REPORTED

IN THE COURT OF SPECIAL APPEALS

OF MARYLAND

No. 1700

September Term, 1998

NISSAN MOTOR CO.
LTD., ET AL.

V.

JUDITH A. NAVE ET AL.

Moylan,
Salmon,
Dugan, Robert N.
(Specially Assigned),

JJ.

Opinion by Salmon, J.

Filed: November 4, 1999

On March 25, 1994, Donald Nave was driving a 1989 Nissan pickup truck when he crashed head-on into a jack-knifing tractor-trailer. The accident occurred near the intersection of Ridge and Braddock Roads in Carroll County, Maryland. As a result of the collision, Nave struck the pickup's steering assembly and sustained fatal chest injuries. Nave's estate and his surviving family members (appellees) filed suit in the Circuit Court for Baltimore County against appellants, Nissan Motor Co., Ltd.; Nissan Motor Corp., USA; and Nissan Manufacturing Corp., USA (collectively, "Nissan"). Appellees allege, inter alia, that the steering column in Nave's pickup was designed defectively and that a proper design would have prevented Nave's death.[1]

The case against Nissan was tried before a jury. At the close of plaintiffs' case, Nissan made a motion for judgment. The court reserved its ruling on the motion. The motion was renewed at the conclusion of the entire case and denied. At the end of an eleven-day trial, the jury returned a verdict in favor of appellees and awarded damages of $4,034,000. Nissan made motions for judgment notwithstanding the verdict and for new trial that were denied.

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[1]Appellees also alleged in their complaint that the steering column was manufactured negligently. The trial court granted Nissan's motion for judgment as to that count.

Nissan then filed this timely appeal and presents four questions,[2] but we need only decide one, viz:

> Did the trial court err in denying Nissan's motions for judgment at the conclusion of plaintiff's case?

We answer "yes" to that question and reverse.

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[2]As worded by Nissan, the four questions presented are:

1. Did the trial court commit reversible error by permitting the Naves to re-open their case for the sole purpose of introducing improper rebuttal evidence?

2. Did the trial court commit reversible error by excluding evidence of Nave's failure to wear his seat belt in this products liability case where the crash worthiness of the vehicle was at issue and where [appellees'] witnesses and counsel mentioned seat belts and restraints in front of the jury?

3. Did the trial court commit reversible error by (A) admitting an untrustworthy hearsay article by Peter Gloyns and by permitting [appellees'] witnesses to refer to notebooks filled with inadmissible hearsay articles; (B) excluding a report by the National Highway Transportation Safety Administration ("NHTSA") about steering assemblies; (C) excluding numerous defense exhibits prepared by Nissan experts and in giving a cautionary instruction regarding them; (D) excluding [appellees'] signed financial statement which constituted a party admission and by giving cautionary instructions regarding the use of other party admissions; (E) permitting [appellees] to call Lee Sturgill as a witness when Sturgill had never been previously identified as a witness; and (F) permitting [appellees'] expert, Ian Jones, to testify about steering column design when Jones lacked any specialized education, training or experience in steering column design?

4. Did the trial court err in denying Nissan's motion for judgment and motion for judgment notwithstanding the verdict in light of the fact that the Naves failed to prove a prima facie case and the verdict was contrary to the evidence?

FACTS

A. The Accident

1. The Cause of Nave's Death

After Nave's truck collided with the tractor-trailer, his body continued to move forward and crashed into his steering wheel. The cause of Nave's death was blunt force trauma to the chest as a result of his contact with the steering wheel. According to Dr. Wayne Ross, appellees' expert in forensic pathology, biomechanics, and kinematics, the force applied to Nave's chest was enhanced because the steering column did not collapse and absorb the energy of the impact. Dr. Ross explained:

> [W]hen [Nave] contacts the hub of [his steering] wheel, because it doesn't collapse, because it just bends upward, it gets concentrated on his chest. He's pushing on that thing, it's got to go somewhere, so it goes upward. . . . And it bends upwards. Consequently, instead of this thing collapsing, which it should have done, and instead of the steering wheel absorbing the energy, he absorbs the energy. That's not supposed to happen. The column itself is supposed to absorb the energy instead of his chest.
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> * * *
>
> In this particular case, what happened is the rim [of the steering wheel] deformed, the hub was exposed and the force is concentrated in the center of his chest. It didn't collapse, it bends upward and because it didn't collapse, instead of the force going into the column itself, which is what it's made to do, the force went into the center of his chest.

Dr. Ross further explained that the steering column essentially acted like a pole that was being shoved into the center of Nave's chest at a high rate of speed. The large, concentrated force on Nave's chest ruptured his aorta, causing internal bleeding and death.

2. The Severity of the Accident – Delta V

There was much dispute between the parties regarding the severity of the impact that caused Nave's death. The severity of an accident is measured using delta V, which is a number representing the change in velocity that a vehicle undergoes during a collision. The higher the delta V, the more severe the accident. According to Dr. Ian Jones, appellees' accident reconstructionist, the delta V experienced by Nave's truck was 18.5 miles per hour. Jones opined that drivers of vehicles that experience a delta V in this range typically survive their collisions; thus, Jones's opinion was that Nave's accident was "highly survivable" had Nave's truck been equipped with a properly functioning steering column. Jones noted, however, that once the delta V becomes too high it is beyond the capacity of any steering column to protect the driver from serious or fatal injury.

Nissan's accident reconstructionist, Charles Strother, calculated the delta V of the accident to be approximately 27 miles per hour. Using various data, Strother explained that the collision was a "severe impact" and that an accident with a delta V of 27 miles per hour has "fatal potential." According to Strother, the delta V experienced by Nave was too high for anyone to have survived, regardless of how well the steering column performed.

Dr. Ross testified that statistically Nave should have survived the accident at a delta V of 18.5 miles per hour if the steering column in the pickup had compressed 3.5 inches. Furthermore, Dr. Ross opined that it would be reasonable to conclude that Nave would have survived even at a delta V of 27 miles per hour if the Nissan column had compressed properly. Dr. Ross, however, did not provide any data or explanation to support his conclusions, nor did he explain why he believed that the steering wheel should have compressed 3.5 inches. In addition, Dr. Ross admitted that he was not an expert in the design and function of steering columns and had no knowledge concerning the specific performance characteristics of the Nissan column.

Appellees introduced into evidence a chart created by William Bohley when he worked at the National Highway Transportation and Safety Administration (NHTSA). The chart compared fatality rates in frontal collisions. It showed that the fatality rate for accidents where the delta V was between 18 to 22 miles per hour was 0.7% and that the fatality rate for accidents having a delta V between 23 and 27 miles per hour was 2.6%. Both Jones and Ross relied on this chart in reaching their conclusion that Nave's accident was survivable.

Bohley, who testified on behalf of Nissan, explained that the fatality rates contained in his chart were not trustworthy because they were based on very small numbers and did not account for differences in the accidents (e.g., seating positions, age, sex, vehicle size). Bohley, using another chart, testified that accidents with delta Vs greater than 35 miles per hour are “very hard to survive” and that 48% of all fatalities occur in the delta V range of 25 to 35 miles per hour. Bohley conceded, however, that cost-effective designs can be built that will reduce fatality rates in accidents with delta V's of less than 30 miles per hour.

Carl Savage, Nissan's expert on the design, development, and testing of steering columns, testified that in accidents where the delta V is below 20 miles per hour, the energy absorbed by the front end of the vehicle is sufficient to prevent serious and fatal injuries, and in such cases the steering column does not need to absorb any energy. For delta V's above 20 miles per hour, however, Savage explained that the steering column must absorb some of the energy of impact in order to prevent serious injury to the driver. After examining the evidence and data concerning Nave's accident, Savage concluded:

> This is a severe crash. This is a crash that there is going to be a certain percentage of people that will die in this type of crash.

