

# **Crib Hazard Analysis**

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## **Abstract**

Although regulations exist for cribs, they remain to be the number one juvenile product for juvenile death. Working in coordination with the Consumer Product Safety Commission (CPSC), we researched aspects of this problem with our focus being on crib hardware, the human aspects of crib use and the economic factors surrounding cribs. We made recommendations to the CPSC on how to improve crib safety.

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# Executive Summary

When healthy infants die unexpectedly, parents wonder what they might have done to prevent this tragedy. Various products used regularly can cause these deaths, and injuries. A safety problem for infants that has remained an issue for fifty years but has become more prevalent in recent years is the use of infant cribs. Cribs remain the number one juvenile product in juvenile death. Many incidents have occurred where infants have died or been injured from crib misuse by the consumer, poor crib construction or a design flaw in the crib. Ideally, parents should place their infant into a crib and not have to worry about anything happening to the infant in the crib. Unfortunately, that currently is not always the case. The U.S. Consumer Product Safety Commission (CPSC) has been investigating the injuries and deaths of infants that occur in cribs. If the CPSC and the public understood the causes of these incidents, together they would prevent such unfortunate events and ultimately save the lives of many infants.

Crib use, design, and construction have come a long way. This is thanks to the CPSC whose job is to save lives and keep families safe by reducing the risks associated with consumer products. From discovering new problems, the CPSC has worked extensively with setting standards and recalling cribs that do not meet these standards. The CPSC holds the responsibility of setting standards and issuing recalls at the highest level, while continuing to try to bridge the gap between past research and new problems that emerge over time.

The goal of this project was to determine the problems with cribs and make recommendations for crib and crib use improvements to prevent future infant injuries and deaths. The Consumer Product Safety Commission is eager to find solutions and develop recommendations on how to minimize crib incidents. We reviewed In-Depth Investigations (IDIs), a written report of an incident the CPSC has deemed worthy of investigating, and determined the root causes of crib incidents and foreseeable misuses. We studied the IDIs, determined the most problematic factors, and investigated the issues

more. We provided explanations as to the problematic areas of cribs and where to carry out follow-up research on identified problems. We did this by interviewing consumers, industry representatives, and experts in the field of cribs and infants. Lastly, we conducted direct observations and research of the cribs that we found necessary from the information we gathered through the IDI's and interviews. This research was important to provide our sponsors with the data they need to reduce infant deaths and injuries related to cribs and their use.

From our analysis of the information gathered about the problems and gaps in today's crib safety, regulations, and knowledge, we came to several conclusions. Cribs have existed with these lingering problems for the past half-century. By taking the right steps, many incidents surrounding cribs are preventable. By concluding what parts are most problematic on a crib, we recommended what parts needed to be improved. After looking at human interaction with cribs, we determined the major problems to be the lack of knowledge and misuse of cribs. With this information, we recommended a program to the CPSC to improve the public's knowledge and awareness of crib safety. In addition to improving the public's knowledge, we recommend the current IDI investigators have better training and preparation for the investigations. Lastly, we developed results for the economic factors surrounding cribs that include mostly second-hand cribs and the way manufacturers decide to produce their cribs. We recommend not banning second-hand crib use but making people aware of the dangers in using them. Manufacturers need to be careful when manufacturing their product and make sure the quality of their product remains high even if they are using cheaper materials. They should report these quality checks to the CPSC quarterly. With these recommendations, we hope the CPSC ultimately will improve the safety of cribs and decrease the yearly number of deaths and injuries involving cribs.

# 1 Introduction

The birth of a newborn can be the best day of a parent's life. This is the start of a new life, new responsibility and new happiness. Parents expect to see their newborn grow through the stages from newborn to infant to toddler and beyond. However, no one is prepared to deal with the death of an infant who barely got the chance to experience life. What makes it especially hard is when this death was avoidable. These deaths can occur at anytime and leave people wondering what to do to prevent these tragedies. Various products used regularly can cause these deaths, and injuries. A safety problem for infants that has remained an issue for fifty years but has become more prevalent in recent years relates to the use of infant cribs.

Incidents have occurred where infants have died or been injured from either misuse of a crib by the consumer, poor crib construction or a design flaw in the crib. Ideally, parents should be able to place their infant into a crib and not have to worry about anything happening to the infant while he or she is in the crib. Unfortunately, that is currently not always the case. The Consumer Product Safety Commission (CPSC) has been investigating the injuries and deaths of infants that have occurred in cribs. If the CPSC and the public could understand the causes of these incidents, they would be able to prevent such unnecessary events and ultimately save infant's infants' lives.

Crib use, design and construction have come a long way from what they used to be. This is thanks to the Consumer Product Safety Commission whose job is to save lives and keep families safe by reducing the risks associated with consumer products. The CPSC has worked extensively with setting standards and recalling cribs that do not meet the standards. They have discovered new problems and have figured out what new standards need to be set. The CPSC upholds the responsibility of setting standards and issuing recalls at the highest level, while continuing to try to bridge the gap between past research and new problems that emerge over time.

Even though there has already been a lot of research into issues involving crib accidents, there is still a significant amount to learn from more research into the deaths of infants and their interaction with cribs. By looking at the Consumer Product Safety Commission website (2009), it is apparent that to this day, there are still major problems surrounding crib safety. There has been a gap in information relating to a few key parts of the cribs. First, the regulations do not mention how strong the materials to make the cribs need to be and whether or not the cribs go through testing to withstand use over an extended period. Second, the instructions that come with a crib may be unclear, causing the consumers to be uncertain about how to construct and use the crib they have purchased. Lastly, people may try to save as much money as they can when purchasing cribs and may use previously owned cribs. This decision tends to sacrifice some aspects of the crib safety including durability over the lifetime of a crib.

The goal of this project was to determine the problems with cribs and make recommendations for crib and crib use improvements to prevent future infant injuries and deaths. The Consumer Product Safety Commission is enthusiastic about finding solutions and developing recommendations on how to minimize crib incidents. We reviewed In-Depth Investigations (IDIs) and determined the root causes of crib incidents and foreseeable misuses. We studied the problems identified in the IDIs and determined which ones were most problematic and needed further investigation. We developed recommendations on possible solutions to solve the problem of why cribs are not safe and to suggested areas of possible follow-up research. We did this by interviewing consumers, industry representatives, and experts in the field of cribs and infants. This research was important because the results provide the CPSC with the data they need to reduce deaths and injuries related to cribs and their use.

## 2 Background

An understanding of previous research and studies regarding cribs and infant death is essential to understand the necessity to investigate the incidents involving cribs and infant death. Incidents involving cribs fall into several categories of the most common causes of infant death. These causes are problems to look into. In this chapter, we provide the exact definition of what a crib is, as well as the regulations for designing, manufacturing, and constructing cribs. In addition to identifying the regulations, we describe some past incidents and how malfunctions, human interaction, and economic factors played a part in the detrimental outcomes of such incidents. Lastly, we review what researchers have done to solve and prevent future crib incidents.

### ***2.1 Most Common Infant Deaths***

For parents, one of the worst things can be losing their child before they ever gets a chance to experience life. In recent years, the number of deaths of infants under the age of one in the United States has been more than 28,000 per year (Harris, 2008, p. 19). According to a report in 2008, the infant mortality rate in the United States improved by 3 percent between 2000 and 2004 (Norsigian et al., 2008, p. A17). The infant mortality rate (IMR) is “the ratio of the number of deaths in the first year of life to the number of live births occurring in the same population during the same period of time” (The American Heritage, 2009). The IMR in 2004 was an improvement over the 2000 rate of 6.89 and a large improvement from 1995 when the IMR was 7.57 infant deaths per live births (Mathews & MacDorman, 2007, p.1). This infant mortality rate, though an improvement over 2000, still ranks the United States in last place when compared to 15 other countries that have at least 100,000 annual births (Norsigian et al., 2008, p. A17).

More than half of the top ten causes of infant death are a complication or disorder that the infant develops at birth or while still in the womb (Kung et al., 2007, MMWR Weekly). The figure below (Figure 1) shows the distribution of the causes of infant deaths in the year 2005. The rate seen at the bottom of the graph is the number of infant deaths per 100,000 live births. As you can see, the first two causes are due to medical problems. Third on the list is Sudden Infant Death Syndrome, short for SIDS. There is more detail on this topic in section 2.1.1 since this syndrome is something that relates to the death of infants in cribs and is something that might relate to the crib design and use. These top three causes accounted for approximately 43% of all infant deaths in the United States in 2005. The next two causes of common infant death are both complications that affect the newborn around birth including newborns affected by maternal complications of pregnancy.

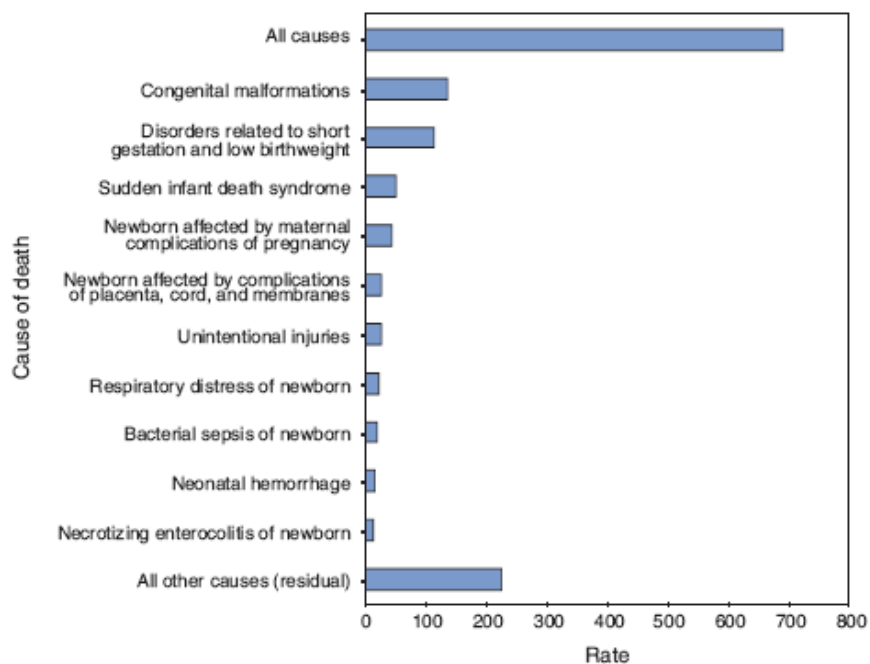


Figure 1: Most Common Causes of Infant Death in 2005 (Mack et al., 2007).

