at the time of the accident. He described observing Darren with the puck along the goal line, apparently losing an edge when hit, seeming to hit the ice and then hitting the boards at high speed. I will refer to him as Kyle to distinguish him from his parents who also testified. According to Kyle, Darren hit the boards with the top half of his back and head with a great deal of force. Under cross-examination Kyle testified that Darren had possession of the puck just before he was hit and was coming out from behind the goal at a slight angle to the goal line. He agreed that Darren rotated counter clockwise before hitting the boards backwards.

[23] Mark Stinson was the other winger on Darren’s line at the material time. He recalled that Darren pursued the puck after it was dumped into the right wing rather than left wing side. He did not recall any check but testified that Darren appeared to lose an edge as he went straight towards the corner. In cross-examination Mr. Stinson indicated that the point of impact with the end boards was near the right wing corner. He also adopted as true his previous statement that he did not know if Darren’s head actually hit the boards.

[24] Kevin Zalba is the father of another player on Darren’s team. He was standing with Sucha More immediately behind the boards in the Grizzlies’ end closer to the left wing corner. He watched Darren chase the puck in from the left wing side as the puck travelled around the boards behind the net just into the right wing side. Mr. Zalba testified that as Darren approached the goal line he received a partial

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check, spun around, went back into the boards, slid down with his legs straight out near the ice and hit his head just below the dasher board.

[25] In cross-examination Mr. Zalba positioned the opposing defenseman facing Darren and between Darren and the goal. As a result, Darren received the check on his right side, rotated clockwise and then hit the boards at about a 70 degree angle with his back and head. Mr. Zalba played hockey at a high level himself and has been involved in various aspects of the game since. He had one of the closest vantage points and, in my view, offered one of the more accurate and plausible accounts.

[26] Sucha More had much the same vantage point as Mr. Zalba. He described player contact and Darren losing an edge near the net, then crashing into the boards. He did not think that Darren was badly hurt although it took some time for Darren to get up and skate to the bench. In cross-examination Mr. More explained inconsistencies or additional details set out in his earlier descriptions of the incident, including at examinations for discovery, as earlier attempts to reconstruct what happened.

[27] While I accept that Mr. More tried to be truthful at all times, his willingness to engage at any time in reconstructing the events based on other information necessarily casts doubt on the reliability of his account. I observe, however, that the detail in the questions and answers at Mr. More's examination for discovery went beyond what one would expect considering the speed and short duration of the incident. In any event, at trial, Mr. More did not adopt as true his detailed earlier accounts.

[28] Kim Smith is Kyle Smith's mother. She also sat in the stands across from the players' bench. She observed Darren chase the puck but was not sure if the opposing defenseman made physical contact before Darren appeared to catch an edge near the goal line and slide backwards into the boards hitting his lower back and then his head. After a few moments Darren got up and skated off the ice. In cross-examination Ms. Smith confirmed that she considered the head motion to be

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like a whiplash in the sense that the head whipped up and back. Along with others, including Mr. Zalba, she identified the point of impact on the boards at an advertising site closer to the left wing corner than to the goal.

[29] The witnesses described above all testified for the plaintiffs. The defendants called two further eyewitnesses to the incident. Kerry Smith is the father of Kyle and is married to Kim Smith. He was an assistant coach and the trainer for Darren's team. As a result, he was at the players' bench close to the center ice line at the material time. He testified that it "appeared" to him that Darren came around the back of the goal and was then hit backwards by the opposing player. This caused Darren to slide towards the boards and strike them first with his rear end. In cross-examination Mr. Smith agreed it was quite possible that Darren hit his head and also agreed that Darren hit the boards hard. No other witness described Darren coming out from behind the net before the contact.

[30] Michael Hellyer was the coach of the opposing team and was also at his bench at the material time but closer to the site of the accident than Mr. Smith. He also described Darren sliding rear-end first into the boards but described the check occurring near the dot in the left wing face-off circle. He estimated that the sliding distance was about 20 to 25 feet and also testified that Darren did not appear to catch an edge at any time. No other witness described Darren sliding such a lengthy distance.

[31] In cross-examination Mr. Hellyer described his player skating backwards before the check between Darren and the goal. He also described two persons going right to Darren on the ice to help him, although his evidence stands alone in that regard as well.

[32] Leaving aside attempts to quantify how fast Darren was skating as he chased the puck, I find that Darren chased the puck hard after it was dumped into the left wing zone near or behind the goal. As he skated in, the opposing player made physical contact with him near the goal line.

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[33] I further find that as a result of the check or trying to avoid it and catching an edge, Darren rotated, fell and slid on his rear end, hit the boards back first and also struck the boards with the back of his helmeted head. There was no appreciable time gap between the initial and head contact which resulted in a single loud noise.

[34] Having regard to the general description of his path of travel and his contact with the boards near where Mr. Zalba was standing I do not accept that Darren hit the boards at a precise 90 degree angle. It is more likely that Darren hit on a slight angle to the boards with his lower back making the initial contact, followed by the mid back, upper back and then the back of his head, almost simultaneously.

[35] Regardless of the actual speed, Darren's fall and collision with the boards was in its entirety a typical incident repeated many thousands, if not hundreds of thousands, of times in hockey rinks during games or practices over the years and across the country. Hockey is a fast sport played on an ice surface surrounded by vertical boards. Players of all ages and sizes skate fast, get hit, or fall, and hit the ice or the boards, or both. There is nothing startling or unusual in the manner in which Darren hit the boards in this case.

[36] Unfortunately, what is very unusual and possibly unprecedented in Canadian organized amateur hockey is the injury Darren sustained that left him with such devastating effects, despite his wearing a CSA certified helmet. According to Dr. Bishop, one of the CSA biomechanical experts, Darren's case is the only reported instance of a helmeted player sustaining an SDH while playing organized hockey.

What caused the SDH?

[37] There is conflicting evidence respecting the cause of the SDH. In his report, Dr. Tator identified two possible sources of the bleeding that resulted in the SDH, either a cerebral contusion (bruising) or torn veins leading from the brain into the vascular channels in the dura covering the brain. These veins are often referred to as bridging veins.

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[38] Dr. Tator conceded that the CT scan did not definitely show a contusion but opined that there was a concussive effect on the brain when Darren's head struck the boards. According to the doctor, the concussive effect was evidenced by Darren's immediately impaired neurological function, that is, temporary loss of cognitive function as he lay on the ice and then tried unsuccessfully, at first, to get up. In Dr. Tator's view the sequence of events was concussion, contusion and subsequent bleeding from the brain resulting in an SDH, although torn bridging veins could also have caused the SDH. He did not consider Darren predisposed to injury as a result of a previous concussion while playing hockey.

[39] In cross-examination Dr. Tator explained that there is also no definitive proof that torn bridging veins caused the SDH but expressed his suspicion that there may have been an arterial rupture instead.

[40] The Bauer defendants consulted Dr. Graeb, a neuroradiologist, and relied on his report. Dr. Graeb was not cross-examined. In his opinion the CT examination on the day of Darren's accident disclosed "no sign of bleeding or contusion of the brain itself." Darren's SDH was successfully drained at hospital the same day. According to Dr. Graeb, a CT scan taken the next day also showed no evidence of hemorrhage or contusion on the brain itself.

[41] Dr. Woolfenden is a neurologist with expertise in the diagnosis of brain injury. At the request of the Bauer defendants, Dr. Woolfenden reviewed the medical records and assessed Darren. He confirmed that Darren sustained a severe traumatic brain injury ("TBI").

[42] Dr. Woolfenden described the initial effect of the SDH in much the same way as Dr. Tator did. He commented in his report that the "large majority" of SDHs are "traumatic and most often result from direct impact injury to the head" with rapid deterioration often following, sometimes within minutes. As I later set out, Darren demonstrated rapid deterioration within minutes of getting up off the ice and making his way to the players' bench.

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[43] The doctor also described the shifting to the opposite side that occurs in the brain as a result of the SDH compressing the adjacent part of the brain resulting in "increased pressure within the cranial cavity (and hence reduced blood flow within the brain) which subsequently leads to reduced alertness to the point of loss of consciousness." Dr. Woolfenden also agreed that the SDH occurred as a result of Darren's collision with the boards.

[44] It does not appear that Bauer directly asked the doctor to consider whether the SDH resulted from torn bridging veins or bleeding within the brain associated with a concussion and contusion. Dr. Woolfenden does however define an SDH in his report as "bleeding outside the brain" and also commented that there was no MRI imaging of brain contusion.

[45] Bauer also engaged Dr. Honey, a neurosurgeon with expertise in the diagnosis and treatment of brain injury. Dr. Honey opined that the cause of the SDH was a bridging vein tear at the time of impact. As he later explained during cross-examination, the bridging veins are outside and distinct from veins within the brain itself.

[46] Dr. Honey also commented in his report on the lack of MRI imaging of any brain contusion and went on to say:

> Unfortunately, the deceleration [force] did cause a vein on the outside of the brain to be torn. This vein was likely stretched between its origin on the brain's surface and its termination in the dura attached to the inside of the skull and was ultimately torn by the relative movements of the brain and skull during the moment of impact.

In cross-examination, Dr. Honey confirmed his assumption that the impact of Darren's helmeted head with the boards after sliding backwards into them caused the bridging vein to tear.

[47] Bridging vein tears are, according to Dr. Honey, common amongst the elderly but "exceedingly rare in the young." This is because the brain atrophies as we age causing the bridging veins to stretch leaving them more vulnerable to rupture. The

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doctor also commented that bleeding associated with a tear within the brain is "exceedingly rare in hockey – the last reports were from the 1960s."

[48] I am satisfied that the immediate cause of Darren's SDH was a bridging vein tear. Later, I will return to the medical opinions as they relate to the important question whether the tear resulted from forces that were translational or linear, angular or rotational, or some combination of the two. This question is significant because ice hockey helmets are designed primarily to protect against translational rather than angular applications of force. The theory of the plaintiffs is that the helmet was inadequate for its primary purpose.

[49] Before discussing the issue respecting the type of forces and the evidence relating to it, it is necessary to understand the devastating consequence of Darren's injury. As referred to above, Darren's condition declined very quickly after he skated to the bench.

Consequences of Darren's traumatic brain injury

[50] After making his own way to the players' bench, Darren sat down. He was responsive and complained about his back but quickly slumped to one side and vomited. Mr. Smith and another member of the coaching staff helped Darren from the bench and out behind into the passageway, or tunnel, to the dressing rooms. Fortunately, Mr. Smith had sufficient emergency medical training to recognize the risk of head injury. As they reached the tunnel, he observed that Darren's pupils were almost completely dilated and non-reactive. Darren vomited a second time.

[51] Darren was positioned on his side in case he vomited again but was, at that point, still breathing on his own. Fortunately, firefighters and two ambulance crews arrived at the scene within minutes to take over emergency response.

[52] By the time the first ambulance attendant arrived, Darren was no longer responding to verbal or pain stimuli. His recorded Glasgow Coma Scale was a 3, as low a score as possible. Darren's lips were blue (cyanotic) and his respiratory rate was well below normal. His oxygen saturation rate was in the low to mid-70 percent

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range. Any rate below 93 percent is questionable since healthy people have a saturation rate in the range of 97 to 100 percent. After the attendant inserted an airway tube, Darren's colour began to improve.

[53] The second ambulance crew was qualified to intubate Darren and attempted to do so. The initial attempts were unsuccessful due to trismus, or clenching, of Darren's jaw. Medication was required to relieve the trismus and eventually the intubation succeeded.

[54] Darren was immediately transported to hospital arriving there about one hour after the accident. While early surgical intervention resolved the SDH, its effects were, as Dr. Tator described in his evidence, profound and catastrophic. For example, as the brain swelled, shifted and herniated in response to the pressure associated with the SDH, the blood flow to the brain was interrupted and the brain suffered from a lack of oxygenated blood reaching it (ischemic hypoxia).

[55] Dr. Honey agreed with Dr. Tator respecting the general nature of the injury and referred in his report to Darren's "characteristic pattern of ischemic brain injury." The significance of the injury is apparent from the following extract:

> The hypoxia was therefore a very significant contributing factor to Mr. More's ischemic brain injury. The hypoxia increased Mr. More's brain swelling and it was the increased intracranial pressure due to that swelling that led to his ischemic brain injury. Without the hypoxia, Mr. More's brain injury would have been less. It would be difficult to quantify how much less but potentially dramatically less if the ischemic injury was averted.

As Dr. Honey further explained during his evidence, the inadequate blood flow prevents the removal of toxic by-products that destroy brain tissue. Accordingly, the eventual brain injury is essentially a metabolic change.

[56] Dr. Woolfenden also agreed that the injury was hypoxic. He referred in his report to Darren's "subsequent severe hypoxic brain injury (i.e. a secondary brain injury due to severe brain deprivation of oxygen)." He observed that such injuries evolve over time, as evidenced by MRI findings in May 2005.

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[57] Dr. Tator also testified that a final MRI taken in May 2007 demonstrated the resulting atrophy in Darren's entire brain. In the result, Darren is left with very substantial deficits that impact on almost every aspect of his life.

[58] On the whole of the evidence, I am satisfied that the three doctors are essentially in agreement as to the nature of Darren's severe brain injury. I am also satisfied that the impact of Darren's helmeted head with the boards triggered the chain of events that culminated in his brain injury.

Translational or angular forces?

