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PRODUCTS LIABILITY

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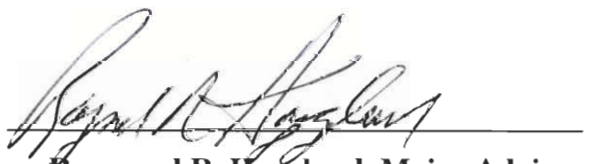
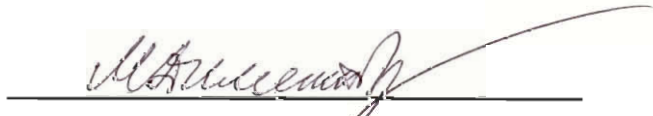
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by


Joshua W. Houghton
Benjamin C. Clark

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Approved:


Professor Raymond R. Hagglund, Major Advisor
Professor Mikhail F Dimentberg, Co-Advisor

Abstract

This project explored the role of an engineer as an expert witness in cases dealing with product liability. To do this, an engineer must become involved with all aspects of the case, including background research, and the litigation process. We learned about the legal process through videos and books then applied our newly acquired knowledge, along with our engineering skills, to several actual cases. We then formed opinions using sound engineering practices and reported our findings.

Table of Contents

<i>Abstract</i>	<u>2</u>
<i>Table of Contents</i>	<u>3</u>
<i>Chapter 1 - Video Summary</i>	<u>5</u>
1.1 Video #1 - Opening Statement	<u>5</u>
1.2 Video #2 - Direct Examination	<u>6</u>
1.3 Video #3 - Additional Opening Statements	<u>7</u>
1.4 Video #4 - Cross Examination	<u>7</u>
1.5 Video #5 - Cross Examination of Non-Medical Experts	<u>8</u>
1.6 Video #6 - The Deposition	<u>9</u>
1.7 Video #7 - The Conclusion	<u>9</u>
1.8 Video #8 - Summation	<u>10</u>
1.9 Video #9 - 60 Minutes II: A Classic Cover-Up?	<u>11</u>
<i>Chapter 2 - An Engineer in the Courtroom</i>	<u>12</u>
2.1 Introduction	<u>12</u>
2.2 The Nature of Accidents	<u>12</u>
2.3 Why Go To Court?	<u>15</u>
2.4 Avoiding Litigation	<u>15</u>
2.5 The Litigation Process	<u>16</u>
2.6 Engineers and Engineering Information	<u>16</u>
2.7 How the Engineer Can Help the Attorney	<u>17</u>
2.8 The Discovery Process	<u>17</u>
2.9 The Deposition	<u>17</u>
2.10 The Trail	<u>18</u>
2.11 Questions	<u>18</u>
2.12 Accident Reconstruction	<u>19</u>
2.13 Definitions and Techniques Employed by Attorneys	<u>19</u>
2.14 War Stories	<u>19</u>
2.15 Tips for the Engineer Involved in Litigation	<u>20</u>

<i>Chapter 3 – Products Liability In A Nutshell</i>	21
3.1 Definition and Scope	21
3.2 The Causes of Action and Damages	23
3.3 The Parties	27
3.4 Factors Affecting Remedies, Jurisdiction, and Procedure	28
3.5 Production and Design Defects	31
3.6 Inadequate Warnings, Instructions, and Misrepresentations	33
3.7 Problems of Proof	34
<i>Chapter 4 - Bartow vs. Extec</i>	38
4.1 Introduction and Background	38
4.2 Details of Accident	39
4.3 Analysis of the Case	40
4.4 Conclusions	42
<i>Chapter 5 - Perkins vs. Rodgers</i>	43
5.1 Introduction and Background	43
5.2 Details of Accident	44
5.3 Analysis of the Case	45
5.4 Conclusions	46
<i>Chapter 6 - Vermont Yankee Nuclear Power Corp. vs. Cianbro Corp. and Rodney Hunt Corp.</i>	47
6.1 Introduction and Background	47
6.2 The Failure	49
6.3 Analysis of the Case	50
6.4 Conclusions	53

Chapter 1 - Video Summary

1.1 Video #1 - Opening Statement

The first video deals with the opening statement. An attorney at the beginning of a trial makes the opening statement, before evidence is introduced. The opening statement outlines what the jury will be introduced to later. Although it is not meant as an argument as to why the speaker's side should win, it can often sway the jury to the speaker's side.

There are several goals that the lawyer should try to achieve during the opening statement. Most importantly, the lawyer should try to create a connection with the victim and the jury, because it is the sad truth that juries are more sympathetic towards those with similar features and situations.

A lawyer can sometimes sway the jury into his favor by painting a narrative picture of what happened, and how the incident affected the victim, as has been shown in a study in Chicago. This study showed that many times, juries believe more about a case from what they hear in the opening statement than from what the evidence presented to them says. This study has led to a new strategy in giving the opening statement. It is a strategy in which the lawyer brings up the key points of his case, and tries to eliminate any advantage the other side may have.

There are other functions of the opening statement, such as explaining unfamiliar terms that will be used frequently throughout the trial. The issue of liability must also be mentioned at some time during the opening statement. The lawyer should explain why the defendant is or is not responsible. The issue of damages to the victim and how these damages will affect him should also be brought up during this time. Finally, in the last part of the opening statement, the lawyer should return to the theme of the trial, and try to tell the jury what to decide.

These are just the basic ideas of the opening statement. What really makes an opening statement good is the way the lawyer uses his strengths, and the way he paints a picture for the jury.

1.2 Video #2 - Direct Examination

Direct examination is the part of the trial where the initial questioning of witnesses starts. The side that called him or her up to testify questions a witness. The purpose of direct examination is for the lawyer to explain his side's version of the events to the judge and jury, and to undercut the other party's version. Often, direct examination is rehearsed by the lawyer and witness so that the witness can give testimony that is helpful to their argument.

Of course, a major part of direct examination, in a product liability case especially, is the area of finances. This can be a difficult area for a lawyer. It can hurt a lawyer if the jury thinks he is after money and nothing else, so it is important that the lawyer shows where the money values are coming from, and why the victim deserves the money he is asking for. The issue of money should not be discussed for too long. It is important for the jury to know how much is being asked for, but at the same time, if the lawyer spends too much time discussing it, the jury will think he is only after the money.

There are several rules that must be followed by the lawyers during the direct examination. It is important that the lawyer is not interrogative towards the witness. Simple 'yes' and 'no' questions are best when interviewing. This way, lengthy explanations by the witness can be avoided, which is good because there is the chance that the witness will say something to hurt their case.

During the direct examination, it is important to talk about the injuries and the effect the accident has had on the victim's lifestyle, but more importantly, emotion should be left out as much as possible. If the witness shows too much emotion, the jury as a desperate attempt to gain sympathy can interpret it.

Direct examination is also when evidence is shown to the witness and jury. Evidence is shown in exhibits, which keeps things organized. Organization is extremely important, because sloppiness would be a terrible trait in a lawyer, and it needs to be avoided at all cost. The injury should not be shown until the last part of the direct examination. This way, it is the last thing the jury sees, and it will stick with them, hopefully until they make their final decision.

1.3 Video #3 - Additional Opening Statements

In the first video, we were introduced to the opening statements, in which each side's lawyer outlines the party's legal position, and previews the evidence that will be introduced later. Adding additional opening statements is a means for each lawyer to reiterate his facts, and to establish a good relationship with the jury.

As always, the lawyer's body language and tone of voice are important in conveying his message, and repetition of statements can show the importance of what he is trying to say. Repetition also helps get important information across to the jury because when people hear things many times, they are more likely to remember it.

The opening statement can also bring in other aspects of the case. For example, a lawyer might take the opportunity in his opening statements to establish the credibility or credentials of the victim or witnesses, and also try to discredit the defendant. Evidence that the lawyer feels to be the most important may also be brought into the opening statement, but it is important to not bring in too much evidence. It is generally poor practice to bring the subject of money up in the opening statements, because jurors may feel that the plaintiff is after more money than is deserved. It is best to bring this information up later in the trial, when the lawyer can call in an expert to estimate the amount of money that is deserved.

Most importantly during the opening statement is to be concise and to the point. This is the part of the trial where the jurors are most impressionable, so it is extremely important to make a strong opening statement.

1.4 Video #4 - Cross Examination

Cross examination is the opportunity to question any witness, including your opponent, who testifies against you in direct examination. The opportunity to cross-examine usually occurs as soon as a witness completes his direct testimony. There are

two important goals in cross-examination. One is to try to get the witness to say something that is helpful to your side, and the other is to try to cast doubt on the witness by getting them to admit something that reduces his credibility. It is important that the trial lawyer establishes his presence with the jury through cross-examination.

At the beginning of cross-examination, the lawyer should get to know the witness by asking open-ended questions. The beginning is the safest time to ask open-ended questions, because the witness was brought forth by the opposition and in most cases will be favorable to that side.