The sixth most common cause of infant death, unintentional injuries, is another cause that may relate to the problems of cribs. There is more detail on this topic in section 2.1.2. These incidents relate mostly to falls and strikes to the infant (Mack et al., 2007, p. 609). The majority of the remaining causes

are all medical complications: respiratory distress, bacterial sepsis, neonatal hemorrhage and necrotizing enterocolitis of newborns.

Before crib regulations, 150-200 children died each year in crib related incidents (CPSC, 2009). Since standards have been set, that number has leveled off to approximately 35 per year. Within the past two years, the CPSC recalled over 5.7 million drop-side cribs. According to Mark Kumagai, an expert within the CPSC, cribs remain the number one child product involved in juvenile death.

### **2.1.1 Sudden Infant Death Syndrome (SIDS)**

According to the American SIDS Institute website (2009), “SIDS is the sudden death of an infant under one year of age which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and the review of the clinical history”. In cases of SIDS, the parent goes to check on their apparently healthy, sleeping infant only to find him or her dead with no explanation as to why.

“SIDS can happen even when you do everything right” (Healthwise, 2008, p.1). There are no symptoms or warning signs for SIDS, and the infants appear to be healthy before going to bed. This death is rare when looking at the general population, but for infants under 12 months of age, it is one of the most common causes of death. The most common cause of SIDS is infants sleeping on their stomachs since it restricts their breathing. Placing infants on their stomachs or sides increases the risk of SIDS.

There are not many ways to prevent SIDS completely from happening but there are certain precautions to take (Healthwise, 2008, p.1). Placing the infant on their back to sleep is most important. For at least the first six months of the infant’s life, he or she should sleep in a crib with a firm mattress with nothing loose or soft that can suffocate him or her.



First Candle is an organization whose goal is helping babies survive and thrive (First Candle, 2009). Their main message in April 2009 was that “Cribs are needed, cribs are important, without cribs, babies will die” (p.1). This was in reference to SIDS and the newer acronym SUID, Sudden Unexpected Infant Death. SIDS or SUID relate to accidental incidents including suffocation, entrapment and undetermined diagnoses. The most common reason for the SUID deaths is ill-fitting bedding and bed sharing. These causes of death can involve adult beds where infants are at the highest risk of being injured. Between 50% to 75% of all SIDS or SUID deaths occur while the infant is sleeping with another person. Nearly 50% of all infants have spent some time over the past week sleeping in an adult bed with parents (p.2).

The problem with SIDS or SUID does not seem to be due to problems related to cribs, but instead the problem lies in the lack of using them. According to the First Candle organization (2009), “taking the baby out of the cribs presents the greatest risk” of injury or death (p.3).

### **2.1.2 Unintentional Injuries**

“Each year an estimated 328,500 infants ages 0-12 months are treated for unintentional injuries in emergency departments (EDs): one infant every minute and a half” (Mack et al., 2007, p.1). The majority of infants injured were at home. They were fall-related injuries or a strike by or against something. The five leading causes of unintentional injury in infants are falls, struck by or against something, fire or burns, foreign body, and bite or sting injuries. Crib injuries and deaths could be included in two of the top leading causes of unintentional injuries, falls and strikes.

Research suggests that the reason injuries from falls are so high among infants is due to their limited coordination, exploratory nature and potential home hazards (Mack et al., 2007, p.1). Due to this curiosity, infants will often try to climb-out of the crib (Midgett et al., 2009, p.12). While trying to get out, infants can cause the crib support structure to fail, resulting in the infant falling out of the crib

(Mack et al., 2007, p.1). When infants fall, they can suffer a head injury including bone and soft tissue injuries. When the crib structure fails, there is the possibility of a gap forming. This gap can be a hazard since the infant can slip into the gap, possibly causing suffocation against the mattress.

## **2.2 What is a Crib?**

A crib, as defined by Merriam-Webster Dictionary (2009), is a “small child's bedstead with high enclosing, usually slatted sides” (Crib). There are several different styles of cribs and the different manufacturing companies make each style slightly different (Cassidy, 2009). Cribs follow specific requirements for dimensions and specifications on how to build cribs [discussed in more detail in section 2.3]. Before turning to technical specifications of cribs, we discuss the different types of beds designed for infants and explain the building process.

### **2.2.1 Types of Infant Beds**

There are many different styles of beds for infants (Choosing a Baby Crib, 2009). There are cradles, bassinets, standard baby cribs, convertible cribs, round cribs, canopy cribs, and portable cribs. This project focuses on standard baby cribs, but it is important to understand the difference between the types. Depending on the manufacturer and designer, the crib's designs differ from one another, but the general concepts are the same. We describe the different types of infant sleep areas below.

**Cradle:** According to the Merriam-Webster Dictionary (2009), a cradle is a bed or a cot for a baby that is usually on rockers or pivots (Cradle). To keep the baby safe and free of harm, most cradles have locking pins that will prevent the cradle from being tilted more than five degrees to either side (Cradles, Bassinets, 2009). The cradle material is generally wood or metal depending on the manufacturer. Usually the mattress is included in the purchase, but the bedding is not.



Figure 2: Cradle (2009) Source: Baby Crib.

The image shown in Figure 2 is an example of a cradle. For the purposes of this project, when referring to a cradle, we mean something that looks like the above image.

**Bassinet:** A bassinet is a baby's basket-like bed often with a hood over one end and usually is for in an infant's first five months of life (Bassinet, 2009). Bassinets are similar to cradles but the major difference is that they come with bedding when purchased (Cradles, Bassinets, 2009). Bassinets generally have mesh sides and a padded top rail to make sure the baby is safe. They come with a retractable canopy to keep the sunlight directly out of the baby's face. Typically, bassinets come with some type of storage space underneath and have wheels to make them easier to move.



Figure 3: Bassinet. (2009) Source: Bassinet Liner.

We show a picture of a bassinet in Figure 3. We refer to an image similar to above when describing bassinets.

**Standard Baby Crib:** A standard baby crib is a bed for a baby that has either a single drop-side, a double drop-side or no drop-side at all (Choosing a Baby Crib, 2009). The drop-sides make it easy for the parent to get the child in and out of the crib. This design especially helps those parents that are short in height or have back problems. On top of the possible drop-side, a standard crib consists of sides with slats and an adjustable mattress support. Most standard cribs are wood, but some designs incorporate a metal frame or an injected plastic mold. This style of crib is can range in cost from an economy crib (approximately \$100) to a high end crib (anything over \$600).



Figure 4: Standard Crib (2009). Source: Modified Crib Designs.

The image in Figure 4 depicts a standard infant crib. When we refer to a standard crib, it is similar to the image shown in Figure 4.

**Round Baby Crib:** A round baby crib usually has a single drop-side and it takes up less space than a standard crib. This style of crib is more for decoration and tends to be more expensive than a standard crib (Cassidy, 2009).



Figure 5: Round Crib. (2009). Source: Something New! Round Cribs.

The image shown in Figure 5 is a round crib. When we refer to a round crib, we are referring to a design similar to the one seen above.

**Canopy Baby Crib:** A canopy baby crib has a more fairytale look (Dietzel, 2006). The canopy serves no real purpose but for presentation and elegance. This style of crib has four posts that hold a fabric canopy over the baby. It is important to check the installation of this fabric canopy to ensure that the canopy will not fall on the baby and cause suffocation.



Figure 6: Canopy Crib. (2009).

When we refer to a canopy crib, we are discussing a crib similar to the one portrayed in Figure 6.

**Convertible Baby Crib:** A convertible baby crib is a crib that converts from a crib to a toddler bed to a day bed by removing a side or sides of the crib (Sharon & Fairchild, 2009). This crib tends to be costlier than purchasing a standard crib; however, this style of bed may last for the first five years of the child's life and thus may save money from a long-term perspective. Even though this product is for the child's toddler and beyond years, this style of bed must still meet the Consumer Product Safety Commission standards for cribs.



Figure 7: Convertible Crib. (2009).

We show the different forms of a convertible crib in Figure 7. When we refer to a convertible crib, we have something similar to this image in mind.

**Portable crib:** Portable cribs are cribs that the user easily can move and fold (MacDonald, 2002). Usually the sides of the portable cribs are made of a soft fabric and net combination. The fabric stretches over a collapsible frame and a thin mattress fits in place in the bottom of the crib. This style of crib sits closer to the floor than standard cribs and usually does not have as many adjustments for mattress height. Portable cribs do not have a drop-side, so the parent must reach over the sides to pick up or place the infant in the crib. Most of the modern portable cribs double as playpens.



Figure 8: Portable Crib. (2009).

We show a portable crib in Figure 8. When we discuss portable cribs, we have in mind something similar to the above image.

### 2.2.2 Manufacturing Process

Every product made goes through a manufacturing process (Crib Manufacturing, 2009). Most companies do not share their companies manufacturing process information. Typically, the basic routine that the companies go through is the factory makes, packages, and ships the parts to the store selling the product. Almost all United States-based baby furniture manufacturers now outsource their work to other countries.

Every company should have their own quality control tests to ensure that each product produced is of the same quality as the first model made, but most companies do not open this information up to the public. The different manufacturers have their own way of conducting their quality testing. In order for JPMA to certify a crib, companies are to test 25% of their models each quarter with the goal that they test all of their models at least once a year (JPMA, 2009). This goes for all crib manufacturers, whether the companies make their products domestically or overseas.

### 2.2.3 Outsourcing

Outsourcing manufacturing to various countries has become a major way that many businesses produce their products (Crib Manufacturing, 2009). The main reason for companies to outsource their work is that it is less expensive. Part of the reason companies who outsource can keep their costs down is because domestic factories need to meet regulatory oversight and safety standards that overseas factories are not required meet. Products made domestically and overseas must still meet all of the same regulatory issues that need approval by the CPSC, but mandatory oversight of factories in other countries is not necessary. This can allow product pieces to slip by that may not be up to standards. This does not mean outsourcing work to other countries is inferior to factories in the United States because poor manufacturing happens everywhere; however, this is one difference in the manufacturing processes of other countries and the United States.

Another common thing that happens when companies choose to outsource their work to other countries is “quality fade” (Midler, 2009). Quality fade is the deliberate and secret habit of widening profit margins through a reduction in the quality of materials. Importers usually never notice what is happening because the initial production sample is fine, but with each successive production run, a bit more of the necessary inputs are missing.