[59] Drs. Tator and Honey also provided opinion evidence, from a medical perspective, on whether the force, or acceleration, applied to Darren's brain was translational (linear), angular (rotational) or some combination of the two. I will set out their evidence and then review some other medical opinion evidence and the biomechanical expert evidence as it relates to the same points. The two fields of expertise, medical and biomechanics, bring different but important perspectives to bear on the issue. I would not expect an expert in either field to entirely defer to one or the other.

[60] Counsel for Bauer raised the subject of translational and angular forces with Dr. Tator in cross-examination. Keeping in mind that the subject relates to the movement of the brain within the skull, Dr. Tator opined that linear rather than rotational forces caused the SDH. In this regard, I keep in mind that Dr. Tator's primary opinion is that the bleeding stemmed from a brain contusion rather than from torn bridging veins.

[61] Dr. Tator conceded, nonetheless, that there must have been some rotational forces because it is generally understood that concussions, even without loss of consciousness, are due to rotation. He did not accept in cross-examination that SDHs are commonly associated with rotational forces except in adults who generally have more space between the brain and the skull for the former to rotate. For that reason, according to the doctor, adults are more susceptible to rotation resulting in

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the tearing of veins but in younger persons the brain is proportionately larger and, accordingly, less susceptible to rotation.

[62] In the result, Dr. Tator agreed that for adults torn veins may result from the rotation of the brain but still maintained that it is more likely to be due to linear acceleration. Given Darren's relative youth, Dr. Tator did not accept that rotation was a factor in causing Darren's SDH.

[63] Dr. Honey, somewhat in contrast, considered the combination of bridging vein tear and SDH "strong evidence that [Darren] sustained some component of a rotational injury."

[64] The CSA relied on a report from Dr. Gennarelli, a neurosurgeon, in reply to some medical aspects of the evidence of Dr. Stalnaker, the plaintiffs' biomechanical expert. Dr. Gennarelli is eminently qualified and a prolific contributor to the medical, neurosurgical and engineering literature respecting topics such as head injury causation and the biomechanics of TBI. Dr. Gennarelli criticized Dr. Stalnaker's opinion relating to the question of linear or rotational impact. He stated:

> I disagree with the statement [of Dr. Stalnaker] that [the] "only way … to tear a bridging vein and not have unconsciousness is to be impacted with a non-rigid linear impact that is in the front to back or back to front." First, rarely are things quite so black and white definitively in biomedical science and second this concept is not supported by my own research or that of others.

Dr. Gennarelli went on to say:

> Indeed, my own work has shown, since 1971, that translational motion can cause SDH, but rotational motion causes more severe SDH, ie at lower accelerations. Others have confirmed these findings. Whether concussion occurs when SDH occurs depends on the duration of the acceleration as shown in the figure on page 5 of this report.

The figure referred to in the above extract demonstrates that concussion without loss of consciousness can produce an SDH and is inconsistent with Dr. Stalnaker's opinion that the rotational forces required to result in bridging vein tear must also result in cerebral concussion with unconsciousness.

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[65] As Dr. Stalnaker purported to rely directly on Dr. Gennarelli's research in reaching his conclusion expressed above, the latter's evidence seriously undercuts assigning any weight to Dr. Stalnaker's opinion.

[66] In his second report, Dr. Stalnaker responded to issues raised by the defendants' experts respecting Darren's injury pattern and whether it resulted from linear or rotational forces. It is convenient to deal with Dr. Stalnaker's evidence on this issue at this point.

[67] Both in his report and in cross-examination, Dr. Stalnaker referred extensively, but incompletely and ultimately in a misleading way, to the academic works of Dr. Gennarelli in support of his contention that an SDH generated by rotational forces "always occurs well after classic cerebral concussion with loss of consciousness." Based on this misstatement of Dr. Gennarelli's work, Dr. Stalnaker insisted throughout his evidence that rotational forces were not a significant factor in causing Darren's SDH as Darren did not suffer a concussion with loss of consciousness.

[68] While Dr. Stalnaker included a Gennarelli figure (graph) in support of that conclusion in his report and returned to it as a mantra throughout his testimony, it is apparent from Dr. Gennarelli's own report that the figure was revised in the early 1980s and was not consistent with Dr. Gennarelli's ongoing published works thereafter.

[69] A review of the publication containing the Gennarelli figure that Dr. Stalnaker relied on identifies it as a hypothetical construct requiring further work to demonstrate its validity. Dr. Gennarelli published papers in 1982 setting out his revised conceptualization of the effect of rotational acceleration on the brain showing that an SDH can occur absent concussion resulting in loss of consciousness. Faced with the contents of these papers in cross-examination, Dr. Stalnaker eventually conceded that rotational acceleration can result in an SDH even though the concussive effect did not result in loss of consciousness.

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[70] There is no doubt as to Dr. Gennarelli's current view. In his report filed at trial, Dr. Gennarelli stated: "SDH can indeed occur without concussion." It is difficult to accept that Dr. Stalnaker did not know that Dr. Gennarelli's work, taken as a whole, has shown, as the latter says: "since 1971, that translational motion can cause SDH, but rotational motion causes more severe SDH, ie at lower accelerations."

[71] I will have more to say about Dr. Stalnaker's evidence later but before doing so, it is necessary to set out the contextual background for both his evidence and that of the other biomechanical experts.

Role of the CSA in setting certification standards for ice hockey helmets

[72] The Standards Council of Canada ("SCC") is a federal Crown corporation with a statutory mandate to "promote efficient and effective voluntary standardization in Canada," including by taking steps to promote "public-private sector cooperation in relation to voluntary standardization in Canada": *Standards Council of Canada Act,* R.S. 1985, c. S-16, s. 4(1)(b). Such promotion is intended, according to the section:

> ... in order to advance the national economy, support sustainable development, benefit the health, safety and welfare of workers and the public, assist and protect consumers, facilitate domestic and international trade and further international cooperation in relation to standardization.

In carrying out its mandate, the SCC accredits and supervises standards organizations like the CSA. The CSA is one of four accredited standards organizations in Canada.

[73] The CSA facilitates the development of standards and tests products for certification against those standards.

[74] The SCC also supervises the process by which the CSA proposes, secures approval of, and performs ongoing reviews of, National Standards. The standard in effect at the time of the manufacture and sale of Darren's helmet is a National Standard. The CSA prepared the standard and the SCC approved it in 1990. The standard was later reaffirmed in 1997. The National Standard for ice hockey helmets is identified as: CAN/CSA-Z262.1-M90 ("M90").

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[75] M90 has been in effect since 1990. In 2009, the CSA approved changes to the standard (CSA-Z262.1-09) although none relate to the pass/fail criterion for certification. Those changes will take effect May 1, 2011. There have been no other changes in the intervening time.

[76] Section 4(1) of the *Hazardous Products Act,* R.S. 1985, c. H-3, prohibits, among other things, the sale of prohibited products. Any ice hockey helmet that does not meet the M90 standard is a prohibited product as defined in the legislation. Accordingly, no store can offer non-certified ice hockey helmets for sale in Canada.

[77] For the most part, the CSA facilitates the development of standards by offering non-voting administrative support and ensuring compliance with the applicable SCC and CSA policies. Employees of the SCC or the CSA have limited involvement in the process of developing, recommending and reviewing specific standards. Instead, a technical committee and any necessary subcommittees or working groups carry out such work. The voting members of the technical committee are all volunteers and the committee is an important part of a broader volunteer committee structure. The participation of any CSA employees is non-voting, consultative or administrative in nature.

[78] An overview of the committee structure is as follows.

[79] At a senior level a standards policy board provides strategic oversight for the standards development process. The members of the board are drawn from a wide variety of sectors across Canada. Immediately below the board are standards steering committees. Each committee is sector specific and has 15 to 20 members at any one time. As might be expected, the standards steering committees provide the terms of reference and advice for the technical committees.

[80] The technical committees are responsible for the development and review of individual standards. Membership on the committee is balanced and includes representatives of manufacturers. Since at least about 1990, a Bauer representative, or a representative of their predecessor companies, was a member of the technical

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committee on protective equipment for ice hockey players, as were representatives of other manufacturers. This technical committee was responsible for the development and approval of M90. For convenience, I will refer to it as the hockey helmet committee.

[81] Other members of the hockey helmet committee represented the various interests of the general public (consumers, hockey associations and leagues), academics, medical professionals, business and government.

[82] Technical committee decisions are reached by consensus; there is no requirement that decisions be unanimous but more than a simple majority is required. The requirements for balanced representation on the committee and consensus decision-making are intended to preclude any one interest group controlling the process. When the hockey helmet committee approved M90, there were 22 individuals on the committee, five of which were manufacturing industry representatives.

[83] Each technical committee has a chairman. Dr. Bishop, an academic with expertise in biomechanics, was the vice-chairman of the hockey helmet committee in 1990 and has been the chairman since about 1996.

[84] The CSA approved the first preliminary hockey helmet standard in the world in 1973. The standard was then supplemented and refined periodically before the changes that resulted in M90. M90 states that its objective is to:

> [R]educe the risk of head injury to ice hockey participants, when the helmet is used as intended and in accordance with the manufacturer's instructions, without compromising the form and appeal of the game.

It also states that ice hockey is a sport with "intrinsic hazards" and that participation "implies the acceptance of some risk of injury." It further states that, while the use of a helmet certified under the standard "will not prevent all injuries" it "is intended to reduce the frequency and severity of head injuries."

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[85] M90 establishes minimum standards for hockey helmet safety, including for impact resistance. Impact resistance is subject to performance testing as a prerequisite for certification. Dr. Hoshizaki, an academic and past Bauer employee, accurately described the test method in his report, as follows:

> The test method involves securing the hockey helmet on a magnesium ISO [International Standards Organization] head form. The head form is equipped with a uni-dimensional accelerometer. The head form is then attached to a guided monorail drop system. The head form is then is [sp] vertically dropped *via* the monorail onto a steel anvil at an impact velocity of 3.96 metres per second. The prescribed impact velocity determines the height from which the head form must be dropped. The head form is dropped so that the helmet impacts the steel anvil at six prescribed sites: front, front boss, crown, side, lower rear boss and rear. The head form is dropped three consecutive times, with a minute between each drop, on each prescribed impact site. The test is performed at ambient temperature and to a prescribed cold temperature.

[86] Section 5.2.1 of M90 sets the standard for impact resistance, as follows:

> No single impact shall exceed a resultant peak acceleration of 275 g under ambient conditions. If the Gadd Severity Index ("GSI") is measured, it shall not exceed 1500 (under ambient conditions). There shall be no cracks in the outer shell of the helmet.

[87] As Dr. Hoshizaki further describes, a "g" is the unit of gravity used to measure acceleration. When the helmeted head-form impacts the steel anvil during a drop test, the impact "creates inbound velocity into the head-form which results in acceleration/deceleration" and approximates tissue stress in the brain as a result of the impact.

[88] The peak g permitted by any single impact during the testing process is 275. To illustrate the effect of the permissible peak g in a standard, a lower permissible maximum represents a higher standard and a higher permissible maximum represents a lower standard. The maximum permissible peak g represents only one aspect of the testing methodology. It is necessary to be cautious when comparing different standards and not focus solely on differences in the maximum permissible peak g.

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[89] The GSI (SI) is a formula that includes the duration, or impulse, as well as the peak value of the acceleration/deceleration curve. M90 does not require an SI measurement but, if it is done, the result must not exceed 1500.

Other standards and testing protocols for ice hockey helmets

[90] There are now also standards applicable to the impact resistance of hockey helmets in other jurisdictions. By 2000 these included the American Society for Testing and Materials ("ASTM"), Committee European de Normalization ("CEN") and International Organization for Standardization ("ISO"). All three incorporated a peak g criterion of 300 rather than 275. The ASTM standard was set in 1990 and the other two in 1996.

[91] The protocols and equipment used in these other jurisdictions are similar to those that the CSA employs but there are differences. Differences include the type of drop apparatus utilized, the head-form assembly and mass, whether the impact surface is steel or modular elastomer programmer (MEP), the impact velocity, the pass/fail criterion and the location of the impact sites to be measured. In spite of the differences, the uncontradicted evidence is that if a helmet meets the CSA minimum impact requirements, it will also meet the minimum standards set by these other organizations.

[92] The National Operating Committee on Standards for Athletic Equipment ("NOCSAE") in the United States has also developed a protocol and testing method for ice hockey helmets. NOCSAE testing is widely used for other sports helmets, including American football helmets, although no certification body has adopted it for the testing of ice hockey helmets. In contrast to the CSA method, the NOCSAE test requires a different type and mass of head-form, a different type of drop assembly, and an MEP contact pad. By the mid-1990s, the failure criterion under the NOCSAE testing regime was 1200 SI, equivalent to 225 g.

[93] Below, I discuss in detail the testing methods and opinions of Dr. Stalnaker. Dr. Stalnaker used a modified NOCSAE test in comparing the performance of

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certain Bauer ice hockey helmets and also criticized the CSA for not incorporating the NOCSAE failure criterion of 1200 SI, or 225 g, into its standard.

Darren More's helmet

[94] At the time of his accident in November 2004, Darren was wearing a Bauer Nike HH5000L (2nd generation) ice hockey helmet (the "accident helmet"). Bauer manufactured the shell and components of the helmet in early 2000. The CSA certified Bauer Nike HH5000L (2nd generation) helmets on May 8, 2000. The Bauer Nike HH5000L (2nd generation) helmet also complied with the ASTM and CEN standards.