The lawyer should look for holes in the witness' story, or look for conflicting statements. The questioning lawyer must show that he has control of the questioning by getting the witness to agree with as many statements made as possible.

1.5 Video #5 - Cross Examination of Non-Medical Experts

It is almost impossible to find a case involving products liability in which an expert witness of some form was not involved. Quite often, engineers are used as expert witnesses in products liability cases. Expert witnesses have most likely appeared in court before, and are therefore accustomed to manipulation attempts by opposing lawyers. Since the witness is being paid to appear, they are much more difficult to discredit than other witnesses may be.

It is vital to not ask an expert witness open-ended questions, as they are experienced and very good at gaining the favor of the jury through explanations. Although mistakes by expert witnesses are rare, the opposing lawyer must always be ready to jump when he hears an inconsistency. It is extremely important to capitalize on flaws in the witness testimony. Often times, it is easier to belittle the profession of the witness. The lawyer must not attack the witness personally, but he should try to put the witness' professional career in question. For example, if the time spent on the case by the witness is less than adequate, the lawyer should concentrate on explaining that the witness could not have come up with a credible explanation without spending more time researching.

For a lawyer, showing dominance over an expert witness can be difficult, but by doing so, winning the case becomes much easier.

1.6 Video #6 - The Deposition

The deposition is an important tool where one party questions the other party or witness in the case. The deposition is often conducted in an attorney's office. It requires that all questions be answered under oath and be recorded by a court reporter who creates a deposition transcript. During the deposition, there is always some hope that the two sides can reach some agreement or understanding before they enter the courtroom with the jury present.

Since the deposition is recorded by a court reporter, it is considered valid evidence in trial. Deposition testimony can be used to cast doubt on a witness by finding contradictions in statements. Also, if a deposed witness is unavailable to testify, his deposition testimony can be used for live testimony.

It is important for a witness in deposition to understand each question completely before answering. If a witness doesn't understand a question before answering, he might answer the wrong way, and when it comes to the cross-examination, it will be very easy for the opposing lawyer to find inconsistencies, and therefore cast doubt on the witness.

Most importantly, the witness should be completely honest during deposition. Also, if a witness doesn't understand a question, it is important that he consults with his attorney before answering.

1.7 Video #7 - The Conclusion

The conclusion usually consists of five or six statements at the end of the closing arguments, which are used to wrap up the entire case, and give the jury a positive impression of the lawyer. The conclusion is much like the opening statement in that the lawyer tries to paint a picture to gain sympathy for the jury.

The conclusion can make or break a lawyer's case, and therefore it should be a prepared statement. The lawyer should have already decided how he is going to deliver

the story to the jury. He should also explain to the jury how important they are, and that whatever decision they make will have a major impact on many lives. By explaining the responsibility of the jury, the lawyer can sometimes make the jurors take their decision more seriously than they would have.

Whatever style of delivery a lawyer uses for the conclusion depends on what he is most comfortable with, and what works best for him. With experience, a lawyer can add many different styles and techniques to his repertoire, which can increase his chances of winning.

1.8 Video #8 - Summation

Summation is the closing statement of the trial. By the time summation comes around, the lawyer should already have established a relationship with the jurors. The summation should be based on the three basic principles of argumentation. The first principle is to try to give insight as to why their case is a good one. Evidence and witness testimony can be used, but that is not always the case.

It is important for the lawyer to know exactly how he is going to phrase specific parts of the summation. For example, the subject of injuries is a sensitive one, and should be handled with care. The lawyer should have a well thought out statement, one that doesn't give a negative impression to the jury. Another delicate issue is the financial part of the case. It is best for the lawyer to have charts and graphs that can easily illustrate where the bottom line is coming from. Since the lawyer generally does not know the background of the jurors, and doesn't know how the jury will react to certain things, he should know exactly how he is going to phrase each part of the summation. This is also a good way for the lawyer to give his credibility one final boost before the decision is made.

Again, it is important for the lawyer to remind the jury of their importance. They should be reminded by the lawyer that many lives will be affected by their decision.

1.9 Video #9 - 60 Minutes II: A Classic Cover-Up?

This is a good example of what a products liability case would be about. The case revolves around a popular classic car, the 1964-1970 Ford Mustang, that has a major defect in its design that can cause serious injuries to whoever is in it.

The problem with the Mustang is the design of the gas tank. It is a drop in gas tank, so the top of the tank is at the floor of the trunk. It was designed this way to save money. It is inexpensive to produce and install. The Mustang was originally marketed as an affordable sports car, so keeping the price down was extremely important.

When the Mustang was struck from behind, the gas tank would be crushed, and could spray gasoline into the passenger compartment through the back seat. If the gasoline ignited, a huge fire would be started inside the vehicle. Ford maintains the collisions were all at high speed, and therefore didn't cause any more deaths than in any other car, but studies have shown that burning deaths in Mustangs is nearly three times that of other cars built in the 60's.

One thing that must be understood is that when the Mustangs were built, Ford was not breaking any laws, because there were no laws in place governing safety in automobiles. The only thing that Ford could be criticized for is not doing what is morally right. Ford was sued over 70 times for the burning of the Mustang, and each time they settled out of court with little publicity. This shows that Ford knows there were flaws in its design, and it can be interpreted as an admission of guilt. But, Ford still didn't change the design until 1971.

Lee Iococa, the president of Ford, helped design the Mustang. He was taped by former president Nixon's secret recording devices saying, "Safety is ruining the automobile industry." It could be said that Ford tried to cover up the issue, especially when you look at the withholding of the crash test 301 video tape, in which the gas tank of a Mustang is shown rupturing and covering the back-seat passengers with gasoline.

Lee Iococa has also been quoted as saying, "If you want safety, buy a new car." No matter how true the statement, it is still a terrible thing to say. It shows that Ford didn't care what happened to its customers. They should be held responsible for the poor design of the Ford Mustang.

Chapter 2 - An Engineer in the Courtroom

2.1 Introduction

This book is to introduce the engineer to what he may expect to encounter in a matter of litigation. Having read this book, the engineer may:

- Be able to avoid litigation
- Know what leads to litigation
- Understand what accidents are, and how they are caused
- Learn something about the litigation process
- Realize the importance of decisions made by an engineer
- Be aware of how the engineer can assist the attorney
- Know what to expect in discovery, in deposition, and at trial
- Know how to best conduct himself in those situations

This book is about the roll of an engineer in the courtroom, and how he can keep himself from being blamed for accidents that are not his fault. Within this book, there is advice on how to handle litigation, and insight as to what types of accidents most commonly lead to litigation, and what can be done to avoid it.

2.2 The Nature of Accidents

Most accidents can be classified in one of 16 categories. They are as follows:

- 1. Collision – Two Bodies Trying to Occupy the Same Space:** This includes two moving vehicles, a vehicle hitting a fixed object, a vehicle hitting a stopped vehicle, airplane crashes, a vehicle hitting a person, a person running into a moving vehicle, and a person running into another person.

2. Slip and Fall Accidents: Any accident that involves the victim and nothing else but the surface, location, or conditions upon which he is moving. Slip and fall accidents can be caused by loss of traction, tripping, dizziness, fall from a ladder, or any number of other situations.

3. Loss of Control: This type of accident occurs when the person loses control over his machine or his responsibility. Steering failure, brake failure, and other types of failure are included in loss of control.

4. Hit by Falling Object: This includes all situations where the person or machine is hit by a falling object. The criteria is that the object be moving, essentially unrestricted, and under the force of gravity. A variation of the falling object accident is the rolling object accident.

5. Suffocation: Deprivation of oxygen, or the replacement of oxygen by a material that does not support life. It may also occur because a person is choked by external means or has a blocked windpipe. Suffocation also includes drowning.

6. Electrocuting: In general, if the accident is caused by contact with electric power, it is electrocution.

7. Poisoning: Includes the ingestion or contact with substances which injure or destroy any part of the body or its functions.

8. Shock and Vibration: Sudden changes in forces acting upon the human body which may cause injury. Repetitive function injuries such as Carpal Tunnel Syndrome are included in this class of accident.

9. Entanglement: Entanglement happens when a person gets some part of his body, clothing, or equipment too close to a moving part of a machine.

10. Cuts and Abrasions: Similar to entanglement. The difference is that cuts and abrasions result from partial involvement (brief contact with an edge or surface which causes a cut), and entanglement results from total involvement (A digit or limb is lost, or clothing is completely wound up in the machine.)

11. Fire: Includes any kind of combustion. Fire accidents include suffocation as a result of being enclosed in or by fire. Also classified as fire are chemical burns, explosions, radiation, and burns from contact with hot surfaces.