Dr. Charles Hastell testified on behalf of Nissan as an expert in the fields of biomechanics and injury causation. Dr. Hastell, using Strother's delta V calculation of 27 miles per hour, calculated that Nave had 20,400 pounds of kinetic energy to dissipate just prior to his collision with the steering wheel. Dr. Hastell noted that the maximum force that a human being can tolerate on his chest is 2,000 pounds (assuming that the force is fairly distributed over the chest) and Nave was therefore exposed to a force ten times the normal human tolerance level. As such, Dr. Hastell classified the collision as a “very serious accident.”

B. Steering Column Design

1. Basic Elements of Steering Column Design

There are three characteristics that a steering column design should have in order to reduce the amount of energy transferred to the driver in an accident. First, when the driver's body contacts the steering column, the column itself must compress downward. This “compression” or “collapse” absorbs much of the energy of the impact, preventing the energy from being imparted to the driver's chest. Second, the steering assembly must also have a large “load area.” Load area refers to the surface area of the steering wheel that actually comes into contact with the driver's chest during an accident. A steering column with a large load area spreads the force of the collision over a larger area of the driver's chest. A spread-out force is less harmful to the driver than a force that is concentrated in one area of the driver's chest. The third feature of an effective steering column is a self-aligning steering wheel. A self-aligning steering wheel conforms to the shape of the driver's body upon impact. This feature reduces the likelihood of serious injury because it: (1) maximizes the load area that a driver's chest is exposed to; (2) reduces the likelihood that the steering column will bend or fail to compress; and (3) insures that the driver's body hits the steering column head-on (axially) rather than at an angle (non-axially).

2. FMVSS 203

Steering wheel performance is governed by Federal Motor Vehicle Safety Standard (FMVSS) 203. FMVSS 203 requires that all steering columns in vehicles sold in the United States undergo a test where a 75 pound body block[3] strikes the steering assembly at 15 miles per hour. Under the 203 regulation, the impact forces generated on the body block may not exceed 2,500 pounds.[4] There was no dispute that the axial compression design used in the 1989 Nissan pickup complied with FMVSS 203 requirements.

C. The Axial Compression Design

1. The Nissan Design

Nissan employed an axial compression steering column design in its 1989 pickup. In this design, the steering shaft is made up of an outer and inner shaft with a ball bearing that creates resistance between the shafts to prevent the column from collapsing under normal driving conditions. In an accident, when the driver's body contacts the steering wheel at a high rate of speed, the force of the driver's body overcomes the resistance produced by the ball bearing and the column collapses. Essentially, the design works like a telescope – when a sufficiently large amount of force is applied to the steering wheel by the driver's body, the inner shaft

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[3]The body block is called a "black tuffy" and is a large block shaped like a human torso that is wrapped in foam.

[4]The 2,500 pound limit does not represent the maximum amount of force that a human chest can tolerate in an accident. Because the black tuffy block is more rigid than the human torso, when a 203 test is run on a black tuffy, it generates a much higher force on the tuffy than would be exerted on a human torso. The 2,500 pound figure was selected because it correlates to approximately 2,000 pounds of force on an average human torso. Two thousand pounds is the maximum amount of force that a human can sustain on his or her chest.

collapses into the outer shaft. This compression allows the steering column to absorb energy thereby reducing the force impacted onto the driver. The greater the amount of column collapse, the greater the amount of energy absorbed.

2. The Defect Alleged by Appellees

Dr. Jones, who was also qualified as an expert in the design and function of steering wheel assemblies, admitted that he had never designed or tested a steering column. His opinions were based on his review of "voluminous" engineering literature discussing energy absorption in steering columns. Nevertheless, he opined that, even though the Nissan design passed 203 testing, Nissan's design was defective. Dr. Jones testified that:

> [The Nissan] column is designed to compress downward and it has approximately seven inches of travel, if it works properly.
>
> And the problem with [the Nissan axial compression] columns is, if they are . . . nonaxial loading, in other words, you don't happen to get the body oriented so that it loads straight down the column, the column bends. And what it is, it's a tube within a tube, and if you bend the tube, they are not going to slide within each other.
>
> And that's exactly what happened in this case. The column binds. So you put unnecessarily high loads on the . . . occupant when they . . . hit the steering wheel.

Later, Jones stated:

> What happens in an accident is . . . the bottom of this rim tends to be loaded, which turns the steering wheel, and then pushes it up, and then . . . it tends to bend around this attachment point.

> Now, if you bend this column, it's not going to collapse. Actually, that's what happens. It doesn't collapse axially, and you get too much load on the top end of the column, which is what happened in the Nave case.
>
> * * *
>
> So . . . in terms of the . . . column collapsing axially, it only moved a quarter of an inch downwards, whereas it should have moved somewhere . . . , according to my delta V, in the region of three and a half inches.

Finally, Jones concluded:

> My opinion is that . . . the steering assembly is defective because it doesn't provide the level of protection that one would expect in a frontal collision.
>
> The reason it doesn't provide that protection is because the axial collapse doesn't work, the column binds and produces unnecessarily high loads on the occupant.

Jones opined that the Nissan design also was defective because its load area was too small to spread the energy from the accident effectively. He testified on this point as follows:

> Q Now, in this accident, based upon the examination of the steering wheel, do you have any opinion about the [load] area in this accident?
>
> A What's clear to me in this accident is that the chest loaded the center of the column and so the steering wheel did not provide an effective contact area . . . .

On cross-examination, Jones said that if you could design an axial compression column with a high load area, then it would be better for the driver.

Billy Peterson, another plaintiffs' expert on the design and functioning of steering columns, also criticized the Nissan design because he believed that it was not designed to self-align with the driver upon impact and because the column had a high tendency to bend and often failed to compress. Peterson admitted on cross-examination, however, that he had never tested the Nissan column, did not know the force necessary to bend the column, and did not know the energy Nave's column absorbed in the crash.

Peterson's and Jones's opinions regarding the defectiveness of the Nissan axial compression design were based primarily on a 1974 study conducted by Peter Gloyns while he was an engineering Ph.D. candidate at the University of Birmingham, England. Gloyns looked at steering column performance in approximately one hundred accidents that had occurred on England's highways. He concluded that fatal injuries should not occur at delta V's less than 30 miles per hour if there is a properly functioning steering column. Gloyns found that axial compression columns were performing well in 203 testing but that those columns had a higher rate of serious injury in real-world accidents, and in some cases were producing fatalities in accidents with delta V's below 30 miles per hour. Gloyns theorized that non-axial loading of the axial compression column was causing the column to bend upward and this bending was preventing the inner shaft of the column from compressing down into the outer shaft. Gloyns referred to this as the binding effect. Because non-axial loading was preventing the axial compression columns from compressing properly, the steering wheel was not absorbing energy — this energy was then being imparted to the chest of the driver, causing serious injury. Gloyns concluded that, because this effect was not being seen in 203 testing, the 203 test was an ineffective measure of the efficacy and performance of steering wheel columns in real-world collisions. Based on Gloyns's work, both Jones and Peterson testified that it was their opinion that FMVSS 203 did not replicate what happens in real-world accidents and a steering wheel design could still be defective even if it passed FMVSS 203. Thus, they concluded that the Nissan design was defective despite the fact that it met federal requirements because the design had a tendency to bind.