[95] During the course of the CSA standard testing, the recorded peak g values for the HH5000L were well under 275. SI values were also recorded and were well under 1500. For example, on May 8, 2000, the recorded peak g values for the rear of the helmet were all less than 100 and the SI values were all less than 400.

[96] During the period 2000 to 2004, including 1st and 2nd generation small, medium and large helmets, nearly a quarter million Bauer Nike HH5000 helmets were sold in Canada. During the same period, on average each year, in minor hockey alone, about 43,000 players were registered in British Columbia and about 531,000 throughout Canada. Each player was required to wear a CSA approved helmet and a significant percentage would have worn the HH5000.

[97] Darren's father purchased the accident helmet new for him at a local sporting goods store in January 2003. At the time of purchase, the helmet bore a CSA sticker number 13021. The sticker signified that the helmet met the requirements of M90 and was not a "prohibited product" within the meaning of the *Hazardous Products Act.*

[98] At the time of purchase, in addition to the CSA sticker, the helmet had a warning label in a conspicuous place on the rear outside. The warning, or one very similar to it, read:

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> Ice hockey is a collision sport which is dangerous. This helmet affords no protection from neck or spinal injury. Severe head, brain or spinal injury including paralysis or death may occur despite using this helmet …

It is likely that, in about January 2004, Darren removed the warning label from its position at the back of the helmet and replaced it with his team number. Darren played the remainder of that season with a higher level Junior B team, the Kerry Park Islanders.

[99] Other warnings would have been apparent when Mr. More bought the helmet for Darren. The owner's information attached to the chinstrap reiterated the risk of serious injury associated with ice hockey and stated in part:

> Protective equipment will not eliminate all injuries but may reduce their severity and frequency. This product is designed to minimize the effect of superficial injuries.
>
> This helmet affords no protection from neck, spinal or certain types of brain injuries including those that may be caused by rotational forces. Severe head, brain and spinal injuries including paralysis or death may occur despite using this helmet.

Similarly, the box in which the helmet was packaged had a visible warning:

> ***WARNING:*** Ice hockey is a collision sport which is dangerous. These helmets afford no protection from neck, spinal or certain types of brain injuries including those that may be caused by rotational forces. Severe head, brain or spinal injuries including paralysis or death may occur despite using this helmet.

[100] At the time of his accident Darren also wore a protective facial cage attached to his helmet. The cage had a warning label that also emphasized the risk of injury associated with hockey.

Other Bauer and CSA testing

[101] In 2000, the CSA and Bauer also conducted other testing on the rear location of new HH5000L helmets. This testing was for other certification purposes. Results are shown in the tables below.

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CSA: 2 helmets - January 17, 2000:

Trial	g
1	99
2	132
3	149

Trial	g
1	114
2	125
3	129

Bauer: 3 helmets – March 2, 2000:

Trial	SI	g
1	343	92.8
2	410	105.7
3	423	108.2

Trial	SI	g
1	400	98.2
2	427	106.7
3	472	114.6

Trial	SI	g
1	314	84.3
2	380	98.7
3	408	102.7

CSA: 2 helmets – March 29, 2000:

Trial	g
1	93
2	110
3	115

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Trial	g
1	93
2	110
3	114

[102] As a comparison, I also set out the results below of similar rear impact testing done during the certification process for the later Bauer helmet model HH5100L that is referred to in Dr. Stalnaker's evidence discussed below.

Bauer: HH5100 - October 2008:

Trial	SI	g
1	231	77.9
2	275	88.3
3	294	91.2

Biomechanical evidence

Dr. Stalnaker

[103] Dr. Stalnaker was the plaintiffs' only biomechanical expert to testify at trial. Biomechanics is concerned with determining the nature and direction of the forces that cause particular injuries. It is apparent that biomechanical experts must work closely with medical experts who diagnose specific injuries. As I have already indicated, Dr. Stalnaker seriously misstated the opinions of Dr. Genarelli. Unfortunately, he was wrong in many other important respects as well.

[104] Regrettably, I have no confidence in Dr. Stalnaker's opinions and give his evidence very little weight. His written reports are replete with errors and his oral testimony was blustery and dangerously close to being actively misleading.

[105] Dr. Stalnaker's first report is dated November 24, 2009. The organization and use of terminology in the report is unusual and potentially confusing. For example, Dr. Stalnaker reviewed witness statements about the hockey game in which Darren was injured and then wrote a paragraph under the heading:

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> **Accident Information:**
>
> On November 11, 2004, 17 year old Darren More was playing hockey when during second period of the game he was checked by a defenseman from the other team as they were competing for the puck. Witnesses stated that they were 4 – 5 feet from the boards and both players were skating fast. Witness statements on the condition of the ice are conflicting, however the majority state that the ice contained ruts and "scars". Mr. More lost his balance, most likely when catching an edge with his skate on the ice and slid backward approximately 4-5 feet (1.21-1.53 m) into the boards striking his head. The statements relate that Mr. More's helmet stayed on during the collision and the hit. He was dazed but able to get up and make his way to the bench on his own. Mr. More was being attended by the assistant coach on the bench, when he slumped to the right and began aspirating and convulsing. He was carried into the tunnel and emergency services were called.

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Instead of identifying assumptions of fact for the purpose of expressing his opinions, Dr. Stalnaker presented factual conclusions about the event, not all of which were borne out by the evidence.

[106] The next paragraph of the report reads:

> **It is my opinion that** Mr. More was skating at a high rate of speed when he fell on the ice and slid approximately 4-5 feet (1.21-1.53 m) backwards into the boards. He struck his head on the rear apex of his helmet at a speed of approximately 6.0 m/sec (19.6 ft/sec) or less. Mr. More hit the boards in a straight on direction rather than a glancing blow off of them. Witnesses stated that he was skating very fast when the accident occurred. The speed of impact was determined by estimating that very fast skating, as Mr. More was doing, is equivalent to the average speed of a NHL player which is approximately 9.0 m/sec (29.4 ft/sec). Based on my experience, it can be estimated that the collision and sliding would have resulted in an energy reduction of approximately 33%. Based on my experience, the impact speed of 6.0 m/sec (19.6 ft/sec) is consistent with the speed at which Mr. More's injury occurs.

Although there is some expression of opinion as to skating and impact speeds in this paragraph, it is, for the most part, a factual description of the event. There is no evidence of the average skating speed of Midget AAA players nor is there any admissible evidence of the average skating speed of NHL players.

[107] Instead, Dr. Stalnaker relied on but misstated the content of an Internet report entitled “The Mechanics of Skating” which stated:

> NHL players can reach speeds in excess of 20 miles (32 km) per hour on the ice. Some speed skaters have been clocked at over 30 miles (48 km) per hour!

Assuming the Internet report is factually accurate, it obviously refers to maximum rather than average skating speeds. Dr. Stalnaker’s conversions in his report to 9.0 m/sec (20 mph) are, as a result, based on the purported maximum skating speeds achievable in the NHL, not the lower average skating speeds. The Internet report provides no information about average skating speeds at any skill level.

[108] It is not likely that Darren, even as a fast skater, skated at 20 miles per hour as Dr. Stalnaker suggested at trial. Unfortunately, this information is of limited use and does not assist in determining the actual force of Darren’s impact with the boards.

[109] I also observe that Dr. Stalnaker did not explain in his report how he arrived at a 33% speed reduction based on the player collision and sliding other than by reference to his experience. Such evidence is of virtually no assistance.

[110] I am left with the impression, upon a reading of the passages set out above from Dr. Stalnaker’s report, coupled with the lack of evidence respecting Darren’s actual skating speed or even the average skating speed of players of his age and at his level, that Dr. Stalnaker manipulated data until it fit his theory. Unfortunately, this impression intensifies upon considering other aspects of his opinion.

[111] There is little doubt that Dr. Stalnaker’s conclusion that the impact speed was 6.0 m/sec (19.6 ft/sec) is an integral part of his analysis. Dr. Stalnaker equates the impact speed with that of a six foot tall skater falling and hitting his head on the ice. According to Dr. Stalnaker, the CSA standard should require testing at a 1.8 m (6.0 ft) drop height or, at least, a 1.5 m (5.0 ft) height. The latter is equivalent to an impact speed of 5.4 m/sec (17.9 ft/sec). Dr. Stalnaker included a 1.8 m (6.0 ft) drop height in his testing.

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[112] As to the pass/fail criterion, Dr. Stalnaker recommended an SI of 1200. According to Dr. Stalnaker, an SI of 1200 represents “an 83% chance of not having a serious head injury.” He also recommended using a NOCSAE/Hybrid III head-form in testing, “which closely mimics a human head inside the helmet.”

[113] In Dr. Stalnaker’s view, M90, based on the energy generated by a “0.8 m, 4.0 m/sec (2.6 ft., 13.0 ft/sec) drop of a helmeted head-form on to a hard surface” did not provide an adequate level of protection from the risk of severe head injury.

[114] Dr. Stalnaker also reported on a series of drop tests that he conducted of several Bauer hockey helmets. He employed the NOCSAE test apparatus but modified the EMP pad by mounting a piece of 2” x 4” wood on the pad to simulate the end board of the rink where Darren’s helmet made contact. The reliability of the simulation is questionable. Dr. Stalnaker assumed that Darren hit the back of his helmeted head up near the dasher in an area of the boards that is reinforced on the other side. The evidence does not establish that the contact point was that high.

[115] According to his report, Dr. Stalnaker subjected four helmets to nine drops each. These consisted of three drops per height at 2.0 ft (0.61 m), 4.0 ft (1.22 m) and 6.0 ft (1.83 m). On each occasion, Dr. Stalnaker recorded the SI scores and peak g accelerations.

[116] The drop tests were conducted on four different helmets: two used HH5000L helmets, one of which was modified; a new Bauer HH5100L helmet that first came onto the market in 2009; and finally, a new HH9500L helmet that Bauer fabricated in 2008. Dr. Stalnaker did not disclose in his main report that the first two helmets were used rather than new. He explained at trial that the unmodified used HH5000L appeared, from the stickers, to have been manufactured in September 2002.

[117] Dr. Stalnaker referred to the unmodified HH5000L as the “exemplar” helmet as it was intended to simulate Darren’s used helmet at the time of his accident. Dr. Stalnaker acknowledged that he knew nothing of the actual use history of the helmet, although it did not display any obvious damage.

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[118] Dr. Stalnaker modified the second used HH5000L by removing the existing rear liner and replacing it with a one inch thick pad of Rubatex 3953 (Rubatex). Rubatex is a vinyl nitrile (VN) product. The second helmet was about four and one-half years old at the time of testing.

[119] Dr. Stalnaker testified that Rubatex was first available for helmet use in 1997. Other evidence demonstrated that Bauer commonly used VN liners in other hockey helmets before manufacturing the HH5000L. In that model, Bauer used a liner made of expanded polypropylene (EPP) instead of VN.

[120] Dr. Stalnaker has never been involved in the commercial design of hockey helmets. He glossed over the engineering requirements for commercial production and simply added the one inch thick piece of Rubatex to the inside back of the second used hockey helmet.

[121] On testing, the average SI and peak g recordings for the 6.0 ft (1.83 m) drops were as follows:

Helmet	**SI**	**g**
HH5000L “Exemplar”	1207	174
HH5000L “Modified”	654	135
H5100L	861	154
H9500L	1002	194

Using the information obtained on testing, Dr. Stalnaker also extrapolated results for a drop height of 2.5 m (8.2 ft).

[122] Dr. Stalnaker set out his final opinion in his report as follows:

> **It is my opinion that** the accident helmet was not adequate to provide protection from the type of injury suffered by Mr. More. Had Mr. More been wearing either the H5100L helmet redesigned with a one inch thick pad of Rubatex 3953 Vinyl Nitrile, he would not have received a severe brain injury. My opinion is based on the testing conducted which showed that at an impact speed of 6.0 m/sec (19.6 ft/sec) Figure 04, the estimated speed at which Mr. More's head impacted with the boards, his chances of having an AIS = 4 brain injury, which he had, were 23%, and had he been wearing the H5100L, his chance of injury would have been reduced by about 2/3 to 8%. A

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> further reduction of 7/8 to 3% would have occurred if he had been wearing the Redesigned H5000L helmet. A 23% chance of having an AIS = 4 hematoma (Small to Moderate) is a borderline AIS = 4 injury, requiring only a minimal reduction in force to prevent. Lowering the risk to 8% for the H5100L or 3% for a redesigned H5000L would have resulted in virtually no chance of a bridging vein tear resulting in a hematoma (Small to Moderate).
>
> With only a 5% risk of AIS = 4 hematoma (Small to Moderate) while wearing the H5100L at an impact speed of 5.0 m/sec (16.4 ft/sec**)** Figure 03, and an even lower risk with the Redesigned H5000L of 2%, there would again have been virtually no chance of Mr. More tearing the bridging vein that led to his injury. Even increasing the head impact speed to a higher speed of 7 m/sec (22.9 ft/sec) Figure 05. with the risk of an AIS = 4 hematoma (Small to Moderate) brain injury at 22%, the H5100L would have reduced the risk by almost half of the risk of the H5000L, lessening the forces and greatly reducing his chance of the bridging vein tear. The redesigned H5000L with the 3953 Vinyl Nitrile would have farther reduced the risk to 10%, which once again would have resulted in virtually no chance of a torn bridging vein.