12. Mechanical Failure: Any mechanical failure that results in injury.

13. Struck by Moving Projectile: Includes being hit by almost anything, except bullets and arrows. Bullets and arrows are a part of a separate classification, *'Firearms and other such devices.'* Also, War is included in this category of accident.

14. Natural or Environmental Factors: Includes earthquakes, tornadoes, cyclones, floods, and other natural and environmental events. Also, the following special cases are included:

- Heat
- Cold
- Lack of water
- Animal attacks
- Wind
- Lightning

15. Homicide: The killing of a person.

16. Other accidents: Includes all other accidents that cannot be classified in one of the above categories.

2.3 Why Go To Court?

The reason people go to court is because someone believes that his relationship with someone else has been unbalanced. The number of possible incidents and claims is seemingly limitless. Quite often, the complaint is a simple one. In the case of the engineer however, the reason is usually to do with the use of a product that has resulted in the injury of the user, and is therefore more complicated. Usually, the question to be answered in court is “Who is to blame for the accident?” Very often, the operator is at fault because he misused the machine, but it is also common for a machine to malfunction, causing injury of the operator. The engineer is there to give his expert opinion, and to help the jury decide who is to blame.

2.4 Avoiding Litigation

The engineer can best avoid litigation by doing the engineering-related things to avoid accidents. The engineer should make it his responsibility to consider the possible consequences of each decision he makes. He should always make sure that his products are designed with safety in mind. A good engineer will always try to anticipate and avoid ways in which his product could be misused. He should also consider other options in the design, features, materials, and processes of his product. It should be close to impossible for someone to have an accident on a machine, and even if an accident were to occur, it should not result in injury. Proper testing of the equipment in adverse conditions is also a necessity. This will allow the designer to pinpoint problem areas, and make sure steps are taken to avoid them. Of course, it is nearly impossible for the engineer to take all of the risk out of using a machine. The operator of the machine has to have proper background in the operation of the machine, and he should always be aware of the risk associated with operating the machine.

2.5 The Litigation Process

The following is a list of the segments of the litigation process:

- The claim (Summons and Complaint)
- The response and defense (Answer)
- The discovery process, including:
 - Interrogatories
 - Requests for Production
 - Requests for Admissions
 - Inspections
 - Depositions
- The trial

The claim is the plaintiff's request to the court for a trial. From there, the court can decide whether or not the case is worth hearing. The response is the defendant's chance to either settle the matter outside of the courtroom, or to bring it to trial. Before the trial begins, assuming the defendant has denied all accusations, there is a discovery process, in which both parties research the case and try to make a convincing argument. For the engineer, depositions are the most important part of the discovery process, since they require the knowledge and opinions of people in a specialized field. After the discovery process is the trial. The trial is where each party presents its case to the jury, and the jury renders a decision.

2.6 Engineers and Engineering Information

There are two ways in which an engineer is used in litigation: as a fact witness or and expert witness. The major difference between the two is that as an expert witness, you are able to use your opinion in your testimony. In either case, you have to present the information you have in an unambiguous and precise manner. You must be ready to explain all design and engineering decisions involved with the product and all crucial information should be on file.

2.7 How the Engineer Can Help the Attorney

The attorney and engineering both have important roles to play during the litigation process and it is essential that they share their expertise in their respective fields in order to be effective. The engineering must listen to the attorney when it comes to the legal process because he knows what to do in order to win the case. The engineer can recommend questions, but the attorney always asks them. It is also the engineer's role to inform the attorney of the process of product development and the specifics of the product in question. He has to show that the product is safe and reliable for its intended use. Experiments, tests, accident reconstructions, and other demonstrations are generally used to prove the point of the engineer. Any sources used in these should be properly documented and sources cited. The engineer also has to make sure technical information is easily deciphered in easy to understand language for both the attorney and the general public.

2.8 The Discovery Process

During the discovery process, it is your job to sort through the information and find out which is pertinent to your party's case. Conversely, it is not your job to lead the process, that should be left up to the attorney. "Smoking guns" can make or break your case so be sure to watch out for them. Be careful when answering questions during this phase, but be sure that you answer any questions fully, and as clearly as possible.

2.9 The Deposition

A deposition is when a witness is questioned, under oath, by an attorney outside the courtroom. The answers you give to these questions are just as important as testimony in the courtroom. You have to make sure you understand the questions being asked and the purpose of the deposition. Since depositions try to establish facts using your expert opinion, you have to know all the pertinent information involved. They can be used along with testimony to try to find discrepancies in your statements so make sure to be

truthful at all times. Know that you are there to be used as a reference and a source of knowledge in the field. When answering questions, think about your answer and the question it's self as to give the best possible answer.

2.10 The Trail

Jury selection is usually the first step in the trail process. After you have a jury, the plaintiff presents his or her case, followed by the defendant presenting theirs. Witnesses, physical evidence, and other strategies are used to prove their respective cases. After this, there are final arguments from both sides and the case is given to the jury to deliberate and decide the outcome. When involved in the trial, it is important to be serious with all the proceedings and to only talk about the case with your attorney when outside of the courtroom. When answering questions during the trial you must be clear and concise with your answers and most importantly, truthful. During the trial is not the time to try to be humorous or smug.

2.11 Questions

Questions can range from specific to general and can be open ended or closed ended. These all depend on how much information is provided. People questioning you can lead you into something by putting answers in the question. Questions may also be rhetorical or interrogating. Word emphasis can also play a role in both questions and answers. Knowing the types of questions that are going to be asked and how they will be asked is key to your testimony. It helps you shape your answer in the best way possible and not get caught saying something that can be interpreted differently than you wanted.

2.12 Accident Reconstruction

In many cases where the facts about an accident aren't all known, an accident reconstruction is used to answer some of the questions left unanswered. This is not always easy but if care is taken to limit the variables, the reconstruction can be very helpful. When recreating an accident you have to make sure take into account as many factors as possible, such as eyewitness reports, the laws of physics and engineering in order to match the original circumstances as closely as possible and to limit the variables. With all of these factors in order, you can prove that things did or did not happen as claimed. This can be essential to proving your case in the courtroom.

2.13 Definitions and Techniques Employed by Attorneys

This chapter covers many definitions of legal terms and a list of techniques that are employed by attorneys and other people in the legal field. By knowing these terms and understanding their meanings, you can be more effective when involved in litigation and can help your party much more with your knowledge of both engineering and of the legal process.

2.14 War Stories

This chapter gives the reader insight into the courtroom using stories from various cases. Most of the examples show you what not to do when in the courtroom and you can take important lessons from them, such as keeping a level head and not getting nervous frustrated, or angry. Also, being honest when answer questions and think about your response before you give it. By using these “war stories” as guidelines and learning from other’s mistakes, your testimony can much more valuable.

2.15 Tips for the Engineer Involved in Litigation

This chapter gives you general tips to remember when you are involved in litigation. First, don't be intimidated by the legal process and be truthful. You have to make sure to listen to the attorney because he knows the process better than you. Also, if mistakes are made, correct them instead of covering them up, it will only make matters worse if you try to mislead people.

Chapter 3 – Products Liability In A Nutshell

3.1 Definition and Scope

A. What is a product?

A product is usually thought of as tangible personal property – as a good, or chattel. Products liability includes things such as electricity, pets, writings, and property - not just tangible goods. When determining whether the law of products liability applies, one should determine if the defendant is in the best position to spread the loss and prevent injuries, and to other policy concerns such as freedom of speech and the difficulties of proof.

B. What is a defect?

In General

Generally, the reason for imposing liability against a product supplier for injuries resulting from a product is because the product is supplied in a defective condition. It is also possible for the law of products liability to apply to the negligent entrustment of a sound product.

Types of Defect and Their Interrelation

There are four types of defects: manufacturing or production flaws, design defects, defective warnings or instructions, and misrepresentation. Manufacturing or production flaws are atypical defects that are the result of a defect in the manufacturing process. Design defects are characteristic of a whole line of products. Defective warnings are also usually characteristic of a whole line of products, and are therefore sometimes placed in the same category as design defects. Misrepresentation is not clearly distinguishable from other types of defects. It is the appearance of a product to have characteristics that it does not actually have.

Conceptual Standards for Determining Defectiveness

There are several definitions that may be used to describe each of the types of defects. The failure of the courts to settle on a single definition of defect for design,

warning and production flaws indicates the fluidity of the law in this area, as well as the uncertainty regarding the proper scope of the law of products liability.

Products must not be of unreasonable danger to the consumer. Unreasonable danger is defined as: “The article sold must be dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics.”

Presumed seller knowledge is sometimes used as another test of defectiveness: would the seller be negligent in placing a product on the market if he had knowledge of its harmful or dangerous condition? This definition presumes that the seller is aware of the defect in his product, but puts it on the market anyway. This definition contains a standard of strict liability, as well as one of defectiveness.