Chitoshi Hoshina, Nissan's designated corporate representative, testified that Nissan's goal in designing steering columns was to comply with federal standards. Hoshina said the following in his deposition (which was read into evidence at trial):

> QUESTION: At the time Nissan was considering its target performances, and it would be back in this time period of '82 to '83 . . . , is it fair to say that with regard to the energy absorbing steering column, the target performance being specified by Nissan would have been compliance with 203?
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> ANSWER: To satisfy 203 . . . .
>
> QUESTION: . . . Would you agree the major design objective from a safety of the occupant point of view of an energy absorbing steering column and wheel is to provide enhanced safety to the occupant in a wide variety of accidents in the real world?

> ANSWER: When you say design objective, it is rather difficult to respond. But when it comes to the actual design target, then the target is to satisfy 203 . . . criteria.
>
> QUESTION: Can a column that complies with 203 . . . still be considered defectively designed from a safety point of view with regard to the protection of an occupant?
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> ANSWER: I don't think it can be defective. I don't think there is a defectiveness.

When asked about this testimony, Peterson expressed a different view, viz:

> Q Mr. Peterson, do you have an opinion whether that design objective [to comply with 203] is deficient from an energy absorbing —
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> * * *
>
> A That is not the appropriate decision to make when you are designing something. The components of the vehicle are supposed to be designed first to protect the occupants who are going to be using those components. Of course, it is necessary that it meets federal standards, but that shouldn't be the primary target.

3. Nissan's Position

Nissan called William Bohley as an expert on the role and effect of FMVSS 203. Bohley had worked for the NHTSA for twenty-seven years and was at the agency when it first promulgated FMVSS 203 in 1968. Bohley testified that the NHTSA conducted a study in 1981 to assess the effectiveness of the 203 standard. That study compared injury and fatality rates for vehicles made before and after the 203 standard went into effect and found that the number of fatalities and serious injuries had been reduced by an average of 38%. The NHTSA study also looked at the individual performance of specific steering column designs. The study found that all 203-compliant steering wheel designs that the agency evaluated, including axial compression designs,[5] were equally effective in reducing the number of fatalities and serious injuries in real-world collisions. The study found nothing to indicate that axial compression columns were more susceptible to binding than other steering column designs. Based on the results of the study, the NHTSA concluded that FMVSS 203 was an effective safety standard.

Bohley criticized Gloyns's conclusion that FMVSS 203 was ineffective in assessing steering column collapse performance. Bohley noted that Gloyns used a relatively small sample of accidents. Gloyns looked at approximately one hundred accidents while the NHTSA study used data from the National Crash Severity Study (NCSS) that compiled extensive information between 1975 and 1979 concerning more than 30,000 collisions. According to Bohley, the NCSS data sample was large enough statistically to invalidate Gloyns's findings.[6] In addition, Bohley criticized Gloyns's data because he only looked at accidents where there was serious injury or fatality — he excluded from his data accidents where the driver

[5]Carl Savage, Nissan's expert on the design and testing of steering wheel columns, testified that the axial compression columns evaluated in the NHTSA report were very similar in design to the 1989 Nissan axial compression column.

[6]In fact, Gloyns himself conceded that his initial sample size was too small to make his results statistically significant. Dr. Jones testified, however, that Gloyns published a 1979 follow-up paper in which he added another 121 accidents to his data sample. After doing this, Gloyns got the same results as he did in his initial paper, but this time he opined that his results were statistically significant.

was not injured. In the NHTSA Report, statistics were calculated by comparing the number of accidents causing injuries or fatalities with accidents resulting in no serious injury.

On cross-examination, Bohley explained that the NHTSA report also found that all the 203-compliant steering columns analyzed were still susceptible to binding when subjected to heavy forces that load the columns non-axially. Bohley agreed that the NHTSA report suggested that FMVSS 203 could be improved by having the test simulate non-axial loading situations. Nevertheless, Bohley noted that, even though the report proposed improvements to FMVSS 203 that would further enhance safety, the report's ultimate conclusion was that 203 standing alone was an effective safety standard.

Carl Savage worked in the Safety Research and Development Lab at General Motors (GM) from 1968 to 1977. During that period he evaluated the safety performance of steering columns designed by GM and its competitors and actively participated in the design process for GM steering columns. Nissan called him as an expert in the design, development, and testing of steering wheel columns. Savage testified that an effective steering wheel design requires a load area of at least 30 square inches (193.548 square centimeters).[7] The Nissan column had a load area between 31 square inches (200 square centimeters) and 46 square inches (298.7739 square

[7]Savage testified that a driver can avoid serious chest injury when hit with a force of up to 2,000 pounds if the load area on the steering wheel is over 30 square inches in size.

centimeters).[8] Savage also testified that the steering wheel on the 1989 Nissan column was self-aligning because the steering wheel's spokes had kinks in them that allowed the wheel to bend and conform to the driver's body. Savage's overall conclusion was that the 1989 Nissan axial compression design was a good, non-defective steering column design.

Savage disagreed with Gloyns's criticism of the 203 standard — in his opinion, FMVSS 203 was a very good test of the hardware for the purpose of measuring protection to the driver's chest in extreme situations. According to Savage, the 203 test is designed to be a severe test of the steering system and is good for testing whether columns are binding and whether they can sustain heavy loads.

Savage explained the performance of the 1989 Nissan column in the Nave accident. Savage's opinion was that the accident was very severe, causing such a large load to be placed onto the steering wheel that no steering column would have been able to function properly. Savage explained:

> [The Nissan] column started here and it was . . . compressing. And also, at some time during the compressing process a very severe bending load came in here. So we have a very high loading situation here, higher than you would normally expect.
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> So we have a column that is functioning like it's supposed to and so the only point is

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[8]Peterson calculated the load area of the 1989 Nissan pickup to be approximately 31 square inches while Savage calculated the load area to be 46 square inches. At trial, Peterson initially calculated the load area to be 394.4 square centimeters (61.13 square inches), but he later corrected that number.

> that the direction is changed and we are getting a bending load in here . . . .
>
> So what we have is a very severe situation in here, more severe that what you normally would have anticipated.
>
> . . . [W]e are seeing a column which is functioning like its supposed to, but it's getting overwhelmed . . . in this particular accident.

According to Dr. Hastell, Nissan's expert in biomechanics and injury causation, in order for Nave to have survived the collision, the steering column in the pickup would have had to absorb the majority of Nave's kinetic energy. Dr. Hastell opined that the accident was “non-survivable” because he knew of no steering column in existence that would have been able to dissipate the large amount of kinetic energy that Nave exerted just prior to striking the steering wheel. His testimony regarding this point was as follows:

> I am not a steering wheel design expert, but I know of no such steering wheel in existence that would allow energy management over any kind of distance and in any manner that is going to allow survival under this kind of an energy challenge.

D. The Self-Aligning Cannister Design

1. The Design

Appellees attempted to show that the self-aligning cannister design[9] was a viable alternative design that Nissan could have

[9]Throughout the course of the trial, witnesses used a variety of different terms to refer to the self-aligning cannister design, including, but not limited to: a “collapsible cannister column,” a “self-aligning type column,” a “classical can column,” a “self-aligning energy absorbing cannister-type unit,” and an “energy absorbing cannister column.”

incorporated into the 1989 pickup that would have made the vehicle safer and prevented Nave's death. Dr. Jones described this design as follows:

> [The self-aligning cannister design is] a column that has a crushable can at the top of the steering assembly. In other words, between the steering wheel and the column, there is a seven-inch can, which has convolutions on it. It's about the size of a beer can. And the idea of that column is that you, in effect, crush that can.

In order to demonstrate how the self-aligning cannister design works, Dr. Jones, with the assistance of Dr. Ross, created plaintiffs' Exhibit 68, which was a set of four frame-by-frame illustrations showing how a self-aligning cannister column would have interacted with Nave's body if it had been incorporated into his pickup truck. Exhibit 68 showed Nave's body contacting the steering wheel, the steering wheel then aligning to his body, and the cannister compressing properly with no bending or binding.