[123] Dr. Stalnaker's reference to an AIS = 4 brain injury is, as I understand it, a category of TBI equivalent to the SDH that Darren sustained.

[124] Effective cross-examination at trial revealed that Dr. Stalnaker made crucial errors, including mislabelling some of the charts setting out his test data. He then incorporated at least one significant resultant error into the final conclusion in his report, namely that the used H5000L exemplar helmet demonstrated a 23% risk factor of an AIS = 4 brain injury.

[125] During cross-examination, Dr. Stalnaker at first appeared reluctant to acknowledge his obvious error. Upon conceding the error, Dr. Stalnaker eventually acknowledged that three of his charts were mislabelled or wrong or both. In the result, Dr. Stalnaker's careless report preparation undermined his attempt to demonstrate the relative performance of helmets.

[126] Dr. Stalnaker wrote a further report on January 30, 2010, in which he responded to the defendants' criticisms of his first report and replied to their expert reports. This report was also careless. Throughout, Dr. Stalnaker inaccurately referred to a diffuse brain injury as a "defused" one.

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Bauer design of HH5000L

[127] Dr. Stalnaker conceded during his evidence that, before any commercial production of a helmet, the Rubatex liner would need to be engineered to properly fit the rear. To assess the implication of this concession it is necessary to review the history of the Bauer design process for the HH5000L.

[128] Dr. Hoshizaki set out part of the history in his report. Although I will review other aspects of Dr. Hoshizaki's evidence later, it is helpful to set out this aspect of his evidence here. I will also review the evidence of Todd McDougall, an engineer and past Bauer employee. Among other duties, Mr. McDougall was involved in designing and testing the liner components for the HH5000L.

[129] Before the commencement of the design process for the HH5000L, Bauer and other manufacturers almost exclusively used VN liner materials, such as Rubatex, for hockey helmets. VN is processed in foam-like sheets that can be stamped and folded to fit as liners, although there were problems associated with processing it at higher densities to manage high impact forces.

[130] By the early to mid-1990s EPP became an alternative to VN for hockey helmet liners. Steam processing of EPP permits a moulded, lightweight and comfortable liner that can be fitted easily within the helmet shell. In contrast to VN, the processing of EPP resulted in a more consistent and higher density than VN in spite of its lighter weight. Dr. Hoshizaki stated in his report that "between 2000 and 2004, VN and EPP were the primary liner materials used for hockey helmets." He opined that:

> EPP is a superior material to VN with respect to reducing the risk of serious or severe head injury, such as subdural hematoma, because of its energy attenuation characteristics.

Dr. Hoshizaki goes on to describe the HH5000L as the "state of the art" helmet in the period 2000 to 2004. According to him:

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> There was no other commercially available hockey helmet that would have preformed any better than the HH5000L to prevent or reduce the risk of serious brain injury, such as subdural hematoma.

[131] Dr. Hoshizaki's conclusion follows that there was not any improved alternative design available to Bauer during the relevant time frame.

[132] Before deciding on a liner for the HH5000L, Mr. McDougall tested a range of possible liners from a variety of manufacturers, including VN and EPP. According to him, he wanted the best liner possible. After the first testing series, he settled on EPP as the liner of choice and then began testing varying densities of EPP.

[133] At the time, EPP was a new product for hockey helmet use although it was used for rodeo helmets. Only one hockey helmet manufacturer had produced a helmet with an EPP liner to that point.

[134] Mr. McDougall explained that the EPP liner maintained its attenuating qualities better over repeated impact testing and was more stable at a wider range of temperatures, opening up the possibility of use for roller hockey. The stiffness of the foam dictates how much energy it can absorb. Assuming the same volume, a heavier piece of VN is needed to achieve the same stiffness as EPP.

[135] On viewing the one inch thick Rubatex sample that Dr. Stalnaker used to modify one of the helmets, Mr. McDougall described it as unbelievably stiff and too hard. As well, it is much thicker than any of the samples Mr. McDougall tested and is, in his view, too stiff to fold into a liner. By contrast, the EPP liner came in 5/8 inch thick slabs.

[136] Mr. McDougall also described the geometry involved in engineering the fit of the liner. Other changes to the second generation HH5000L involved aspects of the liner geometry but nothing of substance relating to the rear.

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The defendants' biomechanical evidence

[137] The defendants' biomechanical experts were Dr. Hoshizaki, an academic and one-time employee of Bauer; Dr. Bishop, an academic as well as a voluntary member and Chair of the CSA hockey helmet committee; and Dr. Newman, a biomechanical engineer with expertise in helmet design and helmet standards development. In final submissions, the plaintiffs objected to the evidence of all three: Dr. Hoshizaki due to his previous association with Bauer; Drs. Bishop and Newman due to their association with the CSA.

[138] For reasons that I will set out later, I reject the contention that the evidence is inadmissible although I accept that the associations are factors to take into account in assessing the weight of their evidence. I do not accept that the witnesses, or any of them, are biased such that I should have no regard to their evidence.

Dr. Hoshizaki

[139] I accepted Dr. Hoshizaki as an expert in biomechanics with an emphasis on impact trauma to the human head and brain. He is amply qualified in that regard and is currently an associate professor, University of Ottawa, Director of the School of Human Kinetics and Associate Dean of Health Sciences. He is also the Director of the University of Ottawa Neuro-trauma Impact Laboratory.

[140] Between about 1989 to 1995, Dr. Hoshizaki was employed by a corporate predecessor of the Bauer defendants. During that period he was in charge of product development and research, intellectual property management, commercialization and development of marketing. He represented his employer on the committees of standards associations, including the CSA.

[141] In July 1995, Dr. Hoshizaki was terminated but continued over nearly two years to represent Bauer on standards committees and also assisted with patent applications. Near the end of the two year period, Dr. Hoshizaki commenced a five year position with another sporting goods manufacturer. He then worked for two years as a private consultant.

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[142] From 1997 to 2002, Dr. Hoshizaki was also an adjunct professor at the University of Windsor. He joined the faculty at the University of Ottawa in 2004.

[143] Unlike Dr. Stalnaker, Dr. Hoshizaki disputed that Darren's head impacted the boards. He opined that even if it did, the speed of impact would have been considerably less than 6.0 m/s. Dr. Hoshizaki described the incidence of an SDH as "extraordinarily rare" in hockey players since the introduction of certified hockey helmets and suggested that, in light of the regularity of similar impacts occurring in the game, it demonstrates that Darren may have been predisposed to the particular injury.

[144] Dr. Hoshizaki has extensive experience in the design of certified hockey helmets. Earlier, I set out his opinion that EPP are superior to VN liners in reducing the risk of serious or severe head injury. In his report, he described the use of the two liners, as follows:

> In the early 1990s, hockey helmets almost exclusively used vinyl nitrile ("**VN**") as liner material. VN is processed in foam-like sheets that are stamped and then folded to fit as a liner into the hockey helmet shell. The density of VN affects its energy attenuation capabilities. To manage high impact forces, VN has to be manufactured at higher densities. The problem with processing VN at higher densities, is that it becomes extremely abrasive and difficult to fold into the shell. In the 1990s. It was also difficult to achieve consistency in the thickness and density of VN. I am familiar with Rubatex as a supplier of VN to helmet manufacturers.
>
> In the early to mid 1990s, expanded polypropylene ("**EPP**") was being studied as an alternative to VN for hockey helmet liners. EPP is processed with polypropylene beads and injected steam. The beads are injected into a mould to which steam is applied. The steam causes the beads to expand and activates an adherent which fuses the beads together in the mould. This process allows EPP to be moulded to fit within the helmet shell and around the head. The number of beads, their density and size, and the geometry of the mould all contribute to the energy attenuation capabilities of an EPP liner. As compared to VN, EPP can be processed at a more consistent and higher density, yet still be lightweight and fit easily into the shell and comfortably around the head. In summary, EPP offers increased energy attenuation capabilities without compromising other design considerations.

[145] Bauer first introduced an EPP liner into the (1st generation) HH5000L. Dr. Hoshizaki described the helmet as "state of the art" during the period 2000 to

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2004. During the early stages of development of the helmet, Dr. Hoshizaki was still employed at Bauer and, accordingly, I must be cautious in determining whether to accept his opinion in this regard.

[146] Dr. Hoshizaki has also been a member of the hockey helmet committee since 1990 and has participated in the drafting of CSA standards. He opined "that the pass/fail criteria set out in the CSA Standard (275 g) has proved to work well in decreasing the risk of severe head injury in hockey." He reported that the peak g values recorded in-house by Bauer for the lot that contained Darren's helmet at the rear boss and rear were 98.7 and 98.2 g respectively. Bauer also recorded SI values although not required to. For the same areas of the helmet, the highest values were 325 and 386 respectively. These readings were well under the maximum permitted 275 g and 1500 SI.

[147] In the end result, Dr. Hoshizaki concluded that "there is no conclusive explanation for why Mr. More sustained a subdural hematoma on November 11, 2004."

[148] Dr. Stalnaker provided an extensive response and criticism of Dr. Hoshizaki's report. Much of that was a defence of Dr. Stalnaker's opinions and views, many of which I have already rejected. Of significance, however, is Dr. Stalnaker's opinion respecting the comparative attenuation qualities of EPP and VN liners. In that regard, he stated:

> Given the same thickness, both VN and EPP have an equal energy reduction capability depending on their densities. Neither is superior over the other from an energy attenuation standpoint. The utilization of these materials would be different, but both can be and have been readily and easily incorporated into helmets.

In my view, this concession highlights the essential difference between Dr. Stalnaker's exemplar and modified helmets. Even if Dr. Stalnaker is right, EPP liners are at least equal to VN liners. Even if Dr. Hoshizaki is wrong respecting the increased energy attenuation available through the use of an EPP liner, the real

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difference in Dr. Stalnaker's modification of the helmet must lie elsewhere. I am satisfied that it does.

[149] The most logical explanation for the comparatively better performance of the modified used helmet on the drop tests that Dr. Stalnaker conducted, based on his own evidence, is not due to the different attenuation characteristics of VN and EPP but because Dr. Stalnaker used a one inch thick, and therefore stiffer, Rubatex (VN) pad in the modified helmet. None of the commercially produced helmets in evidence have a liner approaching that thickness regardless of the material used.

[150] During cross-examination, Dr. Hoshizaki also contrasted the rigour of the NOCSAE and the CSA drop systems. He pointed to three essential differences between the two systems: the NOCSAE system uses a very compliant head-form; the head-form lands on a softer pad; and finally, NOCSAE employs a twin-wired system with the head-form attached that bleeds off energy. The CSA system, on the other hand, uses a guided drop system that does not allow lateral movement and drives the forces right through the aluminum magnesium head-form and onto a harder steel pad.

[151] It is apparent that Dr. Hoshizaki believes that the CSA system is the more rigorous of the two. Dr. Stalnaker never adequately addressed this issue. While I accept that increasing the drop height in a particular system will increase impact energy, it does not follow that employing the same drop height in a different system will result in the same impact energy. All other system factors must also be taken into account. I am not satisfied that Dr. Stalnaker's recommendations for drop testing do so.

[152] On balance, I found Dr. Hoshizaki to be a more cautious, responsive and reliable witness than Dr. Stalnaker in spite of Dr. Hoshizaki's past association with Bauer and continuing association with the CSA helmet committee.

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Dr. Bishop

[153] Dr. Bishop is now Professor Emeritus following 30 years as a faculty member in the Department of Kinesiology at the University of Waterloo. One of his particular research interests was in helmet efficacy in reducing the risk of head trauma. As earlier set out, he has been Chair of the CSA helmet committee since the mid-1990s. His involvement as a member with the CSA Technical Committee on Equipment and Facilities for Ice Hockey dates back to the late 1970s. Dr. Bishop is also a member of the ASTM hockey equipment sub-committee and head of delegation for Canada to the ISO technical and sub-committee responsible for developing its hockey helmet standard. Dr. Bishop is also very well qualified to express opinions on matters relating to the biomechanics associated with impact trauma to the human brain as well as standards development for hockey helmets.

[154] Although Dr. Bishop performed, and undoubtedly continues to perform, extensive volunteer work relating directly to hockey helmet standards for the CSA, he has never been an employee of the organization. This is also the first occasion on which the CSA retained him to provide an expert opinion for the purpose of a lawsuit.

[155] Dr. Bishop is very critical of Dr. Stalnaker's first report. He described it as lacking "scientific rigor", "erroneous in its assumptions" and "simplistic in its approach to a very complex problem."

[156] Dr. Bishop also responded to Dr. Stalnaker's recommended changes to the drop test method that the CSA utilizes. These included: the use of a humanoid type head-form; increasing the impact velocity; adopting an equivalent SI criterion; and incorporating a lower (more rigorous) pass/fail rate.

[157] As to the type of head-form, Dr. Bishop explained that the CSA considered using a humanoid type head-form at the time it was developing M90 but rejected it. At the time, such head-forms were only being used to test football helmets in the USA which were dropped onto a padded surface. Test results using the head-forms

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were variable and some of the energy was absorbed by the head-form alone and not just by the helmet as intended. The CSA also concluded the head-forms were too fragile for use in conjunction with a rigid impact pad. He further pointed out that the Hybrid III head-form, also referred to by Dr. Stalnaker, is covered with a “very thick rubber skin” which has the ability to absorb energy on impact. According to Dr. Bishop, the Hybrid III is not used anywhere in the world for a hockey helmet standard.