One example of a crib company that had a manufacturing problem is Delta (The Delta Enterprise Crib Recall, 2009). Two children died from the use of Delta cribs due to improper pegs made to fit in the crib’s legs, causing the cribs to collapse. There were two ways to avoid the problem. The workers could have taken more time to make the pegs correctly and Delta could have taken the time to properly train and monitor the workers. Delta voluntarily recalled the cribs due to the poor manufacturing of the parts.



## **2.3 Crib Safety Regulation and Standards**

With the risk of injury and death comes the need for safety regulations and standards to prevent such things from occurring. Before crib regulations were developed, 150 to 200 babies died each year in crib-related incidents (Office of Information and Public Affairs, 2000). In 2000, that number had decreased to about 35 per year. The decrease in deaths has been a direct result from a set of regulations and standards given to manufactures by the CPSC. There are different regulations for full size and non-full size cribs (Office of Compliance, 2001). With these regulations, CPSC compiled a test manual that allows them to test cribs most efficiently for flaws. The American Society for Testing and Materials (ASTM) has laid out voluntary standards and performance tests that have been in response to data collected by the CPSC (ASTM, 2009, p.1). By meeting the ASTM standards, companies can have their cribs certified by the Juvenile Products Manufacturers Association (JPMA, 2009, "Fact Sheet").

### **2.3.1 History of CPSC Crib Regulations**

Shortly after the founding of the Consumer Product Safety Commission in 1972, they started publishing mandatory crib regulations (Brown et. al, 1997, p.2). The CPSC published standards for full size cribs in 1973 and non-full-size in 1976. Initial standards included requirements for side height, dimensions, slat spacing and mattress fitting. In 1982, CPSC added requirements to prohibit hazardous cutouts in crib end panels.

Between 1980 and 1984, the CPSC had conducted 46 investigations of incidents involving crib hardware failures or omissions (CPSC, 1984, p.1). In 1984, the CPSC voted on the transfer of the regulation of risk of crib hardware failure from the Federal Hazardous Substances Act to the Consumer Product Safety Act. This move enabled the Commission to act more promptly and effectively to protect the public. This change allowed the CPSC to proceed directly when they learned of a hazard.

Through the ASTM (American Society for Testing and Materials), CPSC was involved in the development of voluntary standards for manufacturers. First published in 1986 and 1989, these regulations addressed issues with corner posts, structural integrity and mechanical failures.

In 1997, the CPSC voted to address the hazard of slats falling out (Brown et. al, 1997, p.2). Between the years of 1985-1997, at least 138 incidents occurred involving this issue. Regulations did not address slat hazards until then.

In 2008, President George W. Bush signed the Consumer Product Safety Improvement Act (CPSIA) (CPSC, 2009, "CPSIA"). This law increased the budget of the CPSC to impose new testing and documentation requirements and set new regulations on a variety of products. One of the first actions of the law was to limit the use of lead paint in children's products. This included the use of lead paint in cribs. Under this act, new additional crib requirements will become regulations.

### **2.3.2 CPSC Crib Regulations**

When the Consumer Product Safety Commission started regulating cribs in 1973, there was not much contained in the documents. According to the Office of Compliance and the documents 16 C.F.R. Part 1508 (2001, Full Size Crib) and 16 C.F.R. Part 1509 (2001, Non-Full Size Crib), cribs have a set of requirements that it must be manufactured by for it to be an acceptable product. These documents mostly regulate the height of the sides of the cribs, the dimensions of the inside of the crib, distances between slats, decorative cutouts and toeholds. These documents include two tests; one that looks at the hazards of decorative cutouts and the other looks at the distance between slats (Engineering Testing Manual, 1983). Appendices H, I, and J include more detail of these regulations.

### **2.3.3 ASTM Standards and Testing for Cribs**

The voluntary standards for cribs laid out by the American Society for Testing and Materials (ASTM) addresses crib accidents that were identified by the U.S. CPSC (2008, p.1). Voluntary standards are not mandatory law and manufacturers are not required to follow them. Companies may or may not elect to follow them. If the manufacturers produce and test cribs that pass the requirements, they can become “certified” by JPMA (Juvenile Products Manufacturers’ Association). You can find more on JPMA certification in section 2.3.4. If an incident does happen and the manufacturer was not following the recommended regulations, they are liable for the incident. The document that includes the regulations is F 1168-07 (ASTM, 2008, p. 1). The focus of ASTM regulations is to minimize injuries and death due to failure of mattress support hardware, failure of glued or bolt connections, drop-side latch failure and dislodgement of teething rails. In order for the ASTM to get a proper analysis of the safety of a crib, they require tests on almost every component of the crib (p.3). The ASTM holds full size cribs to performance requirements during and after testing to make sure that they comply with regulations (p.2). The ASTM addresses incidents involved with poor maintenance or assembly by means of requirements of the contents of instructions included with the crib. More about human interaction is located in section 2.5.3. Appendix G contains the ASTM voluntary standards.

### **2.3.4 JPMA Certification**

The Juvenile Products Manufacturers Association, Inc. (JPMA), is a national trade organization who is dedicated to promoting the industry and the safe use of juvenile products (2006, “Overview”). The JPMA has been benefiting the juvenile products industry for more than four decades. Retailers count on the JPMA to monitor the juvenile products industry as they work to promote the industry and

those involved. Today, they represent 95% of the prenatal to preschool industry. JPMA serves as the voice of the industry and they are committed in ensuring the safety of children.

For companies to receive the JPMA certification seal on their products, manufacturers must voluntarily submit the product for testing (JPMA, 2006, “Fact Sheet”). After thoroughly testing the product to the appropriate ASTM standards (crib standards are seen in Appendix G), the product is given the certification seal that it can then display. Since submitting products is voluntary, not all juvenile products carry this seal and they may not meet all of the ASTM standards. As of December 2009, JPMA has 24 companies that have combined to have 184 crib styles certified (“Certification Program”). With this seal, parents can be confident that the design and construction of their juvenile product was with safety in mind (JPMA, 2006, “Fact Sheet”).

### **2.3.5 Regulations and Testing Outside of the United States**

The United States through the CPSC is not the only country that takes infant safety seriously. Other countries around the world place regulations and mandatory tests on cribs, and many have even begun to tighten those regulations in recent years (Hackett, 2009, p. 5). Countries differ in their regulations, standards and testing of cribs. The standards to compare are CPSC federal regulation, ASTM voluntary standards, Canadian regulation, British standards and Australian standards.

Construction requirements can be stricter or not even present in other countries’ regulations compared to those in the CPSC regulations (Hackett, 2009, p. 7). A point of difference is with cutouts, toeholds and mattress support requirements. The CPSC has basic requirements on these three things (seen in appendices H and I). On the other hand, Canada as well as ASTM has no requirement within the standard. Britain and Australia are similar to the CPSC for these requirements except that they do not have a requirement pertaining to cutouts. The basic requirement for the general construction of cribs involves openings, protrusions, shearing, pinching and sharp edges. ASTM has no requirements in this

standard but Canada, the CPSC, Britain and Australia all have this requirement. The latter two have stricter requirements than just the basic requirement that was previously stated.

The CPSC has no requirements in the standard of wood and joints (Hackett, 2009, p. 8). Many of the requirements have to do with testing the durability and strength of different wooden parts and joints. The ASTM has requirements for crib side testing including cyclic, static load and torque testing. Canada tests the slat and rail joint strength by conducting both static load tests and torque tests. Britain conducts tests on the slats that involve their bending strength and impact strength. Lastly, Australia tests the slat and rail joint strength by conducting just the static load test and looks at the bending strength of slats.

Compared to other requirements outside the United States, the CPSC has barely any regulations for drop-side testing (Hackett, 2009, p. 9). The ASTM has the basic requirement for drop-side locking. This requirement is that the drop-side should be automatically engaging. There is a test for drop and folding side latch described in Appendix G. Both Britain and Australia require that this cycle run 200 times to test the latch of the drop-side. Only Australia requires the cycle drop operation to run 200 times to test the durability of the operation. The only requirement that all countries follow is that of the automatically engaging lock.

The Consumer Product Safety Commission does not have any requirements in structural integrity compared to the four sets of standards (Hackett, 2009, p. 10). The ASTM requires the vertical load cyclic test and the mattress support system test, described the ASTM standards in Appendix G. Britain conducts a horizontal cyclic test that tests the effect of loads on the crib rail for 2000 cycles. The next requirement the others conduct is the vertical load cyclic test that drops a 45-pound weight six inches off the mattress in both the middle and the corners. Britain and Canada both use the vertical load static test that sends a vertical downward force to the top of each side ten times for ten minutes. Canada has the only regulation that tests the mattress support system by applying a 25-pound upward

force to the corners or the support system. Lastly, Britain and Australia look at and test the stability of the crib.

The last category of requirements to focus on is the packaging, labeling and record keeping (Hackett, 2009, p. 11). Across all the standards looked into, the requirements for instructional literature and labeling are identical. Where the differences come are in plastic packaging and recordkeeping. The CPSC and ASTM do not have a requirement for plastic packaging, but Britain and Australia have the requirement that the packaging may be perforated or carry a suffocation warning. One unique CPSC requirement is the 3-year retention of crib records.

According to Patricia Hackett, a crib expert at the CPSC, and the Division of Mechanical Engineering at the CPSC (2009), the standards set by the Consumer Product Safety Commission are not as many as those set in the other countries we have reviewed here. Among the countries Canada, Britain, Australia, and the United States, the United States (CPSC) had the fewest number of requirements. They had 10 out of 34 basic requirements. The ASTM had the second least with 15 out of 34. In comparison, there are 14 in Canada, 15 in Australia and 18 in Britain. Seen in Figure 8 below is a more in-depth comparison. CFR 1508 refers to the CPSC regulations, ASTM F1169-03 to the American Society of Technology and Materials, SOR/86-962 to Canada, BS EN 716 & ISO 7175 to Britain, and AS/NZS 2172 to Australia. UL 2275, not considered here, is from the Underwriters Laboratory.

	CFR 1508	ASTM F1169-03	UL 2275	SOR/86-962	BS EN 716 & ISO 7175	AS/NZS 2172
No Requirement	24	19	5	20	16	19
Basic Requirement	9	15	16	9	13	9
More Stringent Requirement	1	0	13	5	5	6
Total # Requirements (out of 34)	10	15	29	14	18	15

Figure 8: Comparison of Total Number of Requirements (Hackett, 2009, p. 12).