A majority of courts use a risk-benefit analysis to determine defectiveness, especially in design cases. Risk-benefit analysis is based on the question of whether the cost of making a safer product is greater or less than the risk of danger from the product in its present condition. Another way of phrasing the test is in terms of risk vs. cost. If the risk of danger is greater than the cost of eliminating that danger, then the product is defective. At some point, the cost outweighs the benefits. A common standard used for determining risk-benefit is the seven factors proposed by Dean John Wade. The seven steps are:

- 1) the usefulness and desirability of the product
- 2) the likelihood and probably seriousness of injury from the product
- 3) the availability of a substitute product that would meet the same need and not be as unsafe
- 4) the manufacturer’s ability to eliminate the danger without impairing usefulness or making the product too expensive
- 5) the user’s ability to avoid the danger
- 6) the user’s anticipated awareness of the danger
- 7) the feasibility on the part of the manufacturer of spreading the risk of loss by pricing or insurance

Not all courts follow the risk-utility approach, and not all of these factors go without exception, but this is a common standard.

Risk-benefit or risk-burden balancing involves questions concerning state of the art, since the burden of eliminating a danger may be greater than the risk of that danger if the danger cannot be eliminated. Absence of the knowledge or ability to eliminate a danger is assumed for purposes of determining if a product is unavoidably unsafe.

Some products are unavoidably unsafe. If such a product is properly prepared, and accompanied by proper directions and warnings, it is not defective, nor is it unreasonably dangerous.

Defect and Unreasonable Danger

Most courts require proof that the product is in a defective condition and unreasonably dangerous, although the category of plaintiffs has generally been extended to include foreseeable bystanders as well as users and consumers.

The Relation of Defect to Causes of Action

We can conclude that the risk-benefit approach to determining defectiveness will result in fault while the consumer expectation test looks toward strict liability.

C. What is a Sale?

A sale is defined as the passing of title from the seller to the buyer for a price. The issue of the scope of transactions covered by products liability is relevant for purposes of determining the extent of implied strict products liability.

3.2 The Causes of Action and Damages

A. Negligence

Negligence can arise in any number of ways. It can arise through inadequate inspection, processing, packaging, warning, design, marketing, or in any other way a defendant fails to meet the standard of care of a reasonable person in dealing with a product thereby proximately causing injury to the plaintiff. The Plaintiff is responsible for demonstrating that negligence caused the accident. In other words, he has to show that the accident is not possible in the absence of negligence. In addition, the plaintiff

must show that it was the defendant's duty to eliminate the danger. Lastly, the plaintiff must, with evidence, remove responsibility for the accident from all parties except the defendant.

B. Statutory Violations

Statutory violations rely directly on defined terms or intent of a legislative or regulatory body.

C. Reckless Misconduct, Concealment and Deceit

Intentional misrepresentations can counteract what might otherwise be adequate warnings of danger. Reckless misconduct can also justify recovery of damages for emotional distress.

D. Strict Liability

In General

Where strict liability is implied, it is normally only against a business provider. Strict liability for engaging in abnormally dangerous activities is imposed against business and non-business person alike.

Implied Obligations

A. The warrantee of merchantability

1. Unless excluded or modified, a warrantee that the good shall be merchantable is implied in a contract for their sale if the seller is a merchant with respect to goods of that kind.
2. Merchantability is contingent upon the following:
 - a) Must pass without objection in the trade under the contract description.
 - b) In the case of fungible goods they must be average quality within the description.
 - c) Must be fit for the ordinary purposes for which such goods are used.
 - d) Must run within the variations permitted by the agreement of even kind quality and quantity within each unit and among all units involved.

e) Must be adequately contained, packaged, and labeled as the agreement may require.

f) Must conform to the promises or affirmations of fact made on the container or label if any exist.

3. Implied warranties may arise from course of dealing or usage of trade.

B. The Warranty of Fitness for a Particular Purpose

The warranty of fitness for a particular purpose is often interchangeable with the implied warranty of merchantability. The fitness warranty is one of strict liability, since the seller's selection or furnishing of the goods, and his knowledge of the buyer's reliance on his skill or judgment, may be entirely reasonable.

C. Strict Tort Products Liability

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 a product.

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 above applies, although;

a) The seller has exercised all possible care in the preparation and sale of his product.

b) The user or consumer has not bought the product from or entered into any contractual relation with the seller.

D. Abnormal Danger

The factors that Torts sets forth which determine ultra hazardous or abnormally dangerous activities are:

1. The existence of a high degree of risk.

2. The likelihood that the harm will be great.

3. The inability to eliminate the risk by the exercise of reasonable care.

4. The extent to which the activity is not a matter of common usage.

5. The inappropriateness of the activity to the place where it is carried on.

6. The extent to which its value to the community is outweighed by its dangerous attributes.

Misrepresentation

A. Express Warranties

1. Express warranties by the seller are created as follows:

- a) Any affirmation of fact or promise made by the seller to the buyer that relates to the goods and becomes part of the basis of the bargain creates an express warranty that the goods shall conform to the affirmation or promise.
- b) Any description of the goods that is made part of the basis of the bargain creates an express warranty that the goods shall conform to the description.
- c) Any sample or model that is made part of the basis of the bargain creates express warranty that the whole of the goods shall conform to the sample or mode.

B. Strict Tort

One engaged in the business of selling chattels who, by advertising, labels, or otherwise, makes to the public a misrepresentation of a material fact concerning the character or quality of a chattel sold by him is subject to liability for physical harm to a consumer of the chattel caused by justifiable reliance upon the misrepresentation, even though it is not made negligently, and the consumer has not bought the chattel from or entered into any contractual relation with the seller.

E. Damages

In General

A plaintiff is usually entitled to recover all foreseeable damages in a products liability suit based on tort.

Emotional Distress

There are differing opinions on whether recovery for emotional distress alone is allowable, where there is no accompanying physical injury. If there is physical damage, recovery can be made based on emotional distress.

Punitive Damages

Punitive damages are awardable based on the wealth and reprehensible conduct of the defendant.

Joint and Several Liability

These are cases where one tortfeasor is held liable for all damages suffered by a claimant, even though other tortfeasors may also have contributed to the injury. Extensive efforts have been made to modify common law by statute with regard to joint liability.

3.3 The Parties

A The Plaintiffs

The plaintiff is the person who is suing for recovery of personal injuries.

B. Defendant Sellers of New Products

Manufacturers

In the case of manufacturing, the final assembler as well as any manufacturer of any component part may be sued. The manufacturer is responsible for his product before and after it is assembled, and all of the components that go into it.

Middlemen and Retailers

Retailers are not liable for any latent defects unless they are obvious.

C. Defendant Used Products Sellers

The sellers of used products cannot be held responsible for the product after it has left the chain of distribution.

D. Defendant Successor Corporations of Products Sellers

Two major rules of the buying and selling of entire businesses are the Turner rule and the Ray theory. The Ray theory is used when the successor gains control of all manufacturing assets of the predecessor. The Turner rule outlines when a business can be liable for the defective products of the previous owner.

E. Defendant Lessors, Bailors, and Licensors of Products

Lessors are liable for injury if the customer is using the defective product during the rental period.

F. Defendant Employer Suppliers of Products

Some injuries that occur to employees in the work place are the fault of the employer. They can be held liable in instances of negligence.

G. Defendant Providers of Services

There are three types of people who can be held strictly liable: Product certifiers, trade associations, trademark licensors, franchisers, and advertisers. Only non-professional services are liable under strict liability.

H. Defendant Real Estate Suppliers

Some courts see no reason to differentiate between the mass sale of homes and the mass sale of other products such as automobiles. Other courts refuse to impose an implied warranty on homes, believing that the issue is too complex.

It is generally the case that a tenant takes the premises as he finds them, and that the landlord is not held liable for any defect in the property.

A premises occupier who engages in an abnormally dangerous activity may be strictly liable to others who are injured by such an activity.

3.4 Factors Affecting Remedies, Jurisdiction, and Procedure

A. Reliance

Reliance is a necessary condition for personal injury recovery due to misrepresentation. One must show that the consumer relied on certain assurances when buying the product. In the case of warnings, there must be proof that the warning was relied on.

B. Disclaimers and Limitations of Remedies

Disclaimers arise when no remedy is given.

General requirements for disclaimers are conspicuousness and clarity, timeliness, fulfillment of essential purpose, and conscionability.

A disclaimer is effective to bind only those who either directly or indirectly are a party to the agreement.

C. Recovery of Solely Economic Loss

The Rule and its Rationale

Usually a plaintiff cannot recover in tort when he or she has suffered solely economic loss from a defective product.

Definitions of Solely Economic Loss

Economic loss is defined as a loss in value, loss of use, cost of replacement, lost profits, and damage to business reputation, where no sudden physical accident is involved.

Exceptions to the Rule

Some courts make no distinction between solely economic loss and physical injury, and allow recovery in tort in either case.