According to Dr. Jones, one of the key features of the cannister design is its ability to self-align because, if the wheel does self-align, this increases the load area, making the steering column more effective at absorbing energy in an accident. He stated:

> [T]here is [sic] two components to having an effective steering assembly design. You not only have to limit the load, but you also have to make sure that the chest has a large enough contact area.
>
> Which is why the classical can column, which has the higher load, works better in the field. . . . [F]rom [Gloyns's] studies, [the

> cannister design] appears to spread the load more effectively, although the load from the column is high.

Dr. Jones calculated that if a self-aligning cannister had performed as illustrated in Exhibit 68 the load area on Nave's body would have been high, the column would have properly compressed 3.5 inches, and Nave would have survived the accident. Dr. Jones admitted, however, that he had never done any tests to compare the energy absorption of an axial compression column with a cannister design and that he was relying on Gloyns's tests to support his opinions regarding the performance of the cannister design.

Dr. Ross concurred with Dr. Jones's opinions, testifying that Exhibit 68 represented

> what we wanted to happen in this case. That is, [Nave] loads the steering wheel and the column properly functions, but it properly functions because we have what we refer to as a self-aligning wheel. That is, it aligns up over his chest, gives a wide range to have contact and he essentially does, in our opinion, survives the accident.

Dr. Ross added that Nave would have survived the accident at either a delta V of 18.5 or 27 miles per hour if his truck had been equipped with a properly functioning self-aligning design like the “design” shown in Exhibit 68. Dr. Ross, however, did not explain why Nave would have survived the accident had a column like the one in Exhibit 68 been used, nor did he provide any data or numbers to back up his conclusion. Furthermore, on cross-examination, he admitted that he was not an expert on the design and function of steering columns, that he had never tested or investigated the performance of any steering column, and that the Gloyns articles were the basis for his opinion on how a self-aligning cannister column would have performed in the accident.

Peterson testified that Exhibit 68 represented what would have happened to Nave if the 1989 Nissan pickup truck had been equipped with a proper cannister design. He stated:

> Well, with the properly functioning self-aligning steering wheel you can see that the whole column itself collapses.
>
> The cannister part in here has decreased in size considerably, and of course, that is absorbing energy, which would have, certainly, tremendously reduced the energy potential to Mr. Nave.

On cross-examination, Peterson admitted that he did not recall the specifications of the cannister design, did not know what the maximum energy absorption is for that design, and had never tested a cannister column. Peterson testified that the only tests that he knew of regarding the self-aligning cannister column were those tests conducted by Gloyns and he relied on those tests in forming his opinions regarding the performance of the cannister design.

Savage described the cannister design as a coffee can that sits behind the steering wheel, on top of a fixed, non-collapsing steering column. As to how the design works, Savage explained:

> [The cannister] does double duty. Not only does the cannister align the wheel itself, but [it] also serves as an energy absorption element in the car.

Other than the cannister itself, Savage testified that there were no other features in the self-aligning cannister column that were designed to absorb energy. As to the issue of whether a cannister design would have saved Nave's life, Savage opined:

> The cannister design would not have prevented [Nave's death] because it does not contribute enough. Even if you did wildly optimistic assumptions about what it would do, it could not compensate for that overwhelming momentum that we have here.

2. Gloyns's Findings

In his 1974 study on steering column performance, Gloyns also analyzed frontal collisions involving the Ford Capri,[10] a vehicle that used a self-aligning cannister steering column. Gloyns compared the performance of the self-aligning cannister design in the Capri to the axial compression column in the Ford Cortina and found that, for accidents with a delta V of less than 30 miles per hour, the Capri produced no fatalities and had substantially fewer chest injuries than the Cortina. On the other hand, Gloyns also conducted 203 tests on the Capri cannister and found that it was producing much higher chest loads than the Cortina axial compression column and, in some instances, the Capri was failing 203 testing.[11] In short, Gloyns found that the Capri cannister

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[10]The Ford Capri was a vehicle primarily sold in the United Kingdom but, according to Peterson and Dr. Jones, that vehicle was imported into the United States during the 1970's and sold as the Mercury Capri. Peterson testified that the Capri must have passed 203 testing in order to have been sold in the United States.

[11]Based on Gloyns's findings, Nissan argues in its brief that the cannister design was not a viable alternative design because it "failed FMVSS 203 and could not be legally sold in the United States." This does not appear to be true if the evidence is taken in the light most favorable to the appellees. Gloyns only found that the Capri cannister failed 203 testing in some cases. In addition, Peterson testified that the Ford Capri must have passed 203 testing in order to be sold in the United States. Furthermore, Savage testified that, between 1972 and 1974, the Chrysler Barracuda employed a cannister design. Because all vehicles sold in the United States must pass 203 testing, it is reasonable to infer that the Barracuda cannister design met the 203 requirements.

design was performing better than the Cortina axial compression column in real-world accidents but that the Cortina column was performing better in 203 testing. Based on his studies, Gloyns concluded that the cannister design was superior to the axial compression design and that the 203 test was an ineffective safety standard because it was not replicating the cannister's better performance in real-world accidents.

Savage criticized Gloyns's conclusion that cannister columns were more effective than axial compression columns. Savage opined that the disparity in load area between the Capri and the Cortina steering wheels explained why the Capri was performing better than the Cortina in real-world accidents. According to Savage, the reason that the Capri performed better in accidents was because its load area was 31 square inches (200 square centimeters), which was above the 30 square inch minimum load area required for an effective steering wheel system. In contrast, the Cortina's performance was poor because its load area (23.25 square inches) was well below the 30 square inch benchmark. As such, Savage concluded that Gloyns's results did not necessarily indicate that the cannister design was more effective than an axial compression design; rather, Gloyns's findings could be explained purely as a function of the differing load areas of the two specific steering columns he tested.

3. Savage's Testing

As mentioned earlier, Savage worked at the GM Research Lab when that company was conducting intensive research into steering column design. During his tenure at the GM Research Lab, Savage had the opportunity to test and compare axial compression columns with cannister columns. With regard to cannister columns, Savage testified that GM testing revealed that the cannister had inconsistent performance – in some tests cannisters would perform well and yield low loads, but slight changes in the design would lead to high loads that were well over acceptable human tolerance limits. Based on these findings, researchers at the GM lab questioned the reliability of the cannister design.

Savage's opinion, based on the research he had conducted at GM, was that the axial compression design was better than the cannister design. Savage noted that, after the GM Research Lab had completed its testing of a variety of steering column designs, GM opted to use an axial compression design in its vehicles and that over 99% of the vehicles in use in the United States employ some variation of the axial compression design. Savage also testified that the GM axial compression design was very similar to the steering design that Nissan used in its 1989 pickup truck.

4. The NHTSA Report

The 1981 NHTSA study of FMVSS 203 evaluated the performance of five axial compression designs and one self-aligning cannister design. All of the studied designs complied with the 203 standard and cost approximately the same. The study found that each of the six studied columns had a lower injury rate when compared to vehicles with non-203-compliant steering columns. The study also found that the individual column injury reduction rates varied from 23% to 52%. The study found that of all the steering column designs studied, the cannister design had the lowest effectiveness rate at 23%. Even though the cannister design had the lowest observed effectiveness, the difference was not statistically significant. Overall, the NHTSA study concluded that all of the 203-compliant devices that were studied were doing a good job of reducing the energy imparted onto a driver's chest and there was no evidence that any one steering column design was more effective than the others.