### 2.3.6 Current Argument over Drop-Sides

“Major manufacturers on Tuesday signed off on a proposal that would ban drop-side cribs in the United States in the wake of repeated recalls, entrapments and deaths, the Tribune has learned” (Callahan, 2009, p.1). Bad design, missing parts and worn out hardware maybe to blame for the incidents that have occurred where babies have slid through gaps. The biggest crib makers and retailers all support the drop-side ban. In the past, manufacturers have rejected proposals that restrict their designs. However, with more than three million cribs recalled in the past two years with drop-side issues, they are willing to consider the ban. All of the cribs recalled in the past two years had passed the tests required under safety standards but still failed in consumers’ homes.

The CPSC is moving towards tougher federal regulations to fix this problem after trying to push manufacturers at the ASTM semi-annual conference to fix the drop-side problems for years (Callahan, 2009, p.1). New safety regulations would require all four sides of the crib to attach rigidly to each other. This would remove moving parts that have broken off or created a hazard in cribs. Many consumers have recently been purchasing cribs with stationary sides. Many oppose the regulation and feel that “the drop-side is especially helpful to shorter people or those with back problems.” A new proposed standard passed late in 2009 allows a small portion of the top of the crib railing to fold down but all four sides must be fix at the bottom up to a certain height. Below is the excerpt from the new ASTM standards that discusses the point (ASTM, 2009, F1169). ASTM has yet to publish the standard:

“Cribs with side(s) having movable components intended to aid in access to the occupant shall have those sides rigidly attached to the crib ends and contain no movable section more than 6 inches (15 cm) below the top of the side top rail in its fully raised position. Horizontal rails located more than 26 inches (66 cm) above the top surface of the mattress support in its lowest adjustable position shall not be considered toeholds.”

In October 2009, Suffolk County located on Long Island, New York voted to ban the sale of drop-side cribs within the county (Darrow, 2009, pg.1). This county legislature unanimously approved the ban.

Their reasoning for voting this way was because they do not want to put their consumers at risk with a product that has proven to be dangerous and deadly. Legislatures in the county believe that parents are unaware that their drop-side cribs are unsafe as the hardware can malfunction in a way not easily detected. The county did not ban drop-gate cribs that have a fourth side that folds down. When this ban goes into action in February 2010, Suffolk County will be the first to ban the sale of drop-side cribs in the country.

According to experts at the CPSC, the future of cribs is changing within the industry. With the limitation on drop-side cribs, fold-down side and stationary cribs are now the future of the industry. Figure 9 below shows an example of a fold-down side crib and Figure 10 shows an example of a stationary crib.



Figure 9: Folding Side Crib (Atlantic Hospitality, 2009)





Figure 10: Stationary Crib (NurseryFurnitureOnline.com, 2009)

## ***2.4 Incidents in Cribs***

Unfortunately, there have been too many crib injuries due to one of the following ways: misuse by the consumer, poor engineering, an incorrect mattress size or a poor manufacturing process.

### **2.4.1 Consumer Misuse**

One common misuse issue that has occurred is the use of the safety pegs. Safety pegs are in a position that if the locking mechanism of the drop-side style cribs fail, the side will only fall a short distance to the safety pegs support it (Consumer Reports, 2009, p.1). In one case, an eight month old baby and one more child (age not specified) became trapped and suffocated to death because the safety pegs had not been installed by the consumer. There have been at least nine similar cases of incorrectly installed safety pegs and the drop-side falling completely from having no support when the locking mechanism failed. Other cases of misuse have occurred with the bedding material. Warning labels on

cribs state there should be no soft bedding material in the crib. Unfortunately, one family did not follow these instructions (CPSC, 2009, 090416HCC2547). They had put multiple pillows and comforters into the crib with their twin babies sleeping together in the same crib. They woke one morning to find that one of their daughters had suffocated from one of the items in the crib.

### **2.4.2 Mattresses/Bedding Material**

An aspect of baby cribs often overlooked is the correct mattress. There have been cases of SIDS involving a mattress not intended for the crib. There is a possibility that the reason for SIDS was due to the baby suffocating in the mattress while sleeping (Thompson, 2009, p.22). Multiple incidents reported the baby became stuck between the mattress and a side of the crib. These cases resulted in the death of the baby. Cribs do not usually come with a mattress so it becomes the responsibility of the consumer to purchase the correct size mattress. The consumer may create a hazard unintentionally for their baby by purchasing the wrong mattress.

### **2.4.3 Poor Engineering**

There are still current problems with crib designs even though many standards and regulations for the design exist. One common issue that has occurred is that of the drop-side tracks. Tracks are in place to guide the drop-side but consumers have reported them failing. In one case, the consumer found her baby trapped between the bottom rail of the drop-side and the mattress (CPSC, 2009, 090205HCC2305). In this case, the drop-side fell off the track and created a gap allowing the baby to become stuck. Cases such as this one are dangerous because babies can die due to strangulation from the rail. Another case of poor engineering has to do with the latching mechanism of the drop-sides. The design of drop-sides requires two different motions to unlock the drop-side. Incidents have occurred where a baby was able to drop the side from pulling down on it. In another case, a baby simply pushed

on the side causing the drop side to fall and the baby to fall out onto the floor (CPSC, 2009, 090407HCC2516).

#### **2.4.4 Poor Manufacturing Process**

In multiple cases, consumers found cribs pre-assembled incorrectly by the manufacturer (CPSC, 2009, 090127CCC1372). In one case, the consumer reported that the only way to assemble the crib she bought was with the drop-side reversed. The shoes on the bottom of the drop-side were spring-loaded and designed to push the crib into the track when lifting the side. The manufacturer had preassembled the shoes to push in the opposite direction thus making it only possible to assemble the side in reverse. In other cases of poor manufacturing, the connection of the rails was not secure to the slats (CPSC, 2009, 090421HCC1624). A consumer reported that the drop-side on her crib fell apart during normal use. She was lifting up on the drop-side to lower it when six slats came out and fell to the ground.

### **2.5 The Human Element**

When trying to find the underlying cause of a problem, the CPSC must consider the human element (ASTM, 2008, p. 1). The American Society for Testing and Materials (ASTM) recognizes human elements and states in their “Standards for Specifications for Full Size Baby Cribs,” “It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use” (p.1). Problems can arise due to misinterpretations, foreseeable misuse, and the actions of the child. Misinterpretations can happen when reading instructions if they are not written clearly or written in a different language from the target buyers. Foreseeable misuse happens when a consumer uses a product for a different way than intended. The behavior of a child can be another reason for the high number of crib incidents

happening. For example, a child who is approaching the age of seven months is becoming more mobile and they are more likely to be standing in their crib, putting them at more risk for incidents to happen.

### **2.5.1 The Human Factor**

As defined by Encyclopedia Britannica (2009), the human factor is a branch of “science dealing with the application of information on physical and psychological characteristics to the design of devices and systems for human use” (human factor). Dr. Balci-Sinha informed us that the Human Factors Engineering department is to ensure the safe use of consumer products (Balci-Sinha, 2009). This department tries to predict the ways humans can misuse a product that could lead to injuries or deaths, or foreseeable misuse. In the case of cribs, human factors engineers look at the way a child behaves while in a crib. This research has led to regulations including banning toeholds in the design of a crib that would aid in a child climbing out. The goal of the human factors department is to ensure the use of the product is in its intended way and there will be no harm from misusing the product.

### **2.5.2 Instructions**

Instructions for building anything are important, and this is certainly true for assembling a crib. If instructions are not clear, the person putting the crib together has the possibility of assembling it wrong.

One headline of the Philadelphia Inquirer reads, “One Million Cribs Recalled after 3 die; Simplicity and Graco Models Are Affected; Victims Suffocated” (Von Bergen, 2007). This article explains that the cause of the drop-side problem was the crib’s hardware and design. The unclear instructions on how to install the components caused consumers to mount the drop-side railing upside down, weakening the hardware and allowed the drop-side to detach from the crib. The instructions were not clear for the consumer to assemble the product properly leading to several deaths.

Instructions are the link between the consumer and the designer (Dym, 2009). If there is miscommunication in this interface, problems can arise quickly and cause products to function incorrectly and result in harm to the consumer.

### **2.5.3 Human Interaction**

When injuries and deaths due to consumer products occur, people are quick to blame the manufacturers and designers, but it is not always the designer and manufacturer's fault. There are cases where injuries or deaths were preventable, but the consumer used the product in a way the manufacturer did not intend or in a way that they did not realize the dangers of their actions.

An example of human interaction with a crib is a parent or caretaker not watching a child carefully enough. If the child is at an age where they can climb out and the parent leaves them unattended, the child could fall from the crib causing an injury or death. This type of incident is not the result of design flaw, but rather an issue the consumer should have addressed by lowering the mattress support or removing the child from the crib once they became too big. For example, a police brief reported stated that after a baby fell out of her crib, the baby was seriously injured (News Briefs, 2008). It is important to realize the design of a crib is not for a child once he or she becomes a certain height and is able to climb-out. It then becomes the responsibility of the parents or caretaker to watch the child while in the crib and make sure nothing happens.

Differentiating between the problems that are the manufacturer's fault and the injuries that occur because of human error is important in determining if human interaction is a major factor in crib incidents.

## 2.5.4 Recall Compliance

A product recall occurs when a retailer or manufacturer requests the return of a commercial product because of a defect, a safety problem, or an efficiency problem (Encarta, 2009). For consumer products under the range of the CPSC, recalls can happen in two ways: the manufacturer can recall the product voluntarily or the CPSC can force the manufacturer to recall the product (Steele, 2009).

Consumers find out about product recalls through the CPSC, the manufacturer's website, and through the news. Consumers can sign up to receive e-mail notifications of recalls.

Different manufacturers deal with recalls in different ways. The type of product involved is a deciding factor on how the manufacturer handles the recall. One example for a crib recall is with the company Jardine (CPSC, 2009). If a consumer has one of the models of the recalled cribs, they had to fill out paperwork online or send it by mail and they received a voucher towards the purchase of another baby crib.

Human interaction plays a big part in recalls because it is up to the consumer to take responsibility to find out what to do with the recalled item. An expert at the CPSC said the typical percentage of people who respond to crib recalls is only about five percent. This means that there are consumers using recalled products that are dangerous to them. Recalls usually suggest the consumer to stop use of the product immediately and take the appropriate action (obtain a repair kit or discard the product, etc.). Since parents use cribs on a daily basis, they face the problem of finding another safe sleep environment for the child. Some consumers may not have access to another safe sleep surface so they may continue to use the product even though there is a known danger associated with it.