D. Notice of Breach

Where the tender has been accepted the buyer must within a reasonable time after he discovers or should have discovered any breach notify the seller of breach or be barred from any remedy.

E. Wrongful Death

A wrongful death is a death that results from a crime, negligence, carelessness, wrongful act, or default of another.

F. Procedural Considerations

Jurisdiction

a) Statutory Causes of Action

When express warranties are breached by the defendant, state consumer protection statutes give the plaintiff the right to collect damages and all attorney fees.

b) Minimum Contacts of the Defendant

The United States Constitution requires that a defendant have minimum contacts with a forum before it can be subjected to the personal jurisdiction of that forum.

Inconsistent Verdicts and Erroneous Instructions

Some courts hold that if a case is submitted to a jury on a good count and another count not supported by the evidence, then a general verdict for the plaintiff must be reversed and remanded for a new trial.

Res Judicata

Estoppel by judgment precludes relitigation of the same cause of action that has been previously litigated to a final judgment between the same parties or their privies. Issue preclusion, or collateral estoppel, precludes relitigation of an issue that has been finally determined in prior litigation between the same parties or their privies.

Choice of Law

A state will apply its own procedural rules, even though it might apply the substantive law of another jurisdiction provided that law does not conflict with the state's public policy. A procedural rule for state law purposes may nevertheless be substantive for federal diversity jurisdiction purposes.

G. Statutory Compliance

Several states provide by statute that compliance with applicable governmental statutes creates a presumption that a product is not defective or unreasonably dangerous.

H. Contract Specifications Defense

Nongovernment Specifications

It is generally assumed that one who manufactures a product in accordance with the specifications of a nongovernmental purchaser is not strictly liable for a defect in design unless the danger is obvious.

Government Specifications

Generally, contractors are immune to liability for injuries caused by a defectively designed product supplied to the government in accordance with government contract specifications.

I. Statutes of Limitations

The Applicable Statute

When more than one statute of limitation can apply to a cause of action, one approach is to allow the plaintiff to rely on a warranty statute for a warranty claim, and a tort or personal injury statute for tort claims. Another course of action is to look to the

gist of the action, and apply only the tort or personal injury statute even to a claim based on breach of warranty.

Date of Accrual

The time at which the period of the statute of limitations begins to run may vary depending on the statutory language or the applicable rule adopted by the court. Three common types of these dates are the date of the injury, the date when the plaintiff had reason to know about the claim, and the date when the plaintiff should have known of the claim.

Tolling Exceptions

The statutory period can be tolled, or stayed, by the occurrence of an event that keeps the period from beginning or from continuing to run as it would otherwise do in the absence of the event's occurrence.

Constitutional Questions

Sometimes questions arise about the constitutionality of statutes of limitations. Most attacks on the constitutionality of statutes of limitations arise in cases of products liabilities.

J. Statutory Retrenchments

Some issues covered by these retrenchments are limitations on the amount of chargeable contingent fees, elimination of the collateral source rule, provision for the periodic payment of judgments, elimination of strict liability and the adoption of the product state of the art defense, and elimination or restriction of recovery for punitive damages.

3.5 Production and Design Defects

A. Production Defects

A manufacturing or production defect is distinct from a design defect. In manufacturing or production defect cases, the plaintiff proves that the product is defective by showing that it does not conform to the manufacturer's specifications. Production defects are usually random.

B. Design Defects

The Theory of Liability

The most widely exercised standard of liability is some form of risk-utility analysis. Risk-utility analysis is where the liability of the manufacturer depends upon a departure from certain standards of care.

The California Supreme Court established a two-prong test for determining design defectiveness in strict liability:

First, a product may be found defective in design if the plaintiff establishes that the product failed to perform as safely as an ordinary consumer would expect when used in an intended or reasonably foreseeable manner. Second, a product may alternatively be found defective in design if the plaintiff demonstrates that the product's design proximately caused his injury and the defendant fails to establish, in light of the relevant factors, that, on balance, the benefits of the challenged design outweigh the risk of danger inherent in such design.

Polycentricity

Sometimes conscious design decisions are described as 'polycentric' or 'many centered.' This means that to change one part of the design of a product would mean changing every other part of the design. This issue as it relates to products liability is often debated and a compromise is often reached in the courtroom.

The Relation of Design and Warning Defects

There is not always a bright line between design and warning defects. This is because warnings are quite often a part of the design of the product.

Obviousness of Danger

It is less likely that an obviously dangerous product will be found to be unreasonably dangerous or defective because its danger should be known by its user.

Crashworthiness

Crashworthiness is a term used to describe the capability of a product to protect against increased injury from an accident caused by something or someone other than the product. Most courts now require that designs of products be reasonably designed against foreseeable accidents.

3.6 Inadequate Warnings, Instructions, and Misrepresentations

A. Warnings and Instructions

In General

A plaintiff will typically allege a failure to warn, along with a design defect count, in a products liability suit. A plaintiff is not required to make an election between pursuing a case on a strict products liability theory of either design defect or failure to warn. The plaintiff may proceed with both theories if both are viable.

A warning is distinguished from an instruction in that instructions are calculated primarily to secure the efficient use of a product while warnings are designed to insure safe use.

The Standard of Liability

Strict tort liability recognizes that in today's world consumers can do little to protect themselves from the risk of serious injury caused by defects in the products they purchase. And, the more complex the product, the less opportunity there is for the consumer to guard against deleterious defects. The imposition of strict tort liability is justified on the grounds that the manufacturer or seller is almost always better equipped than the consumer to endure the economic consequences of accidents caused by a defective product.

Persons to be Reached

An intermediary is required to give warning to the consumers if they have knowledge of defects, dangers, or past accidents.

Countervailing Representations

Whether or not a warning might otherwise be adequate, it can be made inadequate by countervailing representations that downplay the danger or mislead the user regarding the nature or extent of the danger. A variety of circumstances surrounding the packaging, marketing, and appearance of a product may serve to counteract any warnings that are given.

Post-Sale Duties to Warn

Where a defendant markets a defective and unreasonably dangerous product, it may have a post-sale duty to warn of dangers associated with the product. The post-sale duty may be greater than one of just warning, as in cases where the product needed to be recalled or repaired.

Allergic Users

A seller may reasonably assume that those with common allergies, as for example to eggs or strawberries, will be aware of them, and he is not required to warn against them.

B. Misrepresentations

An action for misrepresentation can arise in a variety of contexts. The misrepresentation can be based on deceit, negligence, strict tort, or strict warranty. There is no need for a defect on a product to be shown other than if the plaintiff's injury is caused by misrepresentation of the supplier.

3.7 Problems of Proof

A. Cause-In-Fact

In General

The plaintiff generally must show not only that the defendant's product was defective and that the defect caused his injuries, but he must also show that the defect existed when the product left the defendant's control. The plaintiff does not have to identify the precise defect that caused his injury, he only has to reasonably eliminate alternative causes not attributable to the defendant.

Several Possible Causes

There are two common fact patterns where the conduct of more than one at-fault actor may combine to cause an injury. The first is where only one of the actors actually caused the injury. The second is where the conduct of two or more at-fault actors actually contributed to the injury, but the extent of their contribution is unclear.

B. Proximate Cause and Foreseeability

In General

Often the concept of foreseeability is used to describe occurrences that can reasonably be anticipated, while proximate cause is used to describe occurrences that are the “direct”, “natural”, or “probable” result of another event.

Misuse

Misuse is treated as an affirmative defense by some courts, and others place the burden on the plaintiff to show the absence of misuse as part of plaintiff’s case-in-chief.

Alteration

A substantial alteration that causes the accident may be unforeseeable barring recovery, unless the alteration should have been anticipated because of characteristics of the product that invite or encourage the change.

Damages

Sec. 435 of the Rest. 2d of Torts states:

(1) If the actor’s conduct is a substantial factor in bringing about harm to another, the fact that the actor neither foresaw nor should have foreseen the extent of the harm or the manner in which it occurred does not prevent him from being liable.

(2) The actor’s conduct may be held not to be a legal cause of harm to another where after the event and looking back from the harm to the actor’s negligent conduct, it appears to the court highly extraordinary that it should have brought about the harm.

C. Plaintiff Misconduct, and Comparative Fault

The Types of Misconduct

The three major types of plaintiff misconduct that can bar or limit the plaintiff’s right of recovery are contributory negligence, assumption of the risk, and misuse including alteration of the product. Contributory negligence is the failure of the plaintiff to take reasonable care for his own safety. Assumption of the risk is a knowing and voluntary confrontation of an appreciated risk. Misuse is the use of a product in a foreseeable or unforeseeable manner.

The Effect of Plaintiff Misconduct in Strict Liability (Without Comparative Fault)

Some courts hold that contributory negligence is no defense in a strict products liability action, but that assumption of the risk is a defense.