[158] As to impact velocity, Dr. Bishop points out that all manner of persons use certified helmets including youngsters, girls, women and players of differing abilities. The selection of 3.96 m/s as the impact velocity in M90 was intended to reflect the constellation of users. Selecting an impact velocity based on 6.0 m/s or 9.0 m/s would require a much stiffer liner in the helmets. This would manage the higher levels of energy associated with a fall from a greater height or skating at NHL speeds but:

> ... when these stiff liners were used by smaller people who could not generate the amount of energy needed to crush the liner and have it absorb energy, then the impact energy would be delivered directly to the skulls of those players, leading to potential injury. ...

He also pointed to the similarities in the impact velocity of 3.96 m/s incorporated into the ISO and CEN standards as well as the 4.5 m/s but onto a padded surface incorporated into the ASTM standard. Finally, he pointed out that testing to an upper limit impact velocity for hockey would be “contrary to common practices used in the evaluation and certification of other products and devices.” These include bicycle and motorcycle helmets as well as barrier crash testing for automobiles.

[159] Dr. Bishop also addressed Dr. Stalnaker’s criticism of the CSA adoption of 275 g as a failure criterion rather than the equivalent SI 1500. In response, Dr. Bishop contends that the SI is derived from tests conducted on biological tissue and accordingly is “only meaningful when used in conjunction with some type of humanoid head-form.” He further contended that studies demonstrate a strong correlation between SI and peak head-form acceleration. I interpret this evidence to

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mean that there is little or no benefit to be obtained in switching to a pass/fail criterion based on peak head-form acceleration expressed in SI units.

[160] Finally, as to Dr. Stalnaker's recommendation that there be a lower failure criterion, such as 225 g (SI 1200), Dr. Bishop points out that Dr. Stalnaker's recommendation appears rooted in changes to the NOCSAE standard for football helmets in the mid-1990s yet concussion injuries continue to be a problem in that sport.

[161] In addition to the above, Dr. Bishop also criticizes Dr. Stalnaker's interpretation of test results and his approach to modifying the second HH5000L. I have considered those criticisms as well as Dr. Stalnaker's detailed responses. In general, I did not find Dr. Stalnaker's responses persuasive. I will only refer directly to one as it relates to the helmet modification.

[162] In that regard, Dr. Stalnaker stated:

> **Response:** The padding used in modifying the HH5000L Helmet for testing purposes was in fact, thinner than the original liner. The replacement material was able to absorb more energy than the original material, without becoming a heavier helmet. This was also shown with the HH5100L redesigned by Bauer, being able to absorb more energy than their HH5000L. It was not Dr. Stalnaker's intent that Bauer should take his modification and apply it to all of their helmets. The intent was to show that a simple and easy modification, such as a less dense lining, could achieve better results. If it can be done in Dr. Stalnaker's lab, then the manufacturer should be able to look at the product and find ways to make it better, as they obviously did in the HH5100L and the HH9500L.

Under cross-examination by counsel for the CSA, Dr. Stalnaker explained that he used calipers to measure the thickness of the original liner although he made no note of the result.

[163] As Dr. Stalnaker demonstrated the measuring process in the courtroom, he changed his evidence and stated that the original liner "was something less than an inch" although, as earlier set out, the Rubatex modification was exactly one inch thick. Dr. Stalnaker went on to say: "So that's why I said it was less."

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[164] In fact, as the extract from the reply report set out above demonstrates, “it” referred to the Rubatex, not to the original liner. Dr. Stalnaker’s evidence on this point, like others, was, in the result, misleading.

Proposed changes to the CSA pass/fail criterion

[165] It is convenient, at this point, and important to set out other evidence, including that of Dr. Bishop, respecting a proposed change to the CSA failure criterion. In March 1994, Dr. Bishop reported to the hockey helmet committee that a female hockey player had suffered a skull fracture. According to the minutes of the meeting, “[a]ll members indicated that this was the first instance of which they were aware in which a focal injury occurred to someone wearing a certified hockey helmet.” During his evidence at trial, Dr. Bishop testified that he was not able to confirm that the injured player wore a certified helmet as he never spoke directly to her. It is apparent, however, from the content of the minutes and the annexure setting out his report, that he believed at the time that she was wearing a CSA certified hockey helmet.

[166] At the same meeting, Dr. Bishop asked the members to review the scientific rationale for the ASTM headgear standard using 300 g as its failure criterion. According to Dr. Bishop, this topic arose because the ISO was considering changing its standard from 300 g to the more rigorous 275 g. Dr. Bishop expressed his opinion in a report tendered at the meeting that he found little scientific basis for using 300 g as a failure criterion in evaluating human performance.

[167] At a subsequent meeting in May 1994, the committee decided to request a study comparing the impact requirements under the various helmet standards. According to the minutes, the motivation for the request was a concern about the relatively higher incidence of concussion injuries in hockey compared to other sports.

[168] The minutes also recorded three methods of improving the attenuating properties of hockey helmets: (a) increasing the impact energy; (b) lowering the

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allowable peak acceleration; and (c) combining the two. In the same month, Dr. Bishop authored a proposal on behalf of the University of Waterloo to evaluate existing helmets on the market. In the proposal, he addressed the "implications of changing the failure criterion to a value less than 275 g" and concluded:

> Based upon the above best estimates of serious brain injury, it seems desirable to have the failure criterion in [M90] changed to something on the order of 250 to 225g. It is not known at this time whether present hockey helmets can achieve such levels, nor what would have to be done if they did not.

At a further meeting of the committee on August 31, 1994, Dr. Bishop made a significant recommendation respecting the CSA pass/fail criteria.

[169] The minutes for the August 31, 1994, meeting disclose that the committee received the results of the University of Waterloo study as well as the recommendation:

> *Members discussed the results and their implications. It was noted that most models would pass the impact test if the pass/fail criteria was reduced to 250 g. If the criteria was lowered to 225 or 200 g some models would require a certain amount of re-engineering. The Chair suggested that the criteria should be at least lowered to 225 g, but indicated a preference for 200 g.*

The committee decided to circulate the data obtained in the study to the manufacturers and give them six months to "conduct their own testing to determine the feasibility of establishing 200 g as the pass/fail criteria." I observe that Dr. Bishop omitted this part of the history when writing his report.

[170] Dr. Bishop testified respecting the content of the committee records reviewed immediately above and described his intention at the time of the August meeting as giving the manufacturers a little challenge to see if the reduction could be achieved. In the end result, the pass/fail criteria was not changed and remained the same at the time of trial. However, in 2009, the hockey helmet committee recommended, and the CSA adopted, other changes to the standard, effective in 2011. These changes include the use of variable head-form masses, higher impact velocities, and the use of MEP pads rather than steel anvils.

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[171] In the end result, and in spite of his recommendation in August 1994, Dr. Bishop did not agree at trial that the pass/fail criteria should be changed. In his view, the recent head-form changes in the 2009 CSA standard were more than adequate and making the standard more rigorous by employing a greater drop height during testing is, at this stage, unnecessary. Dr. Bishop emphasizes that Darren sustained the only SDH while wearing a certified helmet that he is aware of and says that the M90 standard more than adequately protected against catastrophic focal injuries.

[172] In cross-examination, Dr. Bishop refused to accept Dr. Hoshizaki's statement in a 2004 publication that safety standards establish the benchmark for helmet performance and that unless the standard is changed, helmet safety will not improve. Dr. Bishop's own conduct in attempting to change the pass/fail criterion and wanting to give the manufacturers a little challenge is somewhat at odds with this evidence. Given that the manufacturers are just one of several interest groups represented on a committee that is structured so that no one group can control the outcomes, it appears that there was room for the committee to lead on the issue.

[173] While I appreciate Dr. Bishop is in a sensitive position as the ongoing chair of a committee that arrives at consensus decisions, he unnecessarily shaded his evidence at trial respecting his personal view. I am satisfied that Dr. Bishop recommended the changes to the pass/fail criterion because he believed, at the time, that it would lead to greater protection against the risk of serious head injury. As I later set out, pre-trial testing of Bauer helmets intended to duplicate Dr. Stalnaker's testing demonstrates that Bauer, at least, would have had no difficulty meeting the standard that Dr. Bishop proposed.

Dr. Newman

[174] The CSA also retained a private consultant, Dr. Newman, to testify at trial. Dr. Newman is a biomechanical engineer with expertise respecting impact trauma to the head as well as helmet design and the development of standards for helmets. He has extensive experience on CSA technical committees, including the committee

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on athletic protective equipment from about 1970 to 1975. As a result, Dr. Newman was involved with the development and adoption of the preliminary hockey helmet standard in 1973. He also chaired a CSA task force on head protection in 1983. Dr. Newman has continued his involvement with the CSA since the 1970s by serving on various other committees unrelated to hockey helmets. As mentioned earlier, the plaintiffs also object to the admissibility of Dr. Newman's evidence based on his lengthy historical relationship with the CSA.

[175] In his first report Dr. Newman criticizes Dr. Stalnaker's estimated impact speed as nothing more than a guess and opined that any helmeted head-to-boards impact was relatively minor. He went on to question the assumption that a bridging vein ruptured, although he conceded that the assumption is reasonable. According to Dr. Newman, rotational movement of the head rather than a sudden stopping of the skull is the usual cause of bridging vein rupture.

[176] As to Dr. Stalnaker's assumed head impact speed based on skating speed or falling heights is concerned, Dr. Newman pointed out that the head-form impact speed used in testing motorcycle helmets in the United States is between 5 and 6 m/s (3.6 k/h) even though motorcycles may travel at speeds well in excess of 100 k/h. Dr. Newman reasoned that the impact speed utilized in M90 is demonstrably an "entirely appropriate" standard because serious head injuries are an "extremely rare occurrence" in hockey.

[177] Dr. Newman is very critical of Dr. Stalnaker's modifications of the used HH5000L. In his report, he stated:

> Stalnaker goes on to show that the Bauer Nike HH5000L could be redesigned to produce an even lower SI. He achieves this by replacing a portion of the interior liner in the back of the helmet with a 1 inch thick piece of vinyl nitrile foam. This simplistic approach to reducing brain injury among hockey players is naïve and not really deserving of serious debate. Of course adding more/less or thicker/thinner or different liner material will change the response of the headform/helmet to an impact. In so doing it can alter the probability of head injury to a wearer subjected to a similar blow. If adding a 1 inch thick vinyl nitrile pad reduces the likelihood of brain injury for an impact to the back of the helmet, one might logically ask: would it not be a good idea for the front, top and sides? Of course it would. But if 1 inch is good would not

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> say 1.5 inches be even better? Of course it would. Why not in fact go *all in* and prescribe a football helmet or one worn by motorcyclists. The fact is that in order to increase protection one must do so at the expense of something else — such as increased weight, poorer stability, less attractive appearance, higher cost, less ventilation, and so on. It takes more than adding a piece of foam to make a better helmet.

[178] Dr. Stalnaker's response to these criticisms was inadequate.

[179] In his reply report, Dr. Stalnaker suggested that the impact speed used for motorcycle helmet testing is based on the average vertical falling distance for a motorcycle rider. If that is so, it is curious that Dr. Stalnaker went to such lengths to establish Darren's impact speed. It also does not address the significantly greater disparity in speed achieved on a motorcycle in contrast to skating. Dr. Stalnaker did not address Dr. Newman's criticism of the helmet modifications in his reply report.

Admissibility of defendants' expert evidence

[180] Counsel for the plaintiffs contends that the opinions of Drs. Hoshizaki, Bishop and Newman are inadmissible because the witnesses were not independent and impartial. Alternatively, he says that they are not deserving of weight for that reason.

[181] Counsel puts forth several cases to support its argument that any prior relationship between the expert and the party should result in the exclusion of the expert's testimony. Most of that authority is from out-of-province.

[182] There is also support in this province for a contextual approach. The most recent case in British Columbia is *Beazley v. Suzuki Motor Corporation,* 2010 BCSC 480.

[183] In *Beazley,* the plaintiffs alleged they suffered injury because of design defects in a car produced by the defendant corporation. The defendant wanted to introduce expert evidence from an employee respecting the quality and thoroughness of the design process of the vehicle. Justice Goepel reviewed the jurisprudence that the plaintiffs rely on here and stated:

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[20] Canadian courts appear to have taken different positions on the issue of whether an expert witness' bias or perceived bias will disqualify him or her from giving evidence at trial. Some courts have held that for expert evidence to be admissible, the expert must be seen to be absolutely neutral and objective. Other courts have concluded that a lack of objectivity, neutrality and independence are matters that only impact the weight to be afforded that expert. Romilly J. in *United City Properties Ltd. v. Tong*, 2010 BCSC 111 at paras. 35-68, has exhaustively reviewed the jurisprudence.