### **2.5.5 Children's Age and Health Related to Behavior in Cribs**

The age of a child when he or she is in a crib has a lot to do with how the child acts in the crib (Ridenour, 2002). A newborn baby does not have the motor skills to walk and put pressure on the crib unlike a baby who is learning to stand and walk. A child at an age where they are able to walk is going to put more force on the crib. This means crib designers need to be aware of the forces a child can apply when thinking of a safe design and proper materials. In addition, a child learning to walk is more likely to try to get out of the crib by climbing over the railing, putting the child at more of a risk for injury.

Along with a child's age, a child's mental and physical health will have an effect on how the child acts in the crib. For example, autistic children "head-bang" (Toddler Behavior, 2009). This is when children hit their heads against their crib posts because it relaxes them and allows them to get out their frustrations. This is a child's behavior in the crib that could lead to an injury that is unrelated to the mechanics of a crib.

## **2.6 Economic Factors**

Having a baby is a big financial commitment and is something parents must consider when looking to purchase baby products (*Consumer Reports*, 2009). New parents need to worry about the cost of medical bills, as well as buying a crib, clothes, toys, and various child safety supplies. New parents still need to support the rest of their family with food, shelter and other needs. Parents need to consider the cost of a crib, especially those struggling with limited income.

### **2.6.1 Cost of a Crib**

According to the *Consumer Reports* (2009), there are three levels of crib costs. The first is the economy crib ranging from \$100 to about \$150. The mid-priced cribs range from \$150 to \$450 while the

high-end cribs include any crib that costs more than \$450. In addition, the mattress must be purchased separately costing anywhere from \$30 to \$230.

The crib is usually the single most expensive purchase a parent will make for their newborn. Parents can save money on a crib by buying a convertible crib. This would cost more money up front, but would save money over the years of the baby's life. Another way to save money when buying a crib is to use a second-hand crib. Although this might save money, the CPSC highly discourages parents from using second-hand cribs (CPSC, 1986). One reason for this is that some hand-me-down cribs might be before safety regulations were enforced. By using a second-hand crib, the likelihood of accidents increases due to missing or broken parts. More detail on this discussion is in section 4.2.1.5.

## **2.6.2 Economically Disadvantaged Consumers**

Economically disadvantaged families with limited incomes may struggle to find money to buy a crib for their newborn baby (CPSC, 1986). These families are more likely to rely on older cribs or even no crib at all putting their children at risk for injuries and death.

Families with limited income can obtain a new, safe crib free from some organizations. There have been times when the CPSC has teamed up with organizations and given away cribs to families with lesser incomes (CPSC, 2003). There is an organization called "Cribs for Kids" that has been committed since 1998 to providing cribs for families with lesser incomes (Cribs for Kids, 2007). These are great ways for families to obtain a free crib, however, there are still people who do not qualify for these programs and still have no means of purchasing a crib.

Although every new crib should pass the CPSC regulations regardless of cost, parents may choose to purchase a second-hand crib that may not be in the proper condition for use.



## **2.7 Summary**

After extensive research and improvements, the CPSC has found that the incidents involving baby cribs and infant death are still a major concern. The Consumer Product Safety Commission has been investigating the injuries and deaths of infants that occurred in cribs while parents assumed that everything was okay. Crib use, design and construction have come a long way from what they used to be. This is thanks to the CPSC whose job is to save lives and keep families safe by reducing the risks associated with consumer products. They have worked extensively with setting standards and recalling cribs that do not meet the standards. They have discovered new problems and have figured out what new standards need to be set. There is currently not a lot of information linking a child's age and behavior to crib incidents. There is not a lot of research looking into a possible link between crib incidents and economically disadvantaged choosing to use a second-hand crib. The CPSC upholds the responsibility of setting standards and issuing recalls at the highest level, while continuing to try to bridge the gap between past research and new issues that evolve over time. Although the CPSC has already done a lot to improve crib safety, there are still gaps of research to address.

### **3 Methodology**

The Consumer Product Safety Commission has observed that injuries and mortality rates associated with cribs are still a major problem. Our goal of this project was to determine the problems with cribs and make recommendations for crib and crib use improvements to prevent future infant injuries and deaths. Through our background research, our team identified the recurring problems with current cribs. In response to these, we developed a methodology that identified current crib safety technology problems, human interaction problems and economic factors that led to crib incidents.

We used several data gathering methods. We began by analyzing In-Depth Investigation (IDI) reports to find any major factors in incidents that would be useful to look into further. We followed this with observation and minor testing of the components of the cribs. We researched crib companies and their crib products to look for their relation to incidents. Lastly, we conducted interviews with people in the field and used surveys for parents and crib experts to ask them about important factors relating to crib use.

#### ***3.1 Identify Current Crib Safety Problems***

This section addresses issues involved with the components of a crib. The IDIs helped us determine the components that tend to fail and for what possible reasons. By determining the faulty components and recognizing issues through observations, we looked into the testing on these areas. We conducted interviews with experts that focused on suggestions on how to improve the faulty areas.

##### **3.1.1 In-Depth Incident Reports (IDIs)**

A main source of information for identifying current crib safety technical problems is the In-Depth Incident Reports (IDIs). For a better understanding of what occurs in these crib incidents, we

reviewed these reports. We read the IDIs and categorized them using various criteria in a spreadsheet in Microsoft Excel. Examples of the categories we used were brand of the crib, the manufacturer, the child's age, the incident and the problematic component to the crib. A sample piece of this form is in Appendix E. The CPSC does not assign IDIs to every reported incident but instead to the cases they want to look at. Because of this, trends are expected. Instead of looking for trends in the incidents, we looked at the variety of hardware problems. Reading the IDIs assisted us in determining what to look for during observations. From the IDIs, we learned exactly what happened on a case-by-case basis. This was important because we believed that the incidents we found and discussed in our background were missing important details that were necessary to discover solutions.

### **3.1.2 Observations**

We looked at various types and models of cribs. These included assembling and disassembling cribs. This allowed us to get a better understanding of how cribs operate and what problems cribs may have. Assembling the crib ourselves gave us the chance to see what problems people face when they are constructing them. These observations occurred within the CPSC laboratory.

### **3.1.3 Interviewing Crib Experts**

This section addresses how we identified and spoke to experts in the area of infant crib safety. We talked to crib manufacturers and crib experts at the CPSC. We obtained these names and contacts through our liaisons at the CPSC. We interviewed several different people from each category, and when unable to conduct a direct interview we sent them a questionnaire through e-mail or by mail. From these interviews and questionnaires, we found out how what they see as mechanical problems with cribs and what type of recommendations for crib safety would be beneficial.

### **3.1.3.1 Crib Manufacturers**

We attempted to interview nine different crib manufacturers to get a better understanding of the crib designing and manufacturing process and the problems encountered. Unfortunately, only one company, Stanley Furniture, gave us feedback. We received feedback on steps they have taken to improve the manufacturing process. We learned the problematic areas in both the design and distributing process. We constructed an interview protocol with a list of questions that we asked all of the crib manufacturers (see Appendix A for list of questions). Information about how cribs are being manufactured and knowing how the manufacturers produce cribs helped lead us to our goal of informing the CPSC of factors that have contributed to the risk of crib incidents. With a short time frame and few responses from manufactures, it was hard to analyze this aspect of cribs.

### **3.1.3.2 CPSC Experts**

We interviewed crib experts that are currently working for the Consumer Product Safety Commission. Interviewing these experts was beneficial to our project. These people know what information the CPSC has already found and what they are looking for in regards to crib safety and technology. We developed a set of questions that we asked the CPSC experts found in Appendix A. The interviews with these experts gave us useful information on cribs as well as resources the CPSC could offer us. These interviews helped us in achieving our goal by making us familiar with the way the CPSC currently conducts crib reviews and performance testing. They shared their ideas on how to improve crib safety, giving us ideas to look into.

## ***3.2 Identify Human Interactions that Lead to Crib Incidents***

In this section, we address how we investigated the issues related to human interaction with cribs. The data we analyzed here determined how much of a role misuse and incorrect construction

play in past incidents. This information helped us in determining whether human interaction plays a role in crib safety.

### **3.2.1 Identify Foreseeable Misuse thru IDI's**

A main source of information for identifying human interactions that lead to crib incidents was looking through the IDIs. Similar to how we analyzed the IDIs to find what parts are malfunctioning, we looked at what parts of the incidents are due to human error. We were able to understand if certain incidents were only because of human error or if human error played a small role in a larger technical problem. Analyzing these showed us if incorrect construction of cribs is causing problems. In addition, we determined if infant developmental behavior or parents' actions are playing a role in why these crib incidents have occurred.

### **3.2.2 Parent Interaction**

An important group of people we talked to was the people who spend the most time with the babies in their cribs: parents. We interviewed parents who used cribs for their babies and toddlers. We found out the different experiences that parents had with baby cribs as well as s found out the crib safety awareness level of parents. We used the answers to our interview questions to see if there are common trends or experiences that they faced while using a crib for their child. These questions touched on parents' awareness of crib safety and their experiences with buying, choosing, and building their crib (see Appendix A for interview protocol). We conducted the interviews using the online program, Survey Monkey. By using this program, we categorized and analyzed data. This information helped in making recommendations to the CPSC because we looked into real experiences that have occurred with cribs.

### **3.2.3 Human Factors Experts**

We spoke with human factors experts about the human aspects that are associated with cribs. These resources are members of the Human Factors team working within the CPSC. The answers to these questions helped us to find out the human relations regarding crib safety. This information gave us an idea of how the users, both child and parent, interact with cribs.

#### **3.2.3.1 Developmental Psychologists**

One expert we interviewed while working on our project is a child's psychologists from the CPSC. We were interested in looking into the relationship of a child's mental and physical state and age in connection to their behavior in cribs. From our background research, we found gaps in the area relating to a child's developmental behavior and the designs of cribs. We were interested to see if this could be a factor in crib related incidents. We asked a children's psychologist several questions (found in Appendix A) to conclude the normal behaviors of children at the ages they are in cribs. We spoke with students from Virginia Tech who are working with a development psychologist studying the behavior of babies in their cribs and the stresses that babies can put on a crib. The CPSC provided us with this contact and a proposal of their project. Unfortunately, their data is going to be a very small sample and the results will not be available until April 2010.