Comparative Fault

A. Kinds of Comparison

There are three principle patterns of comparison: the plaintiff can recover if 1) her fault is less than that of the defendant, 2) if it is not more than that of the defendant, or 3) if the defendant is at fault in any degree.

B. In Strict Liability

Some states by statute apply comparative fault to strict liability actions. In others, the statute may be limited to negligence actions, in which event the court may or may not extend comparative fault to strict liability by judicial decision.

D. Subsequent Remedial Measures

Evidence of the subsequent measures is not admissible to prove negligence or culpable conduct in connection with the event. This rule does not require the exclusion of evidence of subsequent measures when offered for another purpose, such as proving ownership, control, or feasibility of precautionary measures, if controverted, or impeachment. The rule is generally held to exclude evidence of remedial measures only if taken by the defendant after the plaintiff's injury, and it does not exclude evidence of such measures taken before the injury.

E. Miscellaneous Problems of Proof

History of Unsafe and Safe Use

Evidence of unsafe use and of prior accidents with similar products is admissible for a variety of purposes, including proof of notice of the alleged defect by the defendant, the magnitude of the danger, the foreseeability of user conduct, the defendant's ability to correct the defect, and causation.

Spoliation

Spoliation occurs when a person willfully or negligently disposes of product evidence vital to a litigant's case. The person who disposes of the evidence may be held liable to the litigant for the damages she likely could have recovered but for the disposal.

Expert Testimony

In a products liability lawsuit, expert testimony may be essential to establish a prima facie case of defectiveness, causation, damages, and other issues in the suit. Expert testimony is generally admissible if it will aid the fact finder in its determination of an issue in the suit.

State of the Art and Industry Custom

Courts have difficulty in distinguishing between state of the art and industry custom, and a number of courts permit evidence of industry custom to show state of the art. State of the art is defined as the scientific or technological knowledge available or existing when a product is marketed.

Codes, Reports, and Technical Literature

Safety codes drawn up by industry-sponsored associations are admissible on the issue of defectiveness, due care, and other disputed issues in a case.

Discovery

The use and abuse of discovery have become controversial issues in civil litigation, including products liability. Some commentators believe discovery is used excessively, while others think that it is underutilized.

Chapter 4 - Bartow vs. Extec

4.1 Introduction and Background

This case stems from an accident involving Kenneth R. Bartow, who fell off an Extec 5000S screening plant machine (serial number 3532) and was injured while working for O'Conner Bros, Inc. A screening plant machine is a large piece of equipment used to sift gravel and separate it according to the size of the aggregate, see Figure 4.1.



Figure 4.1: Example of gravel screening machine.

The accident in question occurred on December 16th, 1994, while Mr. Bartow was working in a gravel pit owned by O'Conner Bros, Inc. The Extec 5000S that he was working on required that the screens be adjusted, a normal maintenance procedure for the machine. While adjusting the bolts that control the screen, Mr. Bartow claims that he fell off the service platform and was hurt. He suffered neck, head, and back injuries in the

fall, along with cuts and bruises. In the suit, it states he sustained permanent damage and is unable to return to his job or enjoy his life as it was before the accident.

He claims that Extec Screen and Crushers LTD., Extec of North America, and Extec of America designed, manufactured, and sold a machine that was not safe and it caused his injuries. He argues that there should have been a railing around the service platform or other safety devices to safely access said platform and that Extec was negligent in not doing so. Engineer Marc H. Richmond backs his claims and states that there should have been safety devices in place and that Extec is at fault for Bartow's injuries. There are eighteen different counts against three different companies in this case. The counts include, negligence, Breach of Implied Warranty of Merchantability, Breach of Express Warranty, and Breach of Implied Warranty of Fitness for a Particular Purpose. These all mean that Mr. Bartow believes that the machine in question was not built in a way that was safe for its intended use and it contributed to his accident and injuries. In addition to the charges brought by Mr. Bartow himself, there are six counts of Loss of Consortium against the companies filed by his wife, Diane Bartow, and his son, Nicholas Bartow. They claim that because of Kenneth's injuries, their lives have been adversely affected and they are seeking compensation. In total, Mr. Bartow and his family are suing for approximately 35 million dollars in damages.

4.2 Details of Accident

In his deposition, Mr. Bartow claims he was standing on the service platform located near the back of the machine when he fell. To gain access to this platform, which was approximately 15 feet off the ground and had dimensions of 65''x 16'', he had to either climb up main conveyor or use a ladder that he had manufactured. On the day in question, Mr. Bartow stated that he climbed up the main conveyor to get to the platform. He said that when he fell, he was on this platform adjusting the screens, a task that consisted of Mr. Bartow tightening four bolts located near his feet in front of the platform. He also stated that he was using his foot to push on the wrench to turn the bolt because he would only have one foot on the platform as the other hung over the side on

the ratchet. This was a procedure completed regularly and had been done many times by Mr. Bartow himself.

After the fall, another O’Conner Bros. Employee, Harold Green discovered Mr. Bartow and called an ambulance that took him to the hospital to assess his injuries. Preliminary reports from the hospital and from Workers Compensation forms state that Mr. Bartow fell from a ladder. This is inconsistent with his deposition and leads us to believe that his statements aren’t entirely true.

4.3 Analysis of the Case

From the evidence in this case, we feel that it is very unlikely that Mr. Bartow is telling the truth about these events. First, Mr. Bartow says that he hit the side conveyer during his fall. That is almost impossible according to the evidence regarding where he landed. After examining pictures of the accident scene, we have concluded that the service platform and the side conveyor he claimed to hit were a horizontal distance of 12 feet apart. This make it almost impossible for the events that Mr. Bartow describes to be fact, which is yet another reason that makes us seriously doubt many of his statements.

Mr. Bartow also claims John Guilfoyle, the sales representative for Extec Screen, told him in order to access the screens he should walk up the main conveyor. This is inconsistent with the statements from Harold Green, Dickie Bassett Jr., and Ronald Marchant, who are all O’Connor Bros. Employees. They maintain that John Guilfoyle had told them to use scaffolding or bucket truck to gain access to the screens. Using a bucket loader was the general procedure used in the past by O’Connor Bros. Employees, who said that two people were always present while performing this task, one to operate the loader, and one to adjust the screens. This was not the case the day of Mr. Bartow’s injuries.

In addition to the possible discrepancies in Mr. Bartow’s deposition, there are several retrofitted parts on this machine that were manufactured by O’Conner Bros employees, including Mr. Bartow, that may have come into play during the accident. The first such item was a ladder, which was used to access certain locations on the screen machine. It is approximately 6 feet tall and although it is known from the depositions

that it was used for that purpose, it did not directly access the service platform in question. The accident report states that Mr. Bartow was injured when falling off a ladder. This leads me to believe that his story may have changed and he is not telling the truth. From the evidence, it is possible and quite likely, that Mr. Bartow was climbing this ladder when he fell and was injured. From this ladder, it is much more possible that Mr. Bartow hit the side conveyer mentioned in his deposition because it is only a horizontal distance of 5 feet to the side conveyer.

Another retrofit, and possible culprit, was a conveyer guard that consisted of plywood and metal. Its purpose was to keep snow from building up on the rear conveyer belt. Since Mr. Bartow admitted that he used the rear conveyer to access the service platform on several occasions, including the one in question, it is possible he may have been climbing on this retrofitted part when he fell. Although none of Mr. Bartow's co-workers, can confirm that any of these parts were on the machine the day of the accident, all stated that the parts were usually attached to the machine due to the difficulty involved in taking them off.

Another contributing factor that was noted in several reports was frost. On the day of the accident, the temperature was well below freezing and frost was visible on the machine. This would make all the parts slippery and dangerous to work on and since the platform was the only part that I have mentioned that was diamond cut for traction, it is more likely Mr. Bartow fell from another place on the machine.

O'Conner Bros. maintains that they had safety measures and procedures in place, such as using a harness when working above six feet, but this device was not used by Mr. Bartow. In fact, it was not even near the machine at the time of the fall. Since they accident they have started using a lift, or "cherry picker", to access the platform in question. This shows that proper safety procedures were not followed by O'Conner Bros. or Mr. Bartow.

4.4 Conclusions

From the evidence in the case we do not believe Extec is at fault therefore, Mr. Bartow is not entitled to any compensation from Extec Screen and Crushers LTD., Extec of North America, or Extec of America. The main reasons we feel that Extec is not responsible for Mr. Bartow's injuries are the discrepancies between reports and Mr. Bartow's deposition, the fact that there were several retrofitted parts they may have been involved, and since proper safety procedures were not taken at the time of the accident. From our point of view there are more probably scenarios that lead to Mr. Bartow's injuries, which do not incriminate Extec. In addition, even if Mr. Bartow fell from the service platform, which we think is unlikely, he should have followed safety procedure in use by O'Conner Bros. and regulated by OSHA. These both say that a safety harness or another safety device should be used when performing work above six feet off the ground. All of these factors should show that Extec should not be held accountable for Mr. Bartow's injuries.