[21] The cases are not easily reconciled. Where there is a personal relationship between the proposed expert and the party, where the expert has been personally involved in the subject matter of the litigation or where the expert has a personal interest in the outcome, the expert has not been allowed to testify. Examples of such cases are *Fellowes, McNeil v. Kansa General International Insurance Co.* (1998), 40 O.R. (3d) 456 (Gen. Div.); *Royal Trust Corporation of Canada v. Fisherman* (2000), 49 O.R. (3d) 187 (Sup. Ct. J.); *Bank of Montreal v. Citak*, [2001] O.J. No. 1096 (Sup. Ct. J.); and *Kirby Lowbed Services Ltd. v. Bank of Nova Scotia*, 2003 BCSC 617. In cases where the relationship between the expert and the party is more institutional in nature, the evidence has been admitted subject to weight. Examples of such cases are *R. v. Klassen*, 2003 MBQB 253 and *R. v. Inco Ltd.* (2006), 80 O.R. (3d) 594 (Sup. Ct. J.).

[22] Mr. Wood is more in the category of an institutional witness. He was not involved in the development of the Tracker. He has no personal interest in the outcome of the litigator.

[23] In *Inco* the defendant was accused of discharging untreated mine effluent into a watercourse. The trial judge declined to qualify a proposed Crown witness as an expert capable of giving opinion evidence on the ground that the witness was an employee of the Enforcement Branch of the Ministry of the Environment and could be perceived as lacking independence. On appeal, the court found that the trial judge had erred in summarily rejecting the witness. The court held at para. 49:

> A finding of lack of independence or impartiality cannot be based on a cursory examination of the employment relationship or status. Unless the court is satisfied that the witness is in a co-venture with the party, is currently in a position as an advocate for the party or has acted as advocate for the party on the same matter, the court must test any perceived partiality through a *voir dire* hearing that tests the substance of the opinion to be proffered. After such a *voir dire*, the trial judge will be in a much better position to assess the partiality of the witness.

[24] In my opinion, those considerations apply in this case. I cannot find on the limited material before me on this application that Mr. Wood cannot be properly qualified as an expert witness. He is a trained engineer with extensive experience in the automobile industry. He was not directly involved in the development of the Tracker. While his employment at GM may influence the weight to be given to his opinion, I cannot summarily determine that it is improper for him to testify. In the circumstances of this case I accept

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> the defendants' submission, that his perceived partiality must be tested in the course of a *voir dire*.

In *Lee v. Swan* (1996), 19 B.C.L.R. (3d) 21 (C.A.), the Court of Appeal also supports a contextual approach. That case involved an appeal from a judgment awarding damages suffered in a motor vehicle accident. The plaintiff alleged soft tissue damage and relied on the expert opinion of her chiropractor. The chiropractor and plaintiff signed a form authorizing the plaintiff's solicitor to pay the chiropractor directly from the proceeds of settlement or trial. Accordingly, the chiropractor had a pecuniary interest in the outcome of the proceedings. In discussing the effect of this interest, Goldie J. states:

> [32] Now it is unusual, so far as I am aware, for the burden of a contingency arrangement to be in part transferred from the solicitor to a care giver, but where the care giver is an expert witness permitted to express opinions there is room for concern over his or her disinterest in the outcome of the litigation. I am not referring to bias or even apprehension of bias. I am referring to what Fletcher Moulton L.J. in *Lovell and Christmas Ltd. v. Wall* (1911) 104 L.T. 85 (C.A.) at 91 described as the fact that honest people naturally intensify a little in the direction in which their interests point. This is a matter, then, that affects the weight to be given the evidence of this witness.

Overall, in my view, the British Columbia jurisprudence rightly favours a contextual approach to determining whether a prior relationship between an expert and party is grounds to exclude the expert's testimony. I decline to exclude any of the opinion evidence under challenge in the present case.

[184] Instead, I have considered the past and present relationships between each defence expert and the particular party that retained him in assessing the weight to be given to their evidence. None are employees, or otherwise have such a close relationship, so as to justify excluding their evidence rather than taking it into account in the usual way in assessing weight. With the one exception noted earlier respecting Dr. Bishop's personal view about changing the pass/fail criteria in 1994, all three testified in accord with their stated acknowledgment of the duty that an expert owes to assist the court and not to act as an advocate for a party. In general, their opinions appear academically sound and were carefully presented. Cross-

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examination of these witnesses, unlike that of Dr. Stalnaker, did not reveal obvious deficiencies or other indicia of unreliability in their evidence.

Other Bauer testing of the HH5100L and HH5000L

[185] As well, results of additional helmet testing by Bauer support the general tenor of the defence expert evidence. This testing attempted to duplicate aspects of Dr. Stalnaker's testing methods. The impact speed was 6.0 m/s (1.83 m/6 ft drop) using a NOCSAE testing apparatus with a rubber MEP pad.

[186] On January 8, 2010, the results of testing the rear location of an unused second generation HH5000L helmet were:

Trial	**SI**	**g**
1	742	135
2	973	169
3	1088	189

[187] On January 25, 2010, the Neurotrauma Impact Laboratory at the University of Ottawa impact tested an unused HH5100L helmet in a similar fashion. The results were:

Trial	**SI**	**g**
1	688	126
2	841	153
3	836	148

[188] On March 12, 2010, the same laboratory tested another unused second generation HH5000L helmet in the same way as on January 8 except that the tester placed a piece of 2" x 4" wood on top of the MEP pad. The results were:

Trial	**SI**	**g**
1	691	128
2	901	153
3	1017	165

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[189] Two points are evident from these tests. First, there is no meaningful difference between the test results for the new HH5000L and HH5100L helmets in spite of their different liners. Second, Dr. Stalnaker recommended that the pass/fail criteria in the standard should be 1200 SI. The average SI results for the three test dates were well under 1200 SI and no individual test result exceeded it.

Conclusion respecting cause of injury

[190] Taking all the evidence into account, I am satisfied that Darren suffered torn bridging veins as a result of his rear helmeted head impact with the boards. While the impact was primarily translational, there was also some degree of brain rotation involved. The speed at impact is unknown but was certainly no more than 6.0 m/s (13 mph) and probably significantly less.

[191] The rear impact attenuating qualities of a hockey helmet do not, in any way, protect against the effect of rotational impacts as evidenced by the continuing frequency of concussive injuries in the game. Dr. Stalnaker's recommended changes to the standard do not address that issue.

[192] Darren's injury is a highly unusual one in hockey. I am not persuaded that the rear impact design features of his helmet contributed to it at all. This unfortunate accident may have occurred, as Dr. Hoshizaki suggested, because Darren was predisposed to such injury.

Duty of care

[193] There is no issue that Bauer, as a manufacturer of consumer products, had a duty to take reasonable steps to ensure that its hockey helmets were safe for their intended use. Bauer must design products to minimize the risks arising from their intended use and to minimize the loss that may result from reasonably foreseeable mishaps involving the product. See *Tabrizi v. Whallon Machine Inc.*, [1996] B.C.J. No. 1212 (S.C.) (QL).

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[194] Bauer relies on decisions from outside British Columbia for the basic principles relating to claims of negligent design. These cases are largely consistent with the law in this province. Bauer also relies on several British Columbia cases, such as *Tabrizi,* as well as *Phillippot v. Murphy,* [1987] B.C.J. No. 530 (C.A.) (QL), and *Meisel v. Tolko Industries Ltd.,* [1991] B.C.J. No. 105 (S.C.) (QL), for the basic principles of negligence law. None of these decisions have been overruled and they accurately set out the principles of negligence law.

[195] The most recent expression from the B.C. Court of Appeal on the proper approach in a negligent design case is *Harrington v. Dow Corning Corp.,* 2000 BCCA 605, where Huddart J.A. states:

> [42] At the risk of oversimplifying a complex decision-path, I venture to suggest the first step in every products liability case alleging negligent design, manufacture, or marketing is the determination of whether the product is defective under ordinary use or, although non-defective, has a propensity to injure. Some American authorities refer to this step as "general causation", whether a product is capable of causing the harm alleged in its ordinary use.
>
> [43] The second step is the assessment of the state of the manufacturer's knowledge of the dangerousness of its product to determine whether the manufacturer's duty was not to manufacture and distribute, or to distribute only with an appropriate warning. It may be prudent to refer to this as an assessment of the state of the art; it may be that a manufacturer did not but should have known of its product's propensity for harm.
>
> [44] In my view, these two steps are the "risk assessment" Mr. Justice Mackenzie permitted to be undertaken as a part of what he saw as a multi-staged proceeding.
>
> [45] If the value of the product's use outweighed its propensity to injure such that distribution with a warning was appropriate, the third step will be an assessment of the reasonableness of the warning (whether direct or by a learned intermediary) given the state of the art and the extent of the risks inherent in the product's use.
>
> [46] The final step will be the determination of individual causation and damages. The difficult question will be whether the individual's knowledge of the risks would have prevented the injury. If the product should not have been manufactured or distributed, the determination of whether the product caused the injuries to the individual seeking damages and the assessment of those damages will be the last step. At this stage, the risks created by the product will be used to determine whether a defendant caused the alleged injury to an individual plaintiff. They may also be used in the determination of the date of discoverability for the purposes of any limitation defence, and for the allocation of fault, if that becomes necessary.

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> [47] I arrive at this analytic approach from *Donoghue v. Stevenson* [1932] A.C. 562 (H.L.) at 580; *Grant v. Australian Knitting Mills Ltd.*, [1936] A.C. 85; *Phillips v. Ford Motor Co.* (1970), 12 D.L.R. (3d) 28, [new trial ordered for other reasons, [1971] 2 O.R. 637 (C.A.)]; *Lambert v. Lastoplex Chemicals Ltd.*, [1972] S.C.R. 569; *Nicholson v. John Deere Ltd.* (1986), 34 D.L.R. (4th) 542 at 549 (Ont. H.C.J.), (appeal dismissed (1989), 57 D.L.R. (4th) 639 (C.A.)); and *Hollis v. Birch*, [1995] 4 S.C.R. 634.

Harrington is the most appropriate case to rely on for the basic principles of negligent design in British Columbia.

[196] As Bauer notes, the application of the general principles of negligent design to a product like a helmet is not straightforward. One of the difficulties in applying the general principles here is that a helmet is not inherently dangerous in the same way some other products are. Instead, a helmet is meant to protect against an existing risk of harm. It does not create a previously non-existent opportunity for harm to occur.

[197] Bauer cites the only Canadian case involving the alleged liability of a helmet manufacturer for negligence: *Moore v. Cooper Canada Ltd*., [1990] O.J. No. 66, in which Rutherford J. finds that helmets are not inherently dangerous. On one level, the finding makes sense. A helmet is designed to protect against danger, thereby reducing the risk of harm rather than increasing the risk of harm. However, if one applies the usual negligent design analysis, a finding that a helmet is not inherently dangerous might mean that a helmet manufacturer, or a manufacturer of any safety device, is not liable for injuries even if the safety device offered little or no actual protection.

[198] It is obvious that a more contextual analysis is required. In my view, safety devices are inherently dangerous if they fail to provide reasonable protection when in normal use.

[199] As to the standard of care, Bauer relies on *Enslev v. Challenges Unlimited Inc.,* [2007] O.J. No. 4140 (QL) (Sup. Ct. J.), aff'd 2009 ONCA 44, for the proposition that a lack of prior accidents involving a particular product is relevant to the issue of negligence. On reviewing the decision, I am not persuaded the court gave that factor

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any weight as Lofchik J. did not refer to it in his discussion of foreseeability, or the standard of care.

[200] However, in *Hadley v. Venetian Blink Service Centre*, 2000 BCSC 1321, Powers J. found a lack of prior accidents to be relevant in determining the standard of care. In *Hadley,* the plaintiff suffered an injury when a venetian blind fell and struck her on the wrist. Mr. Justice Powers states at paras. 39 and 40:

> [39] The defendant referred to the decision *Kirby v. Canadian Tire Corp*., [1989] M.J. No. 28 (Man.Q.B.) in which the plaintiff was injured by a blade on a food processor. The blade was extremely sharp and had been packed in the box when the plaintiff reached into the box he cut himself on the blade. The court found the manufacturer was not aware of any claims for personal injuries arising out of the use of the model of the food processor in question, that some sort of a cover would have made the blade safer but the fact that the blade was uncovered did not amount to negligence when there was no evidence of any previous injuries:
>
> [40] The defendants had no reason to believe that anybody would be injured by the sharp edge in the fashion that the plaintiff was and therefore were not negligent in failing to cover the sharp edge on the head rail. The standard of care required is reasonable care in the circumstances (*Phillips v. Ford Motor Co. of Canada Ltd.*) [1971] 2 O.R. 637 (Ont.C.A.).

In *Moore,* Rutherford J. also relies on a lack of previous injuries of the type suffered by the plaintiff as evidence that the defendant had met its standard of care.

[201] In its discussion of the effect of an available alternative design, Bauer relies on *Rowe (Guardian ad litem of) v. Sears Canada Inc.,* 2005 NLCA 65, an appeal of a decision dismissing an action for damages resulting from an accident involving a Raleigh bicycle. The plaintiff alleged a design defect caused her to fall off the bicycle and suffer injuries.

[202] Bauer relies on the following statement:

> [20] Design defect is not the result of something having gone wrong in the production of the product but an error in the design of the product. The central question is whether a different design ought to have been used by the manufacturer. In cases of design defect it is the design specifications themselves which create the risk to the consumer. As is obvious, a finding that there had been a design defect results in a whole line of products being defective. A finding of manufacturing defect relates only to the item under consideration. [Emphasis added.]