#### **3.2.3.2 Human Factors Engineer**

A human factors engineer takes into account the foreseeable misuse and abuse of products. We were interested to learn about the human factors related to cribs. From our background, we saw a gap in the area of foreseeable misuse and product design. We looked into how companies considered these factors while designing and manufacturing their cribs. We interviewed a human factors engineer at the CPSC to acquire this information. The questions asked are in Appendix A.

### **3.2.4 Cribs in Advertisements**

One thing we looked into for human interaction was how distributors and manufacturers portray cribs to the consumers. From this we determined if consumers were getting the wrong idea on how to use their crib from the advertisements. For this we conducted research by looked at distributors' and manufactures' web pages and magazines. Going to several distributors was another method to view the portrayal of cribs.

### **3.2.5 Current Crib Safety Tips**

To find out what current crib safety tips were already available to consumers; we conducted research on advocacy groups, distributors, and the CPSC. To find the information we looked on previous groups web pages to see if they had crib safety tips posted. On top of that we contacted some of the representatives from the organizations and companies to ask them what else they do to promote crib safety.

## ***3.3 Economic Influences***

One area we observed a gap in research was the economic factors of buying a crib and its relation to crib injuries and deaths. We conducted research and interviews with organizations that help the economically disadvantaged parents and other consumers to find out if there are a large number of second-hand crib users to warrant other investigations in this area.

### **3.3.1 Organizations to Help Economically Disadvantaged**

We interviewed staff from organizations that serve economically disadvantaged people such as Cribs for Kids. We gained information that shows the relationship of income, types of cribs, and crib

incidents. Since all cribs manufactured and sold are supposed to meet the CPSC regulations before sold, the issue of cost should not matter; however, we were interested in finding out how income relates to using second-hand cribs. This information provided us with the knowledge to conclude if economics play a factor in injuries and deaths related to cribs. These findings helped us to make appropriate recommendations to the CPSC in the area of second-hand crib usage.

### **3.3.2 Parent's Outlook**

Through our parents' surveys (seen in section 3.2.2), we looked at how many parents used a second-hand crib. Commonly, a secondhand crib is a crib used for more than one child. In the survey, we included questions relating to the purchase of a new or used crib. We then went through the surveys to determine a percentage of second-hand cribs used. This data helped us to determine whether second-hand crib usage is prevalent with a wide sample of parents.

### **3.3.3 Crib Prices**

Through online research, we found the prices of current cribs on the market. We looked at a number of different companies and determined the average price of cribs. With that price, we compared it to the amount of incidents that we saw from that company in the IDI reports. From this information, we found trends in the average crib price and the amount of incidents that have occurred with those cribs.

## **3.4 Summary**

By analyzing In-Depth Investigations, observations, crib related research, and interviewing various people with crib knowledge, we obtained information that allowed us to draw conclusions about the problems with cribs and allowed us to make recommendation to the Consumer Product Safety Commission.



## **4 Results and Analysis**

In this section, we discuss the results of our research about the problems and gaps in today's crib safety, regulations and knowledge. We discuss the current safety problems relating to cribs, followed by what human factors we found to be hazardous to crib safety and lastly what economic factors we found to cause problems in crib safety.

### ***4.1 Current Crib Safety Problems***

To evaluate current crib safety problems, we looked through hundreds of In-Depth Incident reports (IDIs) and experimented with our own cribs. Below are the results we discovered.

#### **4.1.1 What We Found In IDIs**

After reading through and sorting 687 IDIs from January 1<sup>st</sup> of 2007 to October of 2009, a few things are apparent, as seen in Figure 11 below. Although these trends exist among the IDIs they are not to solely determine the reasons for crib failures. Consumer complaints are the basis for Conducting IDIs and what the CPSC wants to look into, thus IDIs do not encompass every crib incident. First, almost every piece of hardware on a crib has failed. Claws, slats and drop-side latches, are just some of the main components mentioned in one or more IDIs as being the cause a failure. At the top of the list are drop-side crib related incidents. Out of 687 IDIs, 172 were in relation to a piece of hardware having solely to do with a drop-side. These pieces include claws, tracks, latches, and safety pegs. The next problematic component was the slats. One hundred and thirty three reports were slats breaking, cracking, or falling out of place completely. The third highest ranking in the IDIs was climb-outs, the incident resulting when a baby climbs out of the crib, with 85 reports. The fourth ranking problem with 72 incidents was mattress gaps. These causes of incidents point out that the problem not only related

to the physical crib, but their assembly and use as well. Hardware and slat related issues show a lack of strength and testing for the crib whereas climb-outs and mattress gap related incidents show a lack of knowledge from the consumer standpoint.

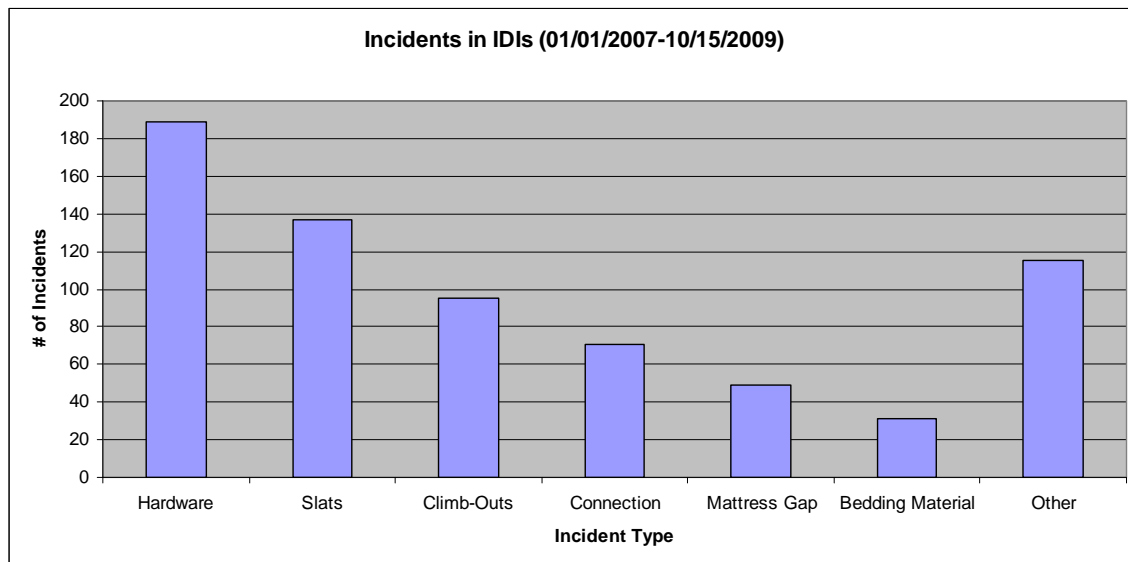


Figure 11: Incidents in IDIs

## 4.1.2 Experimenting with Cribs

The CPSC lab has multiple cribs including cribs that were each at one point recalled. The CPSC gave us the opportunity not only to experiment with these cribs but assemble them as well. While some aspects were fine for normal use, others were not. The first problem that caught our attention was the instructions (see Appendix B). We assembled a brand new crib using only what the consumer would have to use. We found the instructions not to be clear and consumers could easily misinterpret them. Included in the packaging were multiple bolts of different lengths and diameters. The instructions only specified bolt lengths at the beginning of the booklet and not in the step-by-step directions. We found that some of these bolts fit in more than one location. It is possible that the longer bolts could thread further into the crib than designed for it. A consumer may not know the design concept of the crib and

could easily put a shorter screw through a piece of the crib. Later on, this could cause the screw to fall out of place and the crib to fail from instability.

Another issue with the instructions was that they were hard to find. We found them within an envelope attached to the mattress support. This is a great place to have an envelope to put the instructions in for future use but not for first time use. At first, we could not find them and went ahead trying to piece the crib together without instructions. It was only after we tried moving the mattress support that we found the instructions because of the noise the booklet made sliding around in the envelope. While not all manufacturers had their instructions in the same position we believe that this is something that should have a regulation.

Another gap we found in the instructions deals with the mattress support. The mattress support mounted at four different height levels. Higher levels are for younger children and lower levels are for older children. The instructions did not give a recommended mounting height. The consumer does not necessarily know the height to mount the mattress and it is foreseeable that they would mount at a height level too high. This would make it easier for the consumer's child to climb or fall out of the crib.

The next problem had to do with the amount of force needed to disengage a drop-side crib. It did not take much strength to lift and shift the drop-side to make it disengage and lower. We stood on the inside of the crib to try to replicate motions similar to ones a baby would make while standing in a crib. Although we have greater strength than a baby does, the motions we created were something a baby could reproduce and yet they still were enough to disengage the drop-sides. This is troubling because it is possible that a baby could disengage the drop-side by reproducing these forces and consequently get hurt or create a way to exit the crib unsupervised. Many IDIs reported a consumer returning to the room their crib was in and finding that the drop-side was no longer in the raised position they left it in. It is not definite that the cause was the baby putting pressure on the drop-side

but it could very well be the cause as many parents report seeing their baby shaking the drop-side vigorously while standing in the crib.

## **4.2 Human Interaction**

The ways a human interacts and uses a product can be the cause of incidents. Engineers and companies must consider foreseeable misuses when designing a product that the public will use. With the design and use of a crib, there are two categories of human interaction. There are the parents and adults who use the crib for their child and the behaviors of the children inside of the crib.

### **4.2.1 Parent or Adult Interaction**

Parents or adults are the main people that interact with cribs. They go out, obtain a crib, assemble it, use it, disassemble it, reassemble it and so forth. With all of their interaction with the product, there is room for mistakes to occur that could lead to further incidents. We found problems with understanding assembly instructions, foreseeable misuse or misinterpretation on how to use the crib and a lack of crib safety knowledge.

#### **4.2.1.1 Instructions and Assembly**

When we went to the CPSC lab, we experimented with some of the cribs they had. We assembled a crib that had just arrived. Putting it together with three people was not difficult and we did it in under a half hour. For a single parent trying to put it together while juggling other distractions around the house, the task may become much more difficult and time consuming. We found that out of 75 parents surveyed, that 60 of those surveyed had put their crib together themselves. The majority of parents assembled the crib themselves as opposed to having it done in the store. When we constructed

our crib, we ran into difficulty when the drop-side was not functioning properly. We found that we had installed the side backwards. This was because the labels for the left and right sides of the drop-side were not clear. This could have been a common mistake made by anyone, and luckily we realized the mistake before anything bad could happen. Out of the 60 people who constructed their crib, 15 people said it was a “difficult” and sometimes “complicated” ordeal. Two people commented that they needed instructions but did not have them. For those other 45 people that found the assembly to not be that complicated, six commented on how following the directions made it simple and easy.