Chapter 5 - Perkins vs. Rodgers

5.1 Introduction and Background

The case of Perkins vs. Rodgers involves a traffic accident, which occurred on. Bruce S. Perkins is suing Eric J. Rodgers for injuries he sustained during the accident, which included a swollen left knee, crushed foot, and injuries to the eye and head. Rodgers was not hurt in the accident. The accident occurred around 7:00 P.M. on Rt. 101A, Nashua Street, in front of Elisha's Restaurant in Milford, New Hampshire. Figure 5.1 shows the accident scene with the car to the left exiting Elisha's parking lot as Mr. Rodgers did right before the accident.



Figure 5.1: Nashua Street in front of Elisha's Restaurant

5.2 Details of Accident

The posted speed limit on Nashua Street is 25 miles per hour. Only two vehicles were involved the accident, a 1999 Mercury Sable driven by Mr. Rodgers and a 1996 Harley Davidson motorcycle driven by Mr. Perkins. Mr. Perkins struck Mr. Rodgers's car broadside near the back door and spun it 180 degrees. There were several witnesses to the accident. In this case we will use engineering to reconstruct the accident using the available information and draw our conclusions from our results.

In his deposition, Eric Rodgers states that he had been in a restaurant with several family members for over an hour and had consumed four to five beers and ate some appetizers while sitting at the bar. He left the restaurant and shortly before 7:00 and intended to turn left out of the parking lot and head west on Nashua St. He stated that he had looked right, left, then right again before pulling out and had not seen the motorcycle driven by Mr. Perkins until an instant before impact. Prior this accident, Mr. Rodgers had been involved in two other motor vehicle accidents. His view was partial obstructed by a telephone poles located to the left of the parking lot exit, the direction that Mr. Perkins came from. You can see the obstructed view due to telephone poles shown in Figure 5.2.



Figure 5.2: Looking west from Elisha's exit.

Mr. Perkins claims that he saw the car and tried to avoid it by applying his breaks heavily and trying to go around it, but could not avoid the vehicle. In his deposition he said that he had consumed 2 beers at the VFW in Milford a long time before the accident and had several glasses of water after. He left his driveway, which was approximately 500 ft from the from the scene of the accident and claim to have been going 30-40 miles per hour when he saw the car pull out. From his measurements he claims that his skid mark was approximately 57 feet long. Before this incident, he had been involved in 5 other automobile accidents, of which, several seem to put him at fault.

5.3 Analysis of the Case

Detective Chovanec, a police officer who was present after the accident, stated he could smell beer on Mr. Perkins breath and it was reported by a witness, Steve Neill, that he appeared to be drunk. When Mr. Perkins refused a sobriety test he was arrested for Driving Under the Influence. The police measured the skip mark of the motorcycle to be 103.6 feet long, 46.6 feet longer than Mr. Perkins claims. Taking the length of the skid mark into account, it is estimated that Mr. Perkins was traveling between 47 and 60 miles per hour before the accident occurred; even though he claims it was 30 to 40 miles per hour. These speeds were calculated using the Equation 1.

$$V = \sqrt{2\mu gd} \quad (5.1)$$

By plugging in the appropriate values for each variable; 0.7 for the coefficient of friction for rubber on pavement, 32.2 ft/s² for gravity, and 103.5 feet for the distance of the skid mark you can come up with Mr. Perkins' initial speed before applying his brakes. See Equation 2.

$$V = \sqrt{2(0.7)(32.2)(103.5)} = 46.5mph \quad (5.2)$$

This does not take into account the fact that Mr. Perkins had not come to a complete stop after 103.5 feet. At time of impact he was still traveling with a velocity significant enough to cause the Mercury to turn 180 degrees. This leads us to believe that

he was traveling at a more probable speed of 60 miles per hour, more than double the posted speed limit.

5.4 Conclusions

Since it is obvious that Mr. Perkins was traveling well above the posted speed limit and that it is very likely he was lying about how much he had to drink, we do not believe that he should receive any compensation from Mr. Rodgers. In addition to this, Mr. Perkins' prior driving record, seems to show a history of accidents where he has been at fault. We believe that both parties contributed to the accident but Mr. Rodgers was less at fault, even though his view may have been partial obstructed by a telephone pole.

Chapter 6 - Vermont Yankee Nuclear Power Corp. vs. Cianbro Corp. and Rodney Hunt Corp.

6.1 Introduction and Background

Nuclear power plants produce power by turning water into steam that rotates turbines, using a nuclear reactor. This water is then cooled and returned to the where it came from, usually a river. Vermont Yankee nuclear power plant uses water from the Connecticut River in its power generating process. This water has to be cooled before being released back into the river for environmental reasons. The water flows through channels after leaving the plant and is diverted to cooling towers and eventually back to the river. In these channels, flow is controlled by sluice gates. Sluice gates are used to control water flow by opening and closing a gap in a concrete wall within the channels. The gates that Vermont Yankee used were inverted so to let water flow, the gates were lowered. You can see in Figure 6.1 that the gate slides up and down on a frame, with the opening of the wall at the top.

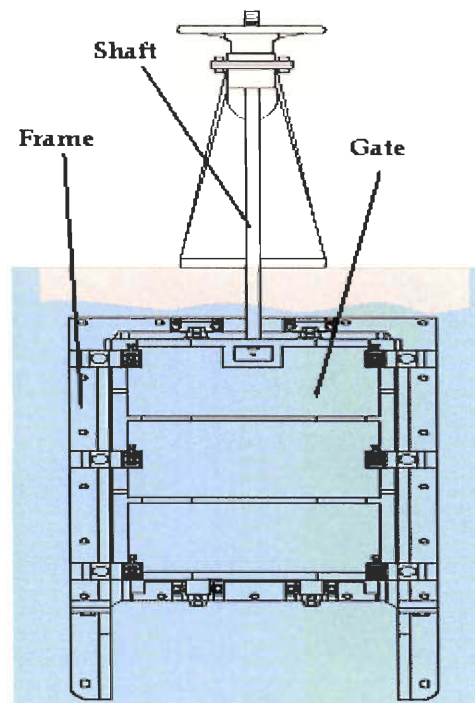


Figure 6.1: Typical Inverted Sluice Gate

The frame is attached to a metal device know as a wall thimble. The wall thimble is mounted to a concrete wall and held in place by a lip that sticks into the middle of the wall. A clear picture of this can be seen in Figure 6.2.

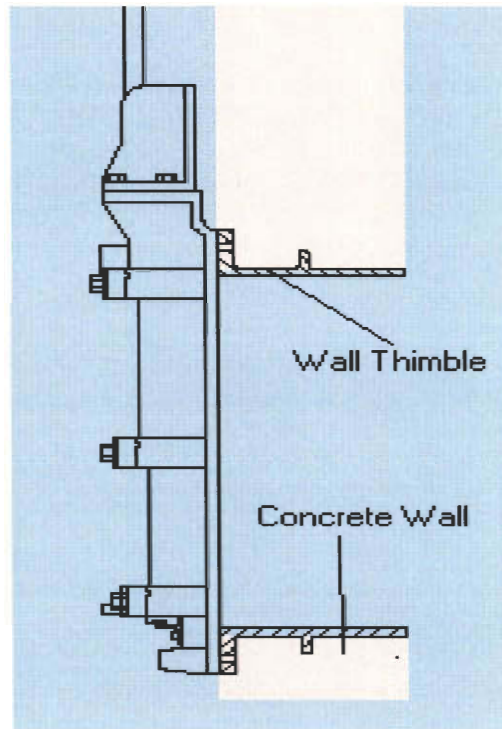


Figure 6.2: Side view of a gate showing wall thimble.

In 1998 Vermont Yankee nuclear power plant decided to replace several sluice gates that had been in operation since the opening of the plant in 1973. The only work done prior the instillation of the new gates was the instillation of a hydraulic drive on the original gates by Rodney Hunt because the old electronic drive was having trouble moving the gates. The gates were both approximately 11'x13'. The original gates were starting to bind and when moving and were starting to crack so they had to be replaced. Vermont Yankee advertised this job to bidders and Cianbro Corp. won the contract. Cianbro intended on doing the instillation of the gates but subcontracted the manufacturing of the gates to Rodney Hunt Corp. The instillations of the gates happened during Vermont Yankee's 1998 refueling outage and they were placed in service on May 28, 1998.

6.2 The Failure

After three days of being in service, Vermont Yankee workers began to encounter problems with the gates. Not only were the gates not opening simultaneously like they were supposed to do, but the gates would not rise against a full head of water. To fix the problem, Vermont Yankee employees decided to change the procedure for operating the gates to have them operate one at a time. They also increased the force used to operate the gates to overcome the binding they were experiencing. It should be noted that Rodney Hunt was not contacted after these problems were discovered.