The NHTSA study also analyzed the amount of compression of each of the six columns to determine if any one of the columns had a greater tendency to bind. The study found that all of the columns studied had similar compression distances and that, at sufficiently high delta V's, binding occurred in all of the columns studied. Based on these results, the NHTSA study concluded that the six columns did not differ substantially in their tendency to bind and there was nothing to indicate that cannister columns were compressing more than axial compression columns.

Bohley testified that the results of the NHTSA study contradicted Gloyns's conclusion that the steering wheel cannister is more effective and more easily collapsible than axial compression columns. He stated:

> The cannister was not found to be any more effective than any of the others in preventing injuries, and I think it's critical to note that this statistical comprehensive evaluation does not support claims of earlier studies that the wheel cannister is substantially less prone to binding and substantially more expensive.
>
> * * *
>
> These are the studies that were performed by Mr. Gloyns based upon accident crashes over in the United Kingdom.

Bohley believed that the NHTSA report findings were more reliable than Gloyns's findings because the NHTSA data sample was large enough statistically to invalidate Gloyns's data. Also, Bohley noted that, unlike the NHTSA study, Gloyns's studies did not compare the injury rates of axial compression and cannister columns to the injury rates in vehicles with no safety features in their steering columns. In addition, Gloyns did not include in his data sample accidents involving axial compression and cannister columns that resulted in no serious injury. Bohley testified:

> When one looks at safety risks one needs to look at the occupants that are exposed to a particular type of crash and those that are injured and compare those rates. Merely by looking at the people who were killed doesn't give you an assessment of the overall safety risk of a system.

In short, Bohley opined that the NHTSA study was more reliable than Gloyns's studies and that the NHTSA findings refuted Gloyns's contention that the self-aligning cannister design was more effective at preventing serious injury.

E. Other Designs

Appellees also introduced evidence at trial regarding the following four other alternative designs:

1. Newer Nissan Axial Compression Design With Self-Aligning Steering Wheel

Appellees presented evidence of a newer Nissan axial compression design that was incorporated into pickup trucks manufactured in late 1989 (this design was not in Nave's truck).[12] After viewing a drawing of the newer design and reading Nissan's studies of it, Peterson opined that the newer design was safer and more effective than the axial compression design in Nave's truck because the newer design appeared to have a self-aligning steering wheel. Peterson also testified that the newer design looked cheaper to manufacture than the older design used in Nave's truck. Peterson admitted, however, that he had never seen or tested the newer design, nor did he know its energy absorbing characteristics.

2. Axial Compression Column With Collapse Mechanism Moved Further Up the Column

Dr. Jones briefly discussed an alternative design where the collapse mechanism was moved further up the column. The collapse mechanism prevents the column from collapsing under normal driving conditions and is triggered by the force of the driver's body crashing into the steering column. The release of the collapse mechanism in an accident allows the steering column to compress. According to Jones, the likelihood of a column binding is decreased

[12]We assume for purposes of this appeal that the newer Nissan axial compression design was one that was known to Nissan at the time it designed Nave's pickup truck and that Nissan could have engineered the vehicle using this newer design.

by placing the collapse mechanism closer to the driver. As such, Jones opined that a design with a collapse mechanism further up the column than the 1989 Nissan design would be safer and less prone to binding.

3. The GM Axial Compression Ball Design

Peterson briefly referred to the GM ball design as a viable alternative design for the Nave pickup. Savage described the GM ball design as an axial compression design that was very similar in design and performance to the axial compression column used in Nave's 1989 Nissan pickup. The primary difference between the GM and Nissan designs was the number of ball bearings — the Nissan design used one ball bearing while the GM design varied from sixteen to forty balls. Savage explained, however, that small design differences between the GM and Nissan designs required the GM design to use more ball bearings — the fact that the Nissan design used fewer ball bearings made no difference with respect to the column's performance.

4. The Mesh Design

Peterson testified that the mesh design was another safer alternative design that Nissan could have incorporated into Nave's 1989 pickup truck. Peterson described the design as one where the steering column strokes upon impact and crushes a metal mesh located inside the steering column. Peterson opined that this design would have performed better than the Nissan design because it was less likely to bind in a collision.

Savage analyzed and tested mesh designs while working at the GM Research Lab and gave the following testimony about it:

> Q [T]here was a GM mesh design, I believe?
>
> A Yes, there was.
>
> Q And as I understand it, GM got good results from that in the early days?
>
> A Yes. There were some drawbacks to it, but the mesh column was a good design. It did have some particular concerns, and it was not very good at bending along. But yes, it was very satisfactory, yes.
>
> * * *
>
> Q [The mesh] design is not at all the same as the Nissan design, is it?
>
> A No. I — I think there's a significant difference there, in that there is more susceptibility of bending of [the mesh] column. As far as a preference standpoint, it's a good design, though. It performs well in a crash.

STANDARD OF REVIEW

In reviewing the denial of a motion for judgment, an appellate court conducts the same inquiry as the trial court, viz:

> [T]he trial court assumes the truth of all credible evidence on the issue and of all inferences fairly deducible therefrom, and considers them in the light most favorable to the party against whom the motion is made. If there is any legally relevant and competent evidence, however slight, from which a rational mind could infer a fact in issue, then a trial court would be invading the province of the jury by declaring a directed verdict. In such circumstances, the case should be submitted to the jury and a motion for a directed verdict denied.

Impala Platinum Ltd. v. Impala Sales (U.S.A.), Inc., 283 Md. 296, 328 (1978) (citations omitted); see Washington Metro. Area Transit Auth. v. Reading, 109 Md. App. 89, 99 (1996); Martin v. ADM Partnership, 106 Md. App. 652, 657 (1995), rev'd on other grounds, 348 Md. 84 (1997).

STRICT LIABILITY

In Phipps v. General Motors Corp., 278 Md. 337 (1976), the Court of Appeals adopted section 402A of the Restatement (Second) of Torts (1965)[13] allowing consumers injured by defective products to sue the manufacturers of those products under a strict liability

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[13]Section 402A provides:

> Special Liability of Seller of Product for Physical Harm to User or Consumer
>
> (1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if
>
> > (a) the seller is engaged in the business of selling such product, and
> >
> > (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold.
>
> (2) The rule stated in Subsection (1) applies although
>
> > (a) the seller has exercised all possible care in the preparation and sale of his product, and
> >
> > (b) the user or consumer has not bought the product from or entered into any contractual relation with the seller.

The American Law Institute recently adopted the Restatement (Third) of Torts: Products Liability (1997), which deals exclusively with product liability law and provides substantially more detail than section 402A of the Restatement (Second) of Torts. Neither the Maryland Court of Appeals nor any other state appellate court has yet adopted or specifically rejected the provisions of the new Restatement. Neither party in this case made any reference to this new Restatement either in the lower court or here, and thus, we have not considered it.

theory. The Phipps Court set forth the essential elements for such a products liability action:

> For recovery, it must be established that (1) the product was in a defective condition at the time that it left the possession or control of the seller, (2) that it was unreasonably dangerous to the user or consumer, (3) that the defect was a cause of the injuries, and (4) that the product was expected to and did reach the consumer without substantial change in its condition.

Id. at 344 (emphasis added); see Valk Mfg. Co. v. Rangaswamy, 74 Md. App. 304, 312 (1988), rev'd on other grounds, 317 Md. 185 (1989); Simpson v. Standard Container Co., 72 Md. App. 199, 203 (1987).