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There are similar statements in some British Columbia cases. For example, in *Tabrizi,* Romilly J. states:

> [35] In determining whether the defendant fulfilled its first duty, to manufacture a reasonably safe product, the plaintiff must prove to the court that the machine as designed was not reasonably safe in accordance with a two part test:
>
> (a) there was a substantial likelihood of harm; and
>
> (b) it was feasible to design the product in a safer manner.

While an alternative design is an important consideration, the Supreme Court of Canada has found that the availability of a feasible alternative design does not always result in liability. See *Dallaire v. Paul-Émile Martel Inc.,* [1989] 2 S.C.R. 419, at paras. 12 and 13:

> [12] The appellant further argued that the design of the conveyer was inadequate because the equipment should have been so designed that it would be unnecessary for the covers to be removable and because the covers should at least have been equipped with hooks. It is perhaps true that the conveyer could have been designed to be safer, and it is true that without protection the worm screw did represent a danger. However, the respondent had provided adequate covers capable of ensuring safety and which could be used without great difficulty. To my mind the fact that they were removable and had no fasteners did not make them inadequate, although it had an effect on the operation of the conveyer, making it necessary to put them back from time to time. However, the appellant had stopped using the covers for three months. The accident was caused by the failure to use them. It was a serious fault for which the respondent cannot be held responsible.
>
> [13] The appellant's accident did not occur because the conveyer was dangerous but rather because it was carelessly used. The users of equipment entailing dangers of which they are or should be aware have an obligation to use it carefully, in particular by using safety devices provided by the manufacturer. The conveyer was not dangerous when the metal covers were in place. The appellant and his father Mr. Francis Côté failed in their duty of care and thereby caused the appellant's accident. The fact that the worm screw may have been dangerous was therefore not the cause of the appellant's accident, but merely occasioned it: the accident was rather due to the way in which the appellant and his father used the conveyer.
>
> [Emphasis added.]

As a result of *Dallaire,* the current state of the law in Canada is that a manufacturer does not have to use the safest design available so long as the design was reasonable in the circumstances.

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The CSA

[203] Unlike Bauer, the CSA does not acknowledge owing a duty of care to the plaintiffs. Counsel for the CSA submits:

> 54. It is clear that Canada's National Standards System relies upon volunteer members of technical committees to develop standards and the technical content of those standards is not reviewable by standards development organizations or by the Standards Council of Canada. This is so whether or not the standard achieves the status of a National Standard of Canada which was achieved by the hockey helmet standard.
>
> 55. Accordingly, accredited Canadian standards development organizations do not owe a duty of care concerning the technical content of standards developed by members of technical committees.

In other words, counsel submits that the CSA only facilitates the development of standards and is not responsible for the technical content. Counsel further contends that there is insufficient proximity between the plaintiffs and the CSA for a duty of care to exist.

[204] The CSA relies on *Hughes v. Sunbeam Corp. (Canada) Ltd.* (2002), 61 O.R. (3d) 433, for the proposition that standards setting organizations owe no duty of care to users of goods that the organization has tested and approved. While that case is helpful in applying the two-part *Anns* test, as discussed by the Supreme Court of Canada in *Cooper v. Hobart,* [2001] 3 S.C.R. 537, it is not necessarily determinative of the outcome in the present case. Only economic loss was at issue in *Hughes* whereas the loss in the present case flows from personal injury in circumstances where Darren was required to wear a certified helmet. Below, I discuss the *Anns* test as set out in *Cooper* and then contrast the circumstances in *Hughes* with the present case.

[205] As set out in *Cooper,* at para. 22, the duty of care analysis starts with the proposition that:

> … liability would lie for negligence in circumstances where a reasonable person would have viewed the harm as foreseeable. However, foreseeability alone was not enough; there must also be a close and direct relationship of proximity or neighborhood.

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To answer the question, what is proximity, one looks first to negligence categories in which proximity has already been recognized. When a new category is suggested, the circumstances must disclose foreseeability as well as "sufficient proximity to justify the imposition of liability for negligence" (para. 23).

[206] The first part of the *Anns* test is directed at whether there is sufficient proximity to create a "*prima facie* duty of care" (para. 24); this is then followed by the second part, that is, a "consideration of whether there were any factors negativing that duty of care" (para. 24). Commencing at para. 30, the judgment in *Cooper* states:

> [30] In brief compass, we suggest that at this stage in the evolution of the law, both in Canada and abroad, the *Anns* analysis is best understood as follows. At the first stage of the *Anns* test, two questions arise: (1) was the harm that occurred the reasonably foreseeable consequence of the defendant's act? and (2) are there reasons, notwithstanding the proximity between the parties established in the first part of this test, that tort liability should not be recognized here? The proximity analysis involved at the first stage of the *Anns* test focuses on factors arising from the relationship between the plaintiff and the defendant. These factors include questions of policy, in the broad sense of that word. If foreseeability and proximity are established at the first stage, a *prima facie* duty of care arises. At the second stage of the *Anns* test, the question still remains whether there are residual policy considerations outside the relationship of the parties that may negative the imposition of a duty of care. It may be, as the Privy Council suggests in *Yuen Kun Yeu*, that such considerations will not often prevail. However, we think it useful expressly to ask, before imposing a new duty of care, whether despite foreseeability and proximity of relationship, there are other policy reasons why the duty should not be imposed.
>
> [31] On the first branch of the *Anns* test, reasonable foreseeability of the harm must be supplemented by proximity. The question is what is meant by proximity. Two things may be said. The first is that "proximity" is generally used in the authorities to characterize the type of relationship in which a duty of care may arise. The second is that sufficiently proximate relationships are identified through the use of categories. The categories are not closed and new categories of negligence may be introduced. But generally, proximity is established by reference to these categories. This provides certainty to the law of negligence, while still permitting it to evolve to meet the needs of new circumstances.

If a category of negligence has been previously recognized, then reasonable foreseeability is established and a *prima facie* duty of care "may be posited"

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(para. 37). I accept, as did the court in *Hughes,* that there has not been, to this point, a category of negligence for standards writing associations.

[207] *Hughes* was an appeal from a decision to strike a statement of claim for disclosing no reasonable cause of action. The plaintiff sued in negligence for damages equivalent to a refund of the purchase price of an allegedly defective smoke alarm. In addition to suing the manufacturer, First Alert, the plaintiff sued the Underwriters Laboratories of Canada (ULC) which certified and approved the smoke alarm. The plaintiff alleged that ULC negligently set inadequate safety standards, negligently approved and certified a product it knew to be unsafe, and negligently failed to warn of the product's unreliability.

[208] Mr. Justice Laskin found that the relationship between the parties was not one that the courts had previously recognized and, as a result, he could not posit proximity:

> [43] I do not believe Canadian courts have yet recognized that an independent tester and endorser - in setting safety standards and testing products - owes a duty of care to the ultimate consumer of a product it has tested and approved. Lack of previous recognition, of course, does not bar a claim from going forward, especially on a rule 21.01(1)(b) motion. The court could recognize a new category. But, in my view, the parties here do not have the necessary "close and direct" relationship that would justify imposing a duty of care on ULC to compensate Hughes for his economic loss.
>
> [44] Two main considerations suggest that the proximity requirement has not been met. First, an independent tester and endorser, like ULC, approves products for the benefit of the entire public. By doing so, it encourages manufacturers to design and build their products safely. But it does not undertake responsibility to protect individual homeowners from economic loss if a product it has approved turns out to be defective. Second, it hardly seems fair and just to permit an individual who has not paid for a valuable service like testing to sue the tester when the service is negligently performed. For these reasons, Hughes' negligence claim against ULC does not pass the first stage of the *Anns* test. Proximity has not been established. Therefore, no duty of care exists. [Emphasis added.]

Mr. Justice Laskin also concluded that the plaintiff's case failed the final part of the *Anns* test, namely whether residual policy considerations outside the relationship between the parties negate the duty of care. He stated:

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> [45] Even if a *prima facie* duty of care did exist, residual policy considerations at the second stage of the *Anns* test would negate the duty. These residual considerations go beyond the relationship between the parties. They concern broader legal and societal interests: see Cooper. Three stand out.
>
> [46] First, Hughes' claim raises the spectre of indeterminate liability in an indeterminate amount, a limiting principle in all economic loss claims. The motions judge made this point well at para. 97 of his reasons:
>
> > Another important issue is indeterminate liability. To extend liability beyond the limited scope set out in Winnipeg Condominium would create a serious risk of imposing liability in an indeterminate amount. This is of particular concern with respect to ULC. Unlike the manufacturer or retailer, ULC may not profit from each unit sold, or may receive a very small profit. It has, after all, only been involved in the testing of the product. Conceivably, someone in the position of ULC may set standards for a product, for which it is paid, and then be liable for every unit sold if it was negligent in the setting of those standards. In both Rivtow and Winnipeg Condominium, at issue was a single structure. Here, we are dealing with liability for a mass-produced product. Given that a defendant in the position of ULC is so far removed in the production process, for it to bear the cost of consumers' contract-like losses could risk bankrupting it.
>
> [47] The position of ULC can be contrasted with that of First Alert. As a supplier of ionization smoke alarms First Alert presumably profited from their sale in proportion to the number of units sold. Thus, the danger of imposing indeterminate liability, though present, is a less compelling policy consideration in the claim against it than in the claim against ULC.
>
> [48] The second and related consideration is that imposing a duty of care on ULC would effectively create an insurance scheme for dissatisfied purchasers, a scheme for which the purchasers have paid nothing.
>
> [49] Finally, manufacturers are better positioned to ensure the supply of safe products and provide a more efficient target for redress if their products prove to be unsafe. The law should not expand duties of care at the price of encouraging needless and expensive litigation.

Whether Laskin J.A. intended his analysis to apply solely to claims of pure economic loss or generally to all claims in negligence by consumers against standards setting organizations is unclear. At several points in the judgment, he stated that the claim was for pure economic loss only (paras. 1, 21, 26, and 36). At para. 50, he also stated: “I agree with the motions judge that Hughes’ claim against ULC in negligence for pure economic loss does not disclose a reasonable cause of action.”

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[209] Mr. Justice Laskin concluded that ULC did not owe a duty of care to the plaintiff because of a lack of proximity. Even if a *prima facie* duty of care existed, he found that residual policy considerations outside the relationship between the parties negated the duty of care. I paraphrase the factors identified below: first, the spectre of indeterminate liability in an indeterminate amount; second, imposing a duty of care would effectively create an insurance scheme for dissatisfied purchasers even though they had not paid for the scheme; and finally, manufacturers are better positioned to ensure the supply of safe products and provide a more efficient target for redress (see paras. 45–49).

[210] Only one case has come to my attention that discusses whether *Hughes* pertains only to pure economic loss: *Colantino (Litigation Guardian of) v. Kuhlmann,* [2006] O.J. No. 903 (S.C.J.). In that case, the plaintiff suffered injuries after diving into a pool. She sued the manufacturer of the pool for negligence, as well as the National Spa and Pool Institute of Canada (NSPIC), a voluntary trade organization that set design and construction standards for above-ground swimming pools. The NSPIC applied for summary judgment to dismiss the claim on the basis that it disclosed no reasonable cause of action. The judge denied their application and the NSPIC appealed, relying on *Hughes* for the proposition that standards organizations have no duty of care to consumers. In denying their appeal, Zelinski J. found that *Hughes* leaves open the question of whether claims against standards setting organizations not premised in economic loss are barred by a lack of duty of care (para. 20).

[211] As I have set out, I do not consider *Hughes* determinative of the proximity analysis in the present case. Nonetheless, some of the same issues are present in spite of the different type of injury. My *Anns* analysis follows.

[212] I am satisfied that it was reasonably foreseeable that a hockey player and wearer of a mandatory certified hockey helmet might suffer harm if the CSA set the certification standard unreasonably low in the circumstances. On the question of proximity, I extrapolate from *Cooper* at paras. 32–34. Is the player, who must obtain

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and wear a certified helmet in order to participate in organized hockey, so closely and directly affected by the CSA decision respecting the adequacy of the certification standard that the latter ought reasonably to have the player's legitimate interest in safety in mind? In my respectful view, the answer must be yes.

[213] By legislative definition, any hockey helmet that is not certified is a hazardous product and cannot be sold in Canada. No matter how well designed the helmet may, in fact, be, no manufacturer can offer it for sale unless it is certified. The consumer hockey player has no choice and buys, or otherwise obtains, the helmet for the purpose of self-protection in a game that has inherent dangers. Nonetheless, there is some reliance by the consumer on the fact of certification and an expectation that the risk of at least some injuries is reasonably reduced. Otherwise, there would be no need for any helmet at all.

[214] With the greatest of deference to the possibility that *Hughes* stands for a different outcome*,* I am satisfied that there is sufficient proximity in the present case for a *prima facie* duty of care. I turn next to whether there are policy considerations outside the relationship that should immunize the CSA from liability.

[215] On this question, I take into account that the CSA is largely a volunteer organization that facilitates the development, establishment and review of standards. There is a public service aspect to its performance and extending the risk of liability to the organization might impact its ability to carry on.

[216] Of the three considerations identified in *Hughes,* only the last potentially applies, in my view. Indeterminate liability is not a factor here. The plaintiff's claim is based on actual physical injury and a rare injury pattern at that. There is no widespread economic loss; accordingly, the CSA would only be potentially liable to persons who suffer physical harm as a result of their negligence. Similarly, the claim against the CSA is not like a free insurance scheme. The specific allegation is that M90 did not set the bar high enough to reduce the risk of the particular injury that Darren sustained.