#### **4.2.1.2 Foreseeable Misuse**

Misuse of cribs is another factor we found that led to crib incidents. After looking through 3 years of crib IDIs, we found that some incidents were because of misuse. These incidents included incorrect assembly, improper use of bedding materials and have blind or power cords from mobiles in the crib. Manufacturers include at least basic crib safety warnings on their cribs that warn parents against such things. The warnings are there, but it does not guarantee that the consumer will read them. The picture below, Figure 12, shows the front page of a set of crib instructions. This picture shows in large writing that by the consumer not reading everything, they are putting their child in harm.

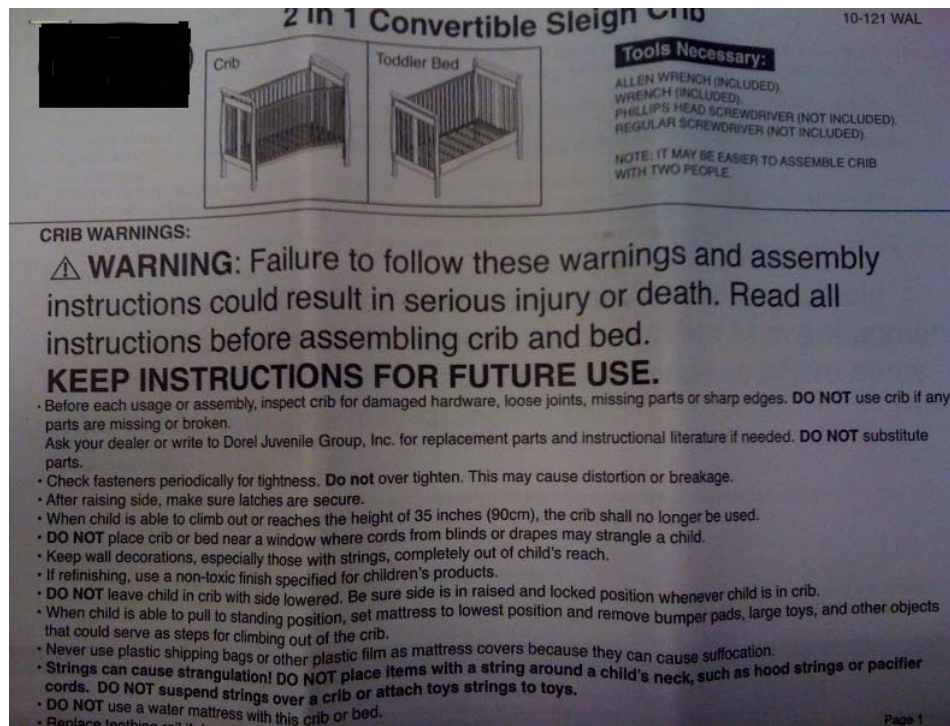


Figure 12: Sample Crib Instructions, Warning Page

When asked if they had remember any specific warnings that come with their crib, only 11 parents out of the 75 that responded had remembered any specific warnings. Several of the incidents that we came across on the IDIs, were avoidable if the consumer had read and followed the warning labels. We found 70 incidents out of the 687 IDIs that included incorrect assembly, improper bedding material and cords. The pie graph below shows the distribution of these incidents (Figure 13).

## Foreseeable Misuse Incidents in IDIs

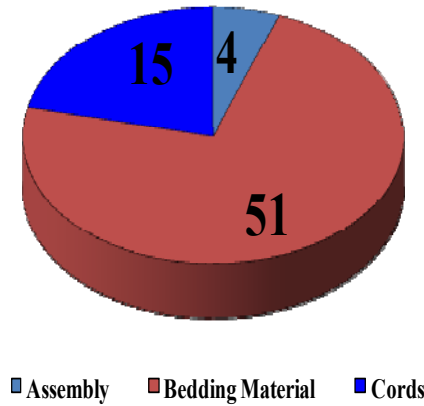


Figure 13: Distribution of Foreseeable Misuse in IDIs

Six out of 687 IDIs showed that parents set up their child's crib next to a window with blinds. The child ended up with the blind cord around their neck causing death by strangulation. In Figure 14, there is a specific warning that states not putting a crib next to a window. An incident that was not high in numbers (28 incidents investigated) but still notable dealt with excess bedding materials and pillows. Of these 28 incidents, 23 resulted in death. The picture below includes the warnings and tips to avoid a possible suffocation (Figure 14).

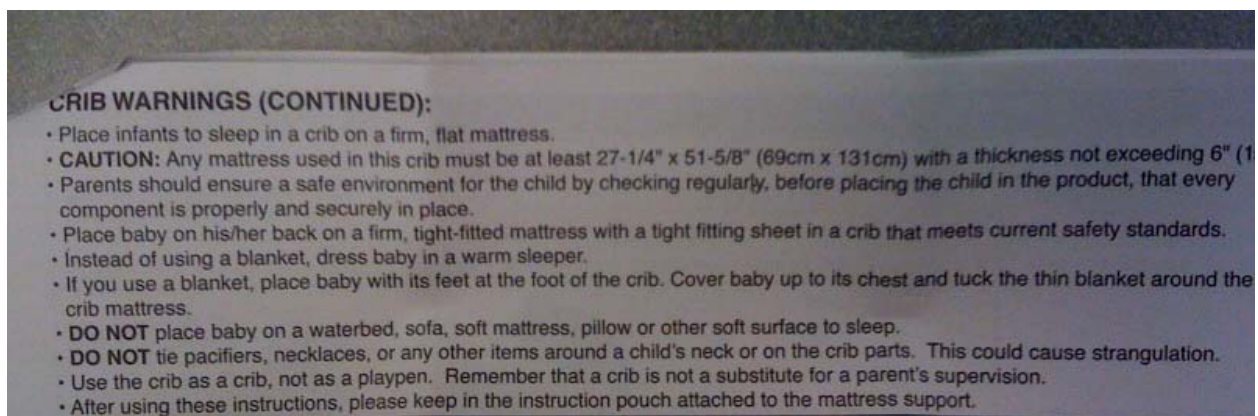


Figure 14: Crib Warnings Continued

After noticing the rate of death in incidents involving bedding material, we looked into the distribution of the 67 deaths in the IDIs. We found that 36 deaths occurred because of a foreseeable misuse. Had the parents of these 36 children read the instructions and warnings, their children may not have died. The other 31 deaths were due to material and hardware failure.

#### 4.2.1.3 Additional Sleep Environments

We looked into our parents surveys to see if there were additional sleep environments that parents allowed their children to sleep. The question we asked was “Have you (parent) let your child sleep anywhere other than in the crib?” We received 121 responses from 81 different parents since it was open ended question. Figure 15 shows the distributions of answers we separated into 3 categories.

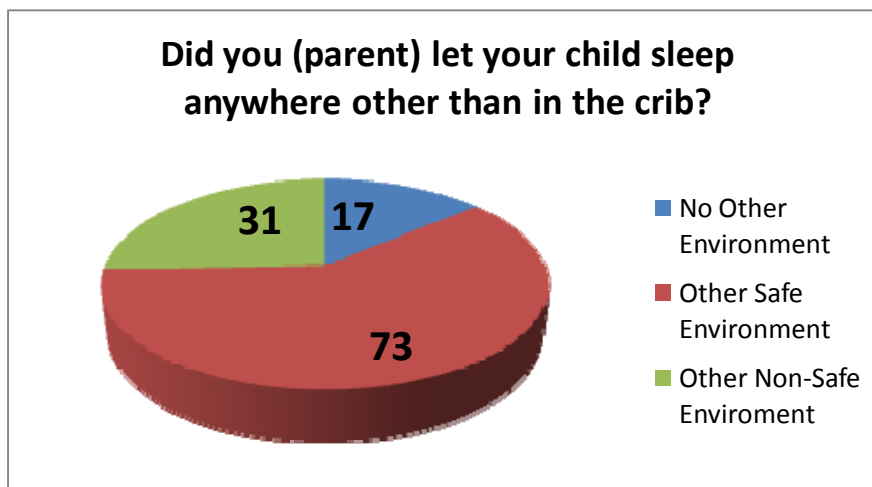


Figure 15: Distribution of Infant Sleeping Environments

If parents stated that they had allowed their child to sleep somewhere outside the crib, we categorized it into safe and non-safe sleep environments. Safe sleep environments included places such as a bassinet, playpen, and toddler chair. We mainly concentrated on the number of responses we received about non-safe sleep environments. These environments included the parents' bed and sofas.



As seen in Figure 14, there specific warning that advises the parent not to place the baby in these locations.

#### 4.2.1.4 Parent's Crib Safety Knowledge

Another area we looked at was what parents knew before using their crib. We asked this question to parents in our survey. Of the 83 responses, the data in Figure 16 below is the results. The question was open-ended, so we grouped the responses we received into three categories representing parents' crib knowledge; little to none, basic information and well informed. People with basic information knew one or two things including the correct slat distance, correct mattress type, and some common safety tips. People who were well informed many safety tips and even some crib regulations.

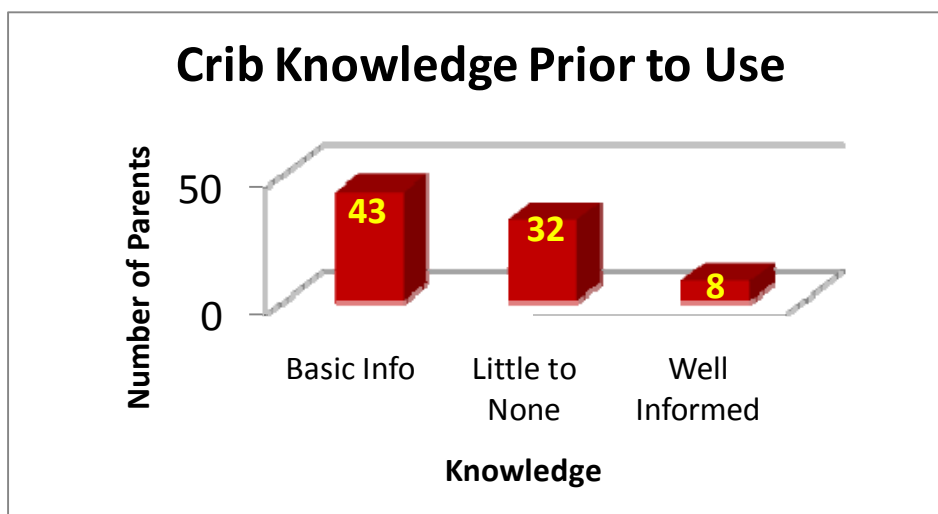


Figure 16: Distribution of Parents' Crib Safety Knowledge

#### 4.2.1.5 Second-Hand Cribs Seen from Parents Surveys

Since cribs are expensive, many parents turn to the use of second-hand cribs. After evaluating the responses we received from our parent survey, we found fifty-five out of the seventy-five parents

used a second-hand crib for their child. This means that a consumer used their crib for more than one child. This was apparent in the IDIs that we look through as well.