There are three situations in which a product is in a "defective condition": (1) there is a flaw in the product at the time of sale making it more dangerous than intended; (2) the manufacturer of the product fails to warn adequately of a risk or hazard related to the way the product was designed; or (3) the product has a defective design. See Klein v. Sears, Roebuck & Co., 92 Md. App. 477, 485 (1992); Valk, 74 Md. App. at 313; Simpson, 72 Md. App. at 203. In cases alleging a defective design (such as the case sub judice), the focus is not on the conduct of the manufacturer, but on whether the product itself is defective. See Phipps, 278 Md. at 344; Klein, 92 Md. App. at 485; Simpson, 72 Md. App. at 203.

In design defect cases, Maryland courts employ the "risk/utility" balancing test to determine whether a specific design is unreasonably dangerous.[14] See Phipps, 278 Md. at 348; Klein, 92 Md. App. at 485-86; Ziegler v. Kawasaki Heavy Indus., Ltd., 74 Md. App. 613, 622-24. The relevant inquiry is "whether a manufacturer, knowing the risks inherent in [the] product, acted reasonably in putting it on the market." Ziegler, 74 Md. App. at 621 (quoting Singleton v. International Harvester Co., 685 F.2d 112, 115 (4th Cir. 1981)). In order to determine the reasonableness of the manufacturer's actions, a court weighs "the utility of the risk inherent in the design against the magnitude of the risk."[15] Phipps, 278 Md. at 345; see Klein, 92 Md. App. at 485;

[14]The Phipps Court noted that there are some instances where a design defect poses such a great risk that it is "inherently unreasonable" and no balancing is necessary. An example of such an "inherently unreasonable" design is a gas pedal on a new car that suddenly sticks, causing the vehicle to accelerate without warning. See Phipps, 278 Md. at 345-46; Ziegler, 74 Md. App. at 620-21; Troja v. Black & Decker Mfg. Co., 62 Md. App.101, 108.

[15]In conducting this balancing, the Phipps Court suggested a consideration of the following seven factors:

1. The usefulness and desirability of the product — its utility to the user and to the public as a whole.

2. The safety aspects of the product — the likelihood that it will cause injury, and the probable seriousness of the injury.

3. The availability of a substitute product which would meet the same need and not be as unsafe.

4. The manufacturer's ability to eliminate the unsafe character of the product without impairing its usefulness or making it too expensive to maintain its utility.

5. The user's ability to avoid danger by the exercise of care in the use of the product.

6. The user's anticipated awareness of the dangers inherent in the product and their avoidability, because of general public knowledge of the obvious condition of the product, or of the existence of suitable warnings or instructions.

7. The feasibility, on the part of the manufacturer, of spreading the loss by setting the price of the product or carrying liability insurance.

Ziegler, 74 Md. App. at 621-22; Troja v. Black & Decker Mfg. Co., 62 Md. App. 101, 107 (1985).

Maryland requires a plaintiff in a design defect case to prove six elements:

1. The existence of an alternative design that is safer than the design used in the suspect product;

2. The technological feasibility of manufacturing a product with the alternative design at the time the suspect product was manufactured;

3. The availability of the materials required to produce the alternative design;

4. The cost of production of a product that incorporates the alternative design;

5. The price to the consumer of a product incorporating the alternative design; and

6. The chances of consumer acceptance of a model incorporating the plaintiff's suggested alternative design.

See Singleton, 685 F.2d at 115; Ziegler, 74 Md. App. at 625; Troja, 62 Md. App. at 109.

Furthermore, in "automobile crash-worthiness" cases,[16] where the alleged design defect did not cause the initial accident, plaintiffs have the burden of establishing that the design used by the manufacturer caused greater injuries to the victim than would

Phipps, 278 Md. at 345 n.4 (quoting Wade, Strict Tort Liability of Manufacturers, 19 Sw. L.J. 5, 17 (1965)).

[16]In crash-worthiness cases (sometimes called second collision cases), plaintiffs are not alleging that a defect in the design of the automobile caused the accident; rather, the claim is that after the accident occurred, the design defect caused increased injuries to the occupant when he or she collided with the interior of the vehicle. See Volkswagen of America, Inc. v. Young, 272 Md. 201, 206-07 (1974).

have occurred had a proper design been used. See Volkswagen of America, Inc. v. Young, 272 Md. 201, 206-07 (1974); Valk, 74 Md. App. at 325-36 & 326 n.3. When, as here, a vehicular accident results in death, plaintiffs must produce sufficient evidence to establish that the design of the vehicle in question caused an otherwise survivable accident to be fatal. See Valk, 74 Md. App. at 326.

ANALYSIS

A. The Self-Aligning Cannister Design

Appellees spent the bulk of their time at trial attempting to show that the self-aligning cannister design was a viable alternative design that would have saved Nave's life if it had been incorporated into his 1989 Nissan pickup truck. We conclude, however, that appellees failed to produce sufficient evidence to establish that Nissan's decision to use an axial compression column in the 1989 pickup in lieu of a self-aligning cannister column was a design defect.

1. Was the Self-Aligning Cannister Technologically Feasible in a 1989 Nissan Pickup Truck?

Appellees first failed to show that the self-aligning cannister design was technologically feasible in a 1989 Nissan pickup truck. At trial, appellees produced evidence that suggested that the self-aligning cannister design, as installed in Ford Capris and other vehicles, was more effective than the axial compression design in preventing death or serious injuries in real-world accidents. What appellees failed to establish, however, was that this more-effective self-aligning cannister design could actually be incorporated into the Nissan pickup model that Nave was operating. A careful review of the record leaves the reader with no idea whatsoever as to what a self-aligning cannister design on a 1989 Nissan pickup truck would look like. Appellees never introduced into evidence any design specification that showed the dimensions, composition, or attributes of a cannister column on a 1989 Nissan pickup, nor was there any evidence that a self-aligning cannister design could be installed successfully in such a vehicle. The fact that cannisters had been used in other cars in the past, and that such designs met FMVSS 203 requirements, does not establish that the design could be used in a 1989 Nissan pickup truck.

In their brief, appellees say that plaintiffs' Exhibit 68 illustrates what a self-aligning cannister steering column would look like if installed in a 1989 Nissan pickup truck. This is a mischaracterization of that exhibit. Dr. Jones, the creator of Exhibit 68, when cross-examined about the dimensions of the alternative “design," emphasized that the exhibit did not purport to show actual dimensions. Instead, he testified that the exhibit's purpose was to illustrate how Nave's body would have interacted with a cannister column if such a column had been installed in Nave's truck. Dr. Ross, who assisted Dr. Jones in creating Exhibit 68, also testified that Exhibit 68 was “simply an illustration” to demonstrate how a cannister column would have functioned in the Nave accident. No one testified that a 1989 Nissan truck could be designed with a self-aligning cannister steering column as shown in Exhibit 68.

The case of Troja v. Black & Decker Manufacturing Co., 62 Md. App. 101 (1985), is apposite. In Troja, the plaintiff amputated his thumb while using a power saw manufactured by the defendant. See id. at 105. The plaintiff brought a strict liability action against the manufacturer, alleging that the manufacturer's failure to incorporate a safety interlock feature into the design of the saw was a design defect that caused the saw to be unreasonably dangerous. See id. In affirming the trial court's grant of a directed verdict in favor of the defendant, we held that the plaintiff had failed to produce sufficient evidence to make out his design defect cause of action. See id. at 111. With regard to the technological feasibility of incorporating the safety interlock system into the saw, we stated:

> Although [plaintiff's expert] suggested that Black and Decker could have incorporated a “safety interlock feature,” which would have prevented [plaintiff's injury], he acknowledged that he had no experience in radial arm saw design. [Plaintiff's expert] was unable to furnish a design demonstrating the actual placement of such a system, or to explain how it could be integrated in the saw without interfering with the functions [of the saw].

Id. at 109-10.