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[217] It is, however, true that the manufacturers are in the best position to ensure the supply of hockey helmets that are adequate for their intended purpose. But the manufacturers also play a significant part in setting the very standard that they are required to meet. Given that the standard is a minimum, this might encourage some manufacturers to maintain the bar at an artificially low level.

[218] Finally, I take into account other broad policy considerations that apply to allegations of negligence causing physical rather than economic harm. As Klar states in *Tort Law,* 4th ed. at 225:

> When one's bodily security or personal integrity has been harmed by the wrongful acts of others, imposing civil sanctions can be justified not only on the basis of the need to compensate the victim, but also on the basis of justice, punishment, deterrence, and education. Interference with an individual's security interests affects not only that individual; it also undermines everyone's sense of well-being, should the offence go unanswered. Since personal injuries can never be fully repaired, even by the payment of monetary damages, it is critical to try to reduce the incidence of these losses, by utilizing the deterrent and educative functions that negligence law provides. Economic losses, which occur generally in a business context, where there is no threat to personal security, do not raise the same concerns. It may be possible to accommodate these losses more adequately by non-tort, non-adversarial, methods.

In all the circumstances, I am not persuaded that I should negate the *prima facie* duty of care and conclude that the CSA owed a duty of care to Darren.

Liability

[219] Perhaps not surprisingly, the plaintiffs' final submissions on liability did not rest heavily on Dr. Stalnaker's evidence. Indeed, there is little reference to his evidence in their written submission.

[220] Instead, the plaintiffs focused on the alleged breach of duty by both the CSA and Bauer in failing to change M90 by lowering the peak acceleration (the pass/fail test) or by increasing the impact energy (increasing the drop height), or a combination of both, so as to "overcome the risk of serious head injury that Dr. Bishop had foreseen." After the defendants knew in August 1994 of Dr. Bishop's recommendation to the hockey helmet committee to change the M90 failure criterion

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from 275 “to something in the order of 250 to 225 g”, the plaintiffs say that they had a duty to act upon this information. The plaintiffs further say that the risk that Dr. Bishop identified:

> … had such serious potential consequences for users of the helmets that a failure to act on Dr. Bishop’s advice and recommendations was a failure to meet the standard of care the law imposes on the manufacturer of a safety product.

It is clear that the committee did not accept Dr. Bishop’s recommendation and, as I earlier observed in my reasons, Dr. Bishop distanced himself at trial from his previously expressed view although, in fairness, he also opined that the head form changes and increased drop height in the 2009 CSA standard were more than adequate.

[221] Returning to the plaintiffs' submissions, they say that in the result the testing standard was not improved by the time Darren’s father purchased the helmet in 2003 and, as a consequence of that, the manufacturers, including Bauer, had not improved the attenuation qualities of the helmets.

[222] On the evidence, these submissions have no merit. In all the evidence of rear impact helmet testing, including that conducted by Dr. Stalnaker, I cannot find a single instance, up to and including drops from 6.0 ft (1.83 m) using the NOCSAE apparatus, resulting in a reading of 200 g or greater. Accordingly, even if the committee had increased the standard by lowering the criteria, say to 225 g as Dr. Bishop recommended, all indications are that the second generation HH5000L would have tested within the threshold.

[223] Further, notwithstanding Dr. Hoshizaki’s observation that the manufacturers will only build to the applicable standard, it is obvious that the Bauer helmets were well within the M90 standard of 275 g. The fact that Bauer consistently manufactured helmets that met a more stringent standard than M90 indicates that Bauer, at least among manufacturers, was not just building to meet the existing standard but exceeding it as well as Dr. Bishop’s proposed standard.

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[224] The plaintiffs' claim that both the CSA and Bauer breached their duty of care by not changing the certification standard cannot succeed in the circumstances. The helmet that Darren wore would have met the revised standard that the plaintiffs urge upon me. If I am wrong in this conclusion, the plaintiffs face a further hurdle respecting causation that I consider to be insurmountable.

[225] Assuming that the defendants ought to have agreed to revise the M90 standard to include a pass/fail criterion of 250 to 225 g, the plaintiffs still must prove that, “but for” the breach, the injury and alleged losses would not have happened. See *Athey v. Leonati,* [1996] 3 S.C.R. 458. Because the helmet in question was successfully tested to a more rigorous standard, the plaintiffs cannot satisfy the “but for” test.

[226] The plaintiffs suggest that a rigid application of the “but for” test would lead to an unjust result in this case and say that, for reasons outside their control, it is impossible to meet the test. Instead they urge me to apply the “material contribution” test set out in *Resurfice Corp. v. Hanke,* [2007] 1 S.C.R. 333.

[227] The basic test for causation in negligence is the “but for” test: *Resurfice Corp.* at para. 21. The plaintiff has the burden to show that but for the negligent act or omission of the defendant, the injury would not have occurred. The law has recognized exceptions to the “but for” test and applied a “material contribution” test in some situations. One is where there are two sources of tortious conduct, and it is impossible to prove which caused the injury. That clearly does not apply here. The other is when proving what a particular person in the causal chain would have done had the defendant not committed a negligent act or omission is impossible: *Resurfice Corp.* at para. 28. In my view, the exception to the “but for” test would not apply here.

[228] The plaintiffs also contend that the defendants ought to have known that there was, under M90, a risk of serious head injury like an SDH. Apart from pointing to the one example that Dr. Bishop referred to of an apparent head injury while wearing a certified helmet in 2003, the evidence does not disclose a history of helmeted

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players sustaining serious head injuries, apart from concussions. I take into account the somewhat limited evidence of Dr. Tator that there were three cases involving SDH or EDH over about a ten year period in Ontario between 1986 and 1995, referred to earlier, as well as Darren's own injury in 2004. I do not accept that the practical experience with M90 was such that the defendants ought to have known that players were unreasonably at risk of suffering a serious head injury like an SDH while wearing a certified helmet.

[229] In all the circumstances, I am satisfied that the Bauer design of the HH5000L helmet offered a reasonable level of safety for rear impacts having regard to the risk of the wearer sustaining a serious head injury like an SDH while playing hockey. There was no substantial likelihood of the alleged harm associated with its ordinary use. Nor did the evidence demonstrate that it was feasible to design the helmet in a safer manner to protect against such risk. In particular, I reject Dr. Stalnaker's evidence respecting the feasibility of his modifications to the HH5000L.

[230] I point out that Bauer was not obligated to design an "accident-free" helmet. It is not an insurer nor is it to be held to a standard of perfection. See *Stiles v. Beckett*, [1993] B.C.J. No. 3, aff'd [1996] B.C.J. No. 19.

[231] I dismiss the claims in negligence against Bauer and the CSA.

Claims against the CSA for negligent misrepresentation and failure to warn

[232] In their pleadings, the plaintiffs allege the CSA negligently issued "Certified Hockey Helmet" labels to Bauer to be affixed on Bauer helmets:

> ... when it knew or ought to have known that such labels would lead users, including the plaintiffs, to believe that such helmets would protect users from the risk of serious head injury.

By this pleading, the plaintiffs appear to be alleging that the CSA is liable for negligent misrepresentation, a failure to warn, or both.

[233] The only reference in the plaintiffs' closing submissions that relates to negligent misrepresentation or failure to warn is their contention that the CSA label

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on Darren's helmet was not qualified in any way. The plaintiffs state that the purchaser or user of a CSA-certified helmet does not know that certification is for linear impacts only, or that the protection provided by the helmet to prevent serious injury was limited to cases where there was a linear focal impact.

[234] Darren's injury involved the application of primarily linear rather than rotational forces. Therefore, whether the CSA had a duty to warn consumers that its testing process involves the application of linear rather than rotational forces is irrelevant. Even if the plaintiffs were able to establish a negligent misrepresentation or failure to warn, they would not be able to establish causation.

[235] By alleging either negligent misrepresentation or failure to warn, the plaintiffs are saying that the CSA did not provide enough information for the plaintiffs to make an informed choice of whether to use the helmet. They say that the CSA knew that users of CSA certified helmets would assume that the certification label would apply to all kinds of injuries, would rely on CSA certification as a representation regarding safety, and that users would not understand the limited nature of CSA testing that underlies the certification labels.

[236] The plaintiffs focus solely on the small CSA label on the helmet that simply says "Certified Hockey Helmet". They ignore the larger label also on the helmet that states severe head and brain injuries may occur despite wearing the helmet. Considering the effect of the smaller CSA sticker without taking the larger sticker into account is misleading.

[237] The plaintiffs also ignore the owner's information that was originally attached to the chin strap of the Bauer helmet. The owner's information had a warning which included the following statement: "This helmet affords no protection from neck, spinal, or certain types of brain injuries including those that may be caused by rotational forces. Severe head, brain, and spinal injuries including paralysis or death may occur despite using this helmet." The box that the helmet originally came in had a similar warning on it. It is unclear on the evidence whether CSA mandated these warnings, or whether Bauer provided them of their own volition.

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[238] Taking both warnings on the helmet together, there is insufficient evidence for a finding of negligent misrepresentation because the labels were not misleading and Darren did not rely on them in any event. As stated in *Queen v. Cognos,* [1993] 1 S.C.R. 87, both of these preconditions must be present to ground a finding of negligent misrepresentation.

[239] The CSA labels on the helmet are in no way misleading. The larger label clearly states that severe brain injuries may occur despite wearing the helmet. The label informs the prospective user that even if they wore the helmet they may suffer injury.

[240] The same reasoning applies to the claim that the CSA breached its duty to warn. In *Buchan v. Ortho Pharmaceutical (Canada) Ltd.* (1986), 54 O.R. (2d) 92 (C.A.), Robins J. aptly describes the duty to warn at paras. 16-18:

> As a matter of common law, it is well settled that a manufacturer of a product has a duty to warn consumers of dangers inherent in the use of its product of which it knows or has reason to know. The guiding principle of liability underlying the present law of products liability in this country was formulated by Lord Atkin in his classic statement in *M'Alister (or Donoghue) v. Stevenson*, [1932] A.C. 562 at p. 599 (H.L.):
>
> > ... a manufacturer of products, which he sells in such a form as to show that he intends them to reach the ultimate consumer in the form in which they left him with no reasonable possibility of intermediate examination, and with the knowledge that the absence of reasonable care in the preparation or putting up of the products will result in an injury to the consumer's life or property, owes a duty to the consumer to take that reasonable care.
>
> This statement has been the source of subsequent developments in products liability law based on negligence. The rationale is that one who brings himself into a relation with others through an activity which foreseeably exposes them to danger if proper care is not observed must exercise reasonable care to safeguard them from that danger. It can now be taken as a legal truism that the duty of reasonable care which lies at the foundation of the law of negligence commonly comprehends a duty to warn of danger, the breach of which will, when it is the cause of injury, give rise to liability: see, generally, Fleming, The Law of Torts, 6th ed. (1983), at p. 459 ff., and Linden, Canadian Tort Law, 3rd ed. (1982), at p. 563 ff.
>
> Once a duty to warn is recognized, it is manifest that the warning must be adequate. It should be communicated clearly and understandably in a manner calculated to inform the user of the nature of the risk and the extent of the danger; it should be in terms commensurate with the gravity of the

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> potential hazard, and it should not be neutralized or negated by collateral efforts on the part of the manufacturer. The nature and extent of any given warning will depend on what is reasonable having regard to all the facts and circumstances relevant to the product in question.

[241] The CSA had a duty to warn the public of the amount of protection a CSA helmet provides. As discussed earlier, the CSA certifies helmets for public use. Consumers cannot buy a hockey helmet in Canada unless the CSA certifies it. Therefore, the CSA must exercise reasonable care to safeguard users of certified helmets by informing them that injury can occur while playing hockey despite wearing a certified helmet.

[242] The question then is whether the CSA's warning was adequate. The warning does not mention whether the helmet protects from linear or rotational injuries or both. Such wording is unnecessary in this situation. While there are situations where more detailed warnings are necessary, adding technical terms such as "rotational" or "linear" to the CSA warning adds little to a typical consumer's understanding of the type of injury the helmet protects against. The warning on the helmet is clear that serious injury may occur despite wearing the helmet.

[243] Darren also had other warnings of the type of injuries one could sustain while wearing a helmet and chose to continue playing hockey regardless of those warnings. One was attached to the helmet's chin strap when he bought it and clearly stated the helmet did not provide protection from rotational injuries.

[244] Equally important, before his accident Darren was aware that people suffer head injuries while playing hockey despite wearing the CSA approved helmets. Darren himself suffered two concussions prior to the accident, and at least one other teammate had suffered a concussion while wearing a CSA approved helmet. Darren was clearly aware of the risks associated with playing hockey, even while wearing a helmet, and like hundreds of thousands of other Canadians, chose to play anyway.

[245] The plaintiffs' claims against the CSA for negligent misrepresentation and failure to warn are dismissed. The plaintiffs failed to prove any statement or omission on the CSA's part contributed in any way to Darren's injury.

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[246] It follows that I dismiss all the plaintiffs' claims. In the circumstances, I will not quantify the plaintiffs' claims for damages.

Costs

[247] Subject to any special considerations arising out of offers to settle, Bauer and the CSA are entitled to their costs throughout on Scale B. If there are special considerations, counsel may agree to, or speak to, a different costs order.

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"M.D. Macaulay, J."
The Honourable Mr. Justice Macaulay