On April 5, 1999, the south gate was deemed inoperable when Paul Stucchi, the field representative for Rodney Hunt, noticed excessive leakage around the south gate and that the tongue liners on which the gates slide on were damaged. Shortly after this, the north gate was found to have similar damage and both gates were only to be used in emergency situations. Upon further inspection, it was found that the screws holding the tongue lines onto the gates had failed. All of this had happened within one year of installation. Because of this premature failure of the gates, Vermont Yankee filed a suit against Cianbro and Rodney Hunt. The suit claimed that the gates were defective and they were suing for damages of over one million dollars to remove and replace the Rodney Hunt gates and for losses due to the inoperability of the gates.

Both sides of the lawsuit looked into the cause of the failures. Vermont Yankee with the help of Kenneth Willens and Robert Oliver in particular, came up with several explanations as to the failure of the tongue cover screws, which led to the failure of the gates. These reasons included hydrogen embrittlement, galvanic corrosion, stress corrosion cracking, high friction forces due to bronze on bronze contact, the use of 410 stainless steel self tapping screws, and over torquing of the screws. Rodney Hunt experts, on the other hand, point the finger at dynamic head and distortion of the wall thimble. The next section of this chapter will analyze each possible cause and determine whether or not it contributed to the failure.

6.3 Analysis of the Case

Hydrogen embrittlement is a process resulting in a decrease of the toughness or ductility of a metal due to the presence of atomic hydrogen. It results from hydrogen being absorbed by solid metals, which causes tiny cracks that are the result of internal pressure of hydrogen, which forms at the grain boundaries. A schematic of the process can be seen in Figure 6.3.

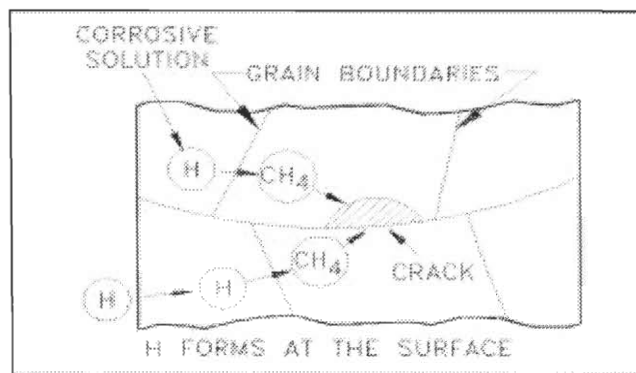


Figure 6.3: A microscopic view of hydrogen embrittlement.

Hydrogen embrittlement is not a permanent condition. If cracking does not occur and the environmental conditions are changed so that no hydrogen is generated on the surface of the metal, the hydrogen can rediffuse from the steel, so that ductility is restored. This looked like a very probably cause of failure after to metallurgical analysis but following further testing, it was shown that inter-granular cracking was only evident in one of the screws from the gate. Since hydrogen embattlement causes inter-granular cracks, the tests prove that it was not a major factor in the failure of the Rodney Hunt gates.

When it came to Vermont Yankee's attention that Rodney Hunt had used different screws than had been specified in the original drawings, they claimed that that had the screws that had been used were not appropriate for the environment and that they were not strong enough to withstand the shear stresses encountered on the sluice gate. The screws used by Rodney Hunt were a type 410 self-taping stainless steel screws that the company has used thousands of times with no problems, according to Vice President of Engineering Paul Gallo. The change was made because the original type 304 stainless

steel screws were just not available at the time of manufacture. Although the 410 screws are slightly more brittle and has a lower shear stress, it followed all EBASCO standards and could easily handle the stresses that were present. To further back their decision to use the 410 screws, Rodney Hunt did tests on their shear strength and the loads caused by the opening and closing of the gates. In these tests it was shown that maximum cylinder output from the hydraulic drive 109,703 lbs when raising the gates and 136,708 lbs when lowering the gates. Strength tests on the screws showed a shear strength of 3000+lbs for each screw. Since there were 54 screws, the combine strength of the screws is 162,000 lbs (54 screws x 3000 lbs.).

The next possible culprit that Ken Willens and Vermont Yankee came up with was galvanic corrosion. Galvanic corrosion, also called dissimilar metal corrosion refers to corrosion damage induced when two dissimilar materials are coupled in a corrosive electrolyte. It occurs when two dissimilar metals are brought into electrical contact under water. When a galvanic couple forms, one of the metals in the couple becomes the anode and corrodes faster than it would all by itself, while the other becomes the cathode and corrodes slower than it would alone. Either (or both) metal in the couple may or may not corrode by itself in water. When contact with a dissimilar metal is made, however, the self-corrosion rates will change. Although the 410 screws are more susceptible to this kind of corrosion than the 304 screws, no evidence was found that it was present on the failed screws.

Another possible reason for failure that was brought up was stress corrosion cracking which is when material failure that is accelerated by the combined effect of a corrosion process and a mechanical stress. It is usually associated with branching cracks along the grain boundaries. This claim proved inconsistent with the cracking exhibited in the screws in question. In addition to this, stress corrosion cracking, galvanic corrosion, and hydrogen embrittlement all take a long time to develop and since these gates failed within one year, it makes it even less likely that any of them played a role in the failure.

Robert Oliver, investigating the failure on behalf of Vermont Yankee, came up with the idea that excessive friction was the cause of the failure. He stated that the bronze tongue liners and covers had a much higher coefficient of friction than that of bronze on cast iron. These claims can easily be disputed because he only approximated

using numbers from brass on brass, which has a coefficient of friction of 0.88, much higher than the 0.22 coefficient of friction from brass on cast. When actual test of bronze on bronze were done it was shown that it had a coefficient of 0.54 when dry and 0.49 when wet. This is much lower than the approximations of Robert Oliver and show that the bronze on bronze combination of the tongue liners and guides was not the cause of the failure.

According to Vermont Yankee, yet another possible cause of the failure was the over torquing of the screws during manufacturing. They claimed that the over torquing caused damage to the screws even before the gates were in operation. To discount this theory, Rodney Hunt did tests to show how they attach the tongue covers in the video demonstration. The video clearly shows the process in which the tongue covers are attached. Paul Gallo noted in his deposition that the same drill that they used to put the covers on the original gates but they did not use the torque limiter like they did in the original process to make it clear that it is virtually impossible to damage the screws. Even without limiting the torque, none of the screws were damaged in the tests and it is clear that this was not a contributing factor to the failure of the gates.

The last and most likely reason for the failure is that the wall thimble (Figure 6.2) was not flat. Since the contract specified that the new gates be installed on the existing wall and wall thimble Cianbro employees just attached the gates the wall thimble without checking for flatness. After gaps were discovered between the wall thimble and the gates, the only steps taken to fix the problem was the injection of expandable foam into the gaps to keep a water tight seal. This went against the procedure set forth by Rodney Hunt in the instillation section of the instruction manual given to Cianbro at the time of delivery of the gates. In the manual it says to check for flatness before installing the gates and if there are gaps, shims should be used along with lead wool to protect the trueness of the gates and to prevent leakage. Since this was not done, it is our hypothesis that the gates were tightened down to a surface that was not flat, which in turn distorted the guides. When this happened and the gates were put into operation, the curved guides pinched the tongue covers and cause excessive friction. When Vermont Yankee increased the pressure on the gates, it caused uneven loads on the screws causing failure

in a domino effect and may have been the cause of some of the problems experienced by the original gates.

In a letter to Hagglund Engineering Associates, Paul Gallo explains what he thinks caused the distortion in the wall thimble. He found in field observations that there was crossflow against the side of the gates and there was a total dynamic head of 72.4 feet. This is much higher than the max head values of 32 feet seating and 23 feet unseating shown in the specifications. This discrepancy may have caused impact loads and vibration that were harmful to the gates. This combined with the gaps in the installation combined to warp the guides and eventually cause failure in the screws.

6.4 Conclusions

In the end it is our determination that Rodney Hunt Corp is not at fault in any way and had nothing to do with the failure of the sluice gates purchased by Vermont Yankee. We arrive at this conclusion because we feel that the gates were not defective in anyway before delivery and were built to all the applicable standards, including the EBASCO and Rodney Hunt's own standards. We do believe that Cianbro was negligent in the installation of these gates by not following proper procedures set forth in the instruction manual provided with the gates. Since Vermont Yankee made no attempt to contact Cianbro or Rodney Hunt when problems first started to arise, we believe they share some of the blame for the failure of these gates. For their part in the failure, we feel that Cianbro is obligated to refund the price of the gates they installed but Vermont Yankee should be responsible for any other expenses having to do with the failure of the sluice gates.