Troja illustrates the principle that it is not enough to show that there is a safer alternative design -- plaintiffs must also produce evidence that such a design can actually be incorporated into the suspect product without impairing the product's use or function. In this case, appellees simply showed that the self-aligning cannister design, as used in other vehicles, was more effective at preventing injuries than the axial compression design; however, as in Troja, this does not suffice.

2. Would the Self-Aligning Cannister Design Have Saved Nave's Life?

Appellees also failed to produce sufficient evidence showing that Nave would have survived the accident if his pickup truck had a self-aligning cannister steering column. While appellees introduced evidence to show that the cannister design produced fewer deaths than the axial compression design, appellees did not establish that the improved performance of the self-aligning cannister would have saved Nave's life.

Although Peterson testified that a cannister design "would have, certainly, tremendously reduced the energy potential to Mr. Nave," Peterson did not testify that this reduction in energy would have made any difference. In other words, there is nothing in Peterson's testimony that indicates that this reduction in energy would have been of such a degree that Nave would have survived the accident.

Dr. Ross did testify that Nave would have survived the accident if a cannister design had been used, but like the plaintiff's expert in Troja, he did not indicate what the alternative design would be, nor did he provide any basis for that conclusion. Dr. Ross, using the four frames illustrated in Exhibit 68, engaged in the following discussion:

> Q Doctor Ross, do you have an opinion to a reasonable degree of certainty in the fields of biomechanics and forensic pathology, would Mr. Nave have survived if the 1989 pickup truck was equipped with [a] properly functioning[17] self aligned wheel?
>
> A Sure.
>
> Q At a Delta V of 18.5?
>
> A At a Delta V of 18.5, yes. When you get [Frame] Two here, where his body begins to contact the rim of that wheel, and then [Frame] Three, when the under surface of the column begins to crush, begins to collapse, the wheel basically lines up with his chest. He may be moving in different sort of ways, but the goal behind this self aligning wheel is to line up with the chest. So, it's real simple. The goal is to line it up so you can disburse the load over the shoulders, over the chest, over a wide area of the body. The more area you got, he's a big guy, he's got a lot of area and that's good for him. Because he's big, that wheel could go over his chest and help disburse the load. He's also got a lot of mass. The bigger you are, the more force you can absorb.
>
> Q Doctor Ross, do you have an opinion to reasonable degree of certainty within the fields of forensic pathology and biomechanics whether Mr. Nave would have survived, had the Nissan been equipped with a properly functioning self aligned steering wheel at a Delta V of 26 to 27?
>
> A Yes, it would be my opinion Delta V at 26 or 27, which is the change in the speed of the vehicle, of the vehicle itself, his Delta

[17]It should be observed that there is a difference between a "properly functioning product" and a properly designed product. A properly designed product may malfunction, of course.

> V would have been less than that, he would have survived.

Essentially, Dr. Ross simply looked at Exhibit 68 and offered his opinion that Nave would have survived the accident if the steering column in his pickup truck had performed in the manner illustrated by that exhibit. This testimony might have been sufficient if Exhibit 68 represented an actual design. It was not, however, a design, because we do not know the dimensions of the cannister, its composition, or its capacities. And, as Savage uncontradictedly testified, testing had shown that even slight changes in the cannister design would lead to great changes in the cannister's performance. What Dr. Ross did is analogous to an expert drawing a picture of a baseball player with a helmet and then showing the jury a series of pictures purporting to illustrate how the helmet would protect the batter's head if the helmet were struck by a baseball thrown at ninety-five miles per hour. Unless the expert knows the size and composition of the helmet, its design features, and how much energy the helmet will absorb due to its composition and design, there is no way either the expert or the jury that considers the expert's testimony can tell if the helmet would indeed function as depicted. As mentioned earlier, Dr. Ross was admitted as an expert in forensic pathology, biomechanics, and kinematics. He was not, as he admitted, an expert in the design and performance of steering columns, and he acknowledged that he did not know how much energy the cannister could absorb. Under these circumstances, he had an insufficient basis for his (implied) assertion that, had the vehicle been designed with a steering column like the one shown in Exhibit 68, the column would have absorbed enough of Nave's kinetic energy to have saved his life. See Beatty v. Trailmaster Prods., Inc., 330 Md. 726, 741 (1993) ("[a]n expert's judgment has no probative force unless there is a sufficient basis upon which to support his conclusions") (quoting Bohnert v. State, 312 Md. 266, 275 (1988)). At most, Dr. Ross was qualified to testify about the maximum amount of force that Nave could have sustained to avoid death — whether any steering column design would have reduced the amount of force experienced by Nave to a survivable level was an issue well beyond Dr. Ross's knowledge or expertise. Aside from the fact that Exhibit 68 was not really an alternative design, Dr. Ross's opinion regarding how the self-aligning cannister would have performed in the Nave accident was pure speculation. See id.

3. Was It Cost-Effective to Build a 1989 Nissan Pickup Truck With a Self-Aligning Cannister Steering Column?

Appellees also failed to demonstrate the cost of incorporating a self-aligning cannister design into a 1989 Nissan pickup truck, the price to the consumer of incorporating such a design, and whether a pickup truck with a cannister steering column would be accepted by consumers.

Appellees' counsel asked Peterson about the costs of other alternative designs in the following colloquy:

> Q Mr. Peterson, do you have any specific information from Nissan about cost of

> alternative designs for steering wheel assemblies?
>
> A No, sir.
>
> Q Was that information, to your knowledge, requested of Nissan?
>
> A Yes, sir. It was.
>
> Q And no information was provided?
>
> A That is correct.[18]

Later, Peterson gave the following testimony:

> Q Mr. Peterson, are you able to give an opinion to a reasonable degree of engineering certainty as to the relative cost of the self-aligning cannister type of steering wheel assembly and that type of steering wheel assembly provided in the 1989 Nissan pickup truck <u>based on just an examination of those two assemblies</u>?
>
> A Yes, sir. I believe, relatively speaking, I can, yes.
>
> Q And what is that opinion?
>
> A That actually, the -- <u>because of less fabrication costs and so forth, the cannister model is probably actually cheaper</u>.

(Emphasis added.) Appellees contend that this testimony was sufficient to establish the cost-effectiveness of the cannister design. We disagree. Peterson's conclusion that the cannister design “is probably actually cheaper” is based only on a visual comparison of a cannister design (he does not say which one) to the steering column used in the 1989 Nissan pickup truck. Peterson did

[18]Appellees do not argue that Nissan violated discovery rules or that the trial judge erred in any way in supervising discovery.

not offer any facts, data, or explanation to support this conclusion, nor did he give any hint as to how he could do a cost-comparison simply on the basis of a visual examination of some unspecified cannister. See Beatty, 330 Md. at 726 (holding that expert opinions must be supported with a sufficient factual basis).

Peterson's testimony is strikingly reminiscent of the expert testimony at issue in Troja. In Troja, we rejected the “expert's bald statement that a safety interlock device could be implemented without great cost to the manufacturer” because the statement “was not supported by any data regarding the cost of the materials necessary to include such a feature.” 62 Md. App. at 110. Given that Peterson's opinion regarding the cost of the cannister design was devoid of any factual basis, it, too, was insufficient to meet appellees' required showing of cost.

Testimony given by William Bohley, Nissan's automotive engineering expert, was also insufficient to fill in this evidentiary gap. During his discussion of the 1981 NHTSA Report, Bohley testified that the axial compression and cannister designs that were evaluated in the NHTSA Report “all cost approximately the same.” Appellees contend that this testimony was sufficient to establish that the cannister design was a cost-effective alternative for a 1989 Nissan pickup truck. Appellees read Bohley's testimony too broadly. Bohley testified only that the cannister design studied in the 1981 NHTSA Report was similar in cost to the axial compression designs included in that study.

There was no showing that the cannister designs studied in the 1981 report were the same as the "design" depicted in plaintiffs' Exhibit 68, nor was there proof that the original compression design studied was the same as that used in Nave's pickup. Moreover, the fact that the cannister design cost the same as the axial compression designs studied in the 1981 NHTSA report does not mean that a cannister design would be cost-effective in a 1989 Nissan pickup truck. Furthermore, nothing in Bohley's testimony makes any reference to the cost of implementing a self-aligning cannister design into a 1989 Nissan pickup truck. As such, Bohley's testimony was also insufficient to show that the cannister design was a cost-effective alternative in a 1989 Nissan pickup.

Finally, Nissan correctly notes that "the cost to the consumer of incorporating cannisters was not discussed by any witness, and there was no proof of any chance of consumer acceptance . . . ." Appellees have no response in their brief to this contention, and we have been unable to find any evidence to contradict Nissan's assertion.

4. Conclusion

Because there was no evidence produced at trial to establish the aforementioned three elements, we conclude that appellees did not establish a prima facie case of design defect with respect to Nissan's decision to not use a self-aligning cannister design in its 1989 pickup.

B. Newer Nissan Axial Compression Design With Self-Aligning Steering Wheel

Appellees also contend that the newer Nissan axial compression design with the self-aligning steering wheel was another viable alternative design. We conclude that appellees did not establish that Nissan's failure to use this newer design in the 1989 pickup was a design defect.

First, there was no testimony indicating that the newer Nissan axial compression design was safer or more effective than the steering column used in Nave's truck. The existence of the newer Nissan axial compression design was discussed during Peterson's testimony. On cross-examination, Peterson testified:

> Q [DEFENSE COUNSEL] Well, now, you don't know whether the energy absorbing characteristics of this more recent design are better or worse than the energy absorbing on the 1989 Nissan pickup, correct?
>
> A I don't know what the energy absorbing characteristics are. I like the way the design looks. . . . And it would appear, assuming that they use the right kind of metal deforming, that it would do a good job.
>
> Q All right, sir. The question was whether you know if the energy absorbing performing characteristics of the newer, more recent design, are better or worse.
>
> You don't know what the answer is to that question, do you?
>
> A No, sir.
>
> Q All right. And I believe that [plaintiff's counsel] showed you, and showed the jury, this testimony by Mr. Hoshina, where Mr. Hoshina points out the energy absorbing was not changed.

> That's the only information that you have, isn't it, sir, that the energy absorbing performance of the '89 Nissan is the same as the energy absorbing performance of this more recent design?
>
> This is all you have, isn't it?
>
> A Yes, sir. . . .

This testimony illustrates that it was unknown whether the newer Nissan design was safer or more effective than the design used in Nave's truck. In addition, nothing in the record indicates that Nave would have survived the accident if the newer Nissan design had been used in his truck. The failure to establish that the newer Nissan design was safer and would have saved Nave's life was fatal to appellees' contention that Nissan's failure to use this newer design in the 1989 pickup was a design defect.

C. Collapse Mechanism Located Further Up the Steering Column

Appellees also contend that Jones proposed another viable alternative design when he testified as follows:

> Q Okay. Do you have an opinion whether there were any available alternative designs?
>
> A Yes, I do.
>
> Q My opinion is that there were clearly identified alternative designs. . . . If you look at the literature, there are other alternative designs where the collapse mechanism is moved further up the column, so that you -- you move the collapse mechanism closer to the occupant so that binding is not a problem.
>
> In other words, the closer you get the mechanism to the occupant that's impacting it, the less binding opportunity there is.

Other than the above testimony, there is no further discussion about alternative designs where the collapse mechanism is moved further up the column. Most important, there is no evidence showing that Nave would have survived the accident if such a design had been used in the pickup. At most, Jones's testimony is merely a theory on how to design a steering column – such a "hypothetical" alternative design is not enough to sustain a design defect cause of action.

D. General Motors Axial Compression Ball Design

Appellees next contend that the General Motors axial compression ball column (GM ball design) was another viable alternative design. Peterson's testimony regarding this alternative design was as follows:

> Q Mr. Peterson, were there alternative designs available for the steering assembly [in the 1989 Nissan pickup]?
>
> A Yes, sir.
>
> Q What alternative designs do you think would have been appropriate?
>
> A Well, certainly, one was the GM ball-type column with the aligning wheel.

Other than this passing reference, Peterson provided no additional testimony regarding the GM ball design. Savage, Nissan's expert on steering column design and testing, provided in-depth explanation of the GM ball design and explained that the GM ball design and the design used in Nave's 1989 Nissan pickup were very "similar" because "the mechanism for absorbing energy is the same." It is clear that nothing in Peterson's or Savage's discussion of the GM ball design established any of the elements of a design defect cause of action.

E. Mesh Design

Appellees' final contention is that the GM mesh design was another viable alternative non-defective design. Peterson testified about the mesh design as follows:

> Q You spoke about a mesh design. . . . [I]n your opinion, how is the mesh design a superior design to [the Nissan design]?
>
> A Well, even though the energy absorbing component, the mesh itself, is located fairly far down on the column, it is still less likely to bind or not to stroke. It is an energy absorbing element that would practically always stroke.

Although Peterson testified that the mesh design was better than the Nissan column because it was less susceptible to binding, nothing in his testimony (or the testimony of any other witness) established: (1) that Nave would have survived the accident if a mesh design had been used in the pickup; (2) that it was technologically feasible to incorporate a mesh design into a 1989 Nissan pickup truck; (3) that it would be cost-effective to build a 1989 Nissan pickup truck with a mesh design; (4) the likelihood of consumer acceptance of a pickup truck with a mesh design; or (5) the cost to the consumer of a 1989 Nissan pickup truck that incorporated a mesh design. Because appellees failed to elicit evidence regarding these elements, they did not establish that

Nissan's failure to use the GM mesh design made the 1989 pickup defectively designed.

CONCLUSION

As we have shown, appellees failed to produce sufficient evidence to support their design defect cause of action with respect to each of the five alternative designs that were mentioned at trial. Because appellees did not establish a prima facie case of design defect, we hold that the trial judge erred in denying Nissan's motion for judgment.

JUDGMENT REVERSED;
COSTS TO BE PAID BY APPELLEES.

I respectfully dissent from the majority opinion. The evidence was sufficient to support an inference that a different steering column design could have been installed in the 1989 Nissan pickup truck at a reasonable cost. Proof that another automobile manufacturer is using an alternative design in a substantially similar automobile permits the inference that appellant could have used the same steering column without an unreasonable manufacturing expense. Furthermore, the majority improperly held that it was appellee's burden to prove the cost-effectiveness of the self-aligning cannister design. In *Dancy v. Hyster Co.*, 127 F.3d 649 (1997), the United States Court of Appeals for the Eight Circuit held as follows:

> In this case, Plaintiff does not contend that the lift truck malfunctioned in any way; he contends the lift truck was not designed properly because it lacked a safety device.. . . Although Dancy does not have the burden of proving that his "alternative safer design was available and feasible in terms of cost, practicality and technological possibility," he still has the burden of proving the existence of a defect by showing that a safer alternative design actually exists.

Id. at 653-54. (Citations Omitted.) *See also Baltimore Gas and Elec. Co. V. Public Service Com'n of Maryland*, 305 Md. 145, 174

(1986) (The Court of Appeals held that BG&E, not the People's Counsel, carried the burden of proving that a power outage was not "the result of its failure to implement cost-effective precautionary measures.") I believe it was error to require that appellee shoulder the burden of proving that another steering column design would have been feasible.