The problem that we found with so many parents using these cribs is that parents do not realize the risks associated with using second-hand cribs. By using an older crib passed through the years, the crib may not meet all CPSC regulations and current ASTM standards. The consumer may not be aware of a recall on the crib if it was not recent or not well publicized. The crib might have broken or missing parts from the disassembly and reassembly of it over the years. Lastly, the crib may become worn out as it ages and parts could start to break. All of these are factors that play into how second-hand cribs can be dangerous. If parents are not aware to stay informed and maintain their crib, a problem may arise.

#### **4.2.1.6 Crib Advertisements**

As we looked through crib advertisements, we noticed that some retailers and distributors advertise their cribs in a way that consumers should not be using them. Figure 17 below shows a couple crib misuses. First, the placement of the crib is next to a window. Warnings state not to do this since a cord from the blinds could end up in the crib and potentially become caught around the child's neck. The next foreseeable misuse is the blanket hanging on the side of the crib. This implies that it is okay for parents to place a blanket there or even possibly in the crib. Warnings highly advise against using blankets since they are a suffocation hazard to the infant.



Figure 17: Example 1 of Misuse in an Advertisement (Wal-Mart Inc., 2009)

The second example of a crib advertisement is Figure 18 below. In this picture, there is a stuffed animal placed within the crib. This is a suffocation hazard to the child while it is at a young age. This picture gives parents the idea that they too can place things such as teddy bears in cribs with their child.



Figure 18: Example 2 of Misuse in an Advertisement (Targetfacef.com, 2009)

### **4.2.2 Children within the Crib**

We interviewed Dr. Sinha and Dr. Midgett, both experts in Human Factors at the CPSC. From these interviews, we learned about the foreseeable misuses for cribs, seen in the previous section. We learned about the normal behavior of children and the age range when they become more active within the crib. When children are younger, they tend not to move around because they do not have the strength to do so. We found that if part of the crib broke causing the baby to roll into a gap, the child does not have the strength at such a young age to pull itself out and may suffocate. Around 8 months of age, children start being able to move around and stand up within the crib. They become curious and want to find out what is around them.

After talking with Patty Edwards, a technical expert in the engineering science department at the CPSC, we learned that children should not be in the crib after they have reached 35" tall, typically at the age of two ½ years old. This is because the child becomes too big and strong for the crib. They can climb-out or break part of the crib causing a potential safety hazard. Out of 80 parents who answer the question "how does your child act while in the crib," 12 parents had mentioned their child had climbed out once or more. Several mentioned that they used their cribs for more than 1 of their children and all of them had climbed out. When looking at the ages where the parents removed the children from the crib, 4 children had climbed out of their crib under the age of 2 years old. Several of the parents did mention that once the child climbed out of the crib, they moved them to a bed but other parents kept their child in the crib and allowed the child to climb-out many times. This leaves the child a greater potential of falling and getting hurt.

### **4.2.3 Public Crib Education**

To determine what organizations and companies are already doing to educate the public about crib safety, we researched their websites. The advocacy groups we researched were American Academy

of Pediatrics, Home Safety Council, Keeping Babies Safe, Kids in Danger and Safe Kids USA. The distributors we looked into were Babies 'R Us, IKEA, Target and Wal-Mart. Lastly we looked into what the CPSC was doing to educate the consumers.

The first advocacy group we looked at was the American Academy of Pediatrics (AAP). This organization "is dedicated to the health of all children" (American Academy of Pediatrics, 2009). The tips for crib safety were hard to locate on the webpage. We had to go through "safety and first aid" and then to "family and community resources" to find a link to infant furniture safety tips. On this page, they include bulleted safety guidelines that are part of "The Injury Prevention Program," a program to address unintentional, mostly home-based injuries. The AAP prints their safety tips and sales it in their bookstore for anyone to purchase.

The next group was the Home Safety Council whose motto is "A safe home in your hands" (Home Safety Council, 2009). To find the safety tips we searched "crib" in the search bar, clicked on safety tips and had to scroll to the bottom. On this site, a link brings the consumer to recent recalls on the CPSC webpage. The page included pictures of proper crib use with bulleted tips.

Keeping Babies Safe (KBS) was the next organization we researched (Keeping Babies Safe, 2009). They exist to provide education in keeping babies safe from preventable injuries and deaths associated with dangerous infant products. To get to the crib safety tips, all we had to do was click on the link to "safety tips & alerts" and the tips were there. The tips were a list of things never to do and a separate list of ways to prevent SIDS. A diagram with tips on it was included as well (seen in Figure 19 below). There was a link to recalled products on their website. KBS distributes flyers (available in both English and Spanish) to hospitals, pediatricians and OB/GYN offices and health and human service agencies. They hope eventually to have it distributed nationwide.

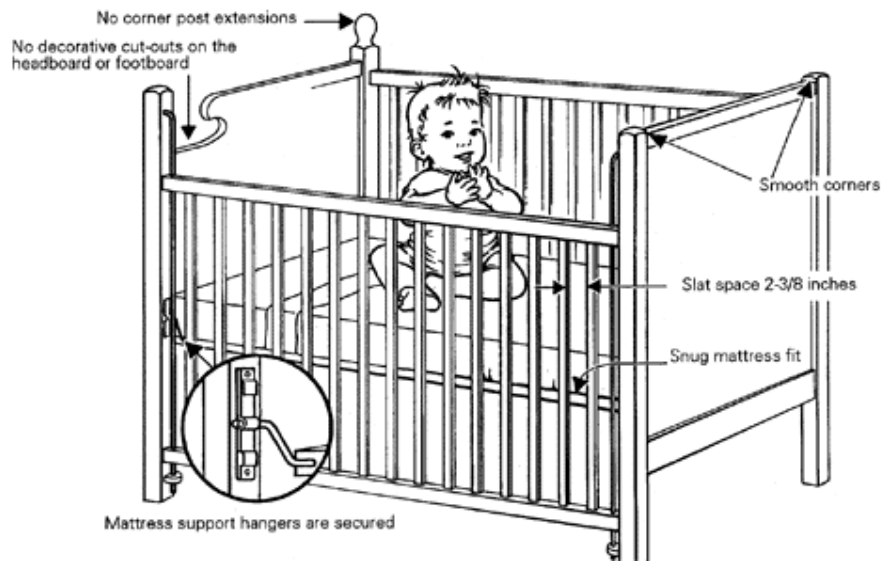


Figure 19: Figure from Keeping Babies Safe website

Kids in Danger (KID) is an organization dedicated to protecting children by improving children's product safety (Kids In Danger, 2009). Although they did not include safety tips on their website, they included tips for recalled products and how to stay aware about recalled products. They had printable flyers that consumers could pass out or hang up.

Safe Kids USA is an organization whose mission is to prevent accidental childhood injury (Safe Kids USA, 2009). To find the crib safety tips on their website, we searched cribs in the search bar and scrolled through a list to find the tips. The tip sheet included Figure 19 mentioned previously and a paragraph explaining the picture. In addition to their online tips (available in English and Spanish), a tips are promoted on social network sites such as Facebook and Twitter. Safe Kids coalitions all over the world can download a safe sleep program of information to distribute at health fairs, educational sessions and classes.

Babies R' Us was the only distributor that included crib safety tips on their webpage (Toys R' Us, 2009). After speaking with a representative from the company, we learn that during the 2009 summer they developed a home safety brochure that included crib safety that is available on their website and in their stores. Target and Babies R' Us had a links on their web pages to current crib recalls that we found

was only because they had been distributing a recently recalled crib (Target.com, 2009). IKEA and Wal-Mart did not have any crib safety tips located anywhere (IKEA 2009; Wal-Mart Stores Inc., 2009). In the event of a recalled product that they were distributing, they would have links to the recalls on their web pages.

The CPSC has a whole section of their webpage dedicated to cribs. The “Crib Information Center” has a link to the CPSC’s crib safety publications (CPSC, 2009, “Crib Information Center”). Within these publications, there are documents that include publications, safety alerts, check lists and tips. Not all the information for tips on crib safety was located in just one file. This made it hard and time consuming to navigate to get the tips.

The table below shows the comparison between the companies and organizations.

**Table 1: Public Education by Companies and Organizations**

	Safety Tips on Website?	Safety Tips Else Where?	Link to Recalls
<b>Advocacy</b>			
AAP	Yes	Sell Books	No
Home Safety Council	Yes	Promote through media and hold safety conferences	Yes
KBS	Yes	Distribute Flyers	Yes
KID	No	Printable Flyers	Yes
Safe Kids USA	Yes	Promoted on Social Networking & Distributes Flyers	Yes
<b>Distributors</b>			
Babies 'R Us	Yes	In Stores, Brochure	-
IKEA	No	No	-
Target	No	No	-
Wal-Mart	No	No	-
<b>CPSC</b>	Yes	Emails, Flyers, Teaming with Advocacy Groups	Yes

## **4.3 Economic Factor**

When first having a child, there are many expenses a parent must pay for and the crib is usually the single most expensive item that a parent needs to purchase for their child while an infant. Parents may need to save money and manufacturers want to maximize profits. In this section, we discuss the results that we found related to the economic factors involved with crib use and design. This includes parents choosing to use second-hand cribs and the quality and expense of materials manufacturers use.

### **4.3.1 Observations of Material Quality**

We went to the CPSC lab and experimented with cribs so we could understand how they operate and where the most common problems occur. One observation we noted was the quality of materials used to make cribs. This led us to want to investigate manufacturers and the economic aspects of cribs.

### **4.3.2 Crib Cost by Manufacturers versus Reported Crib Incidences**

We looked at the average cost of a crib by the manufacturer and then looked at the number of incidents reported to the CPSC with each manufacturer. Appendix C shows the table of the average prices, number of incidents, number of incidents leading to death, and the number of incidents leading injuries. Figure 20 shows the results of the crib cost to incident comparison for twenty-five manufacturers ranging in price from about \$150 to \$2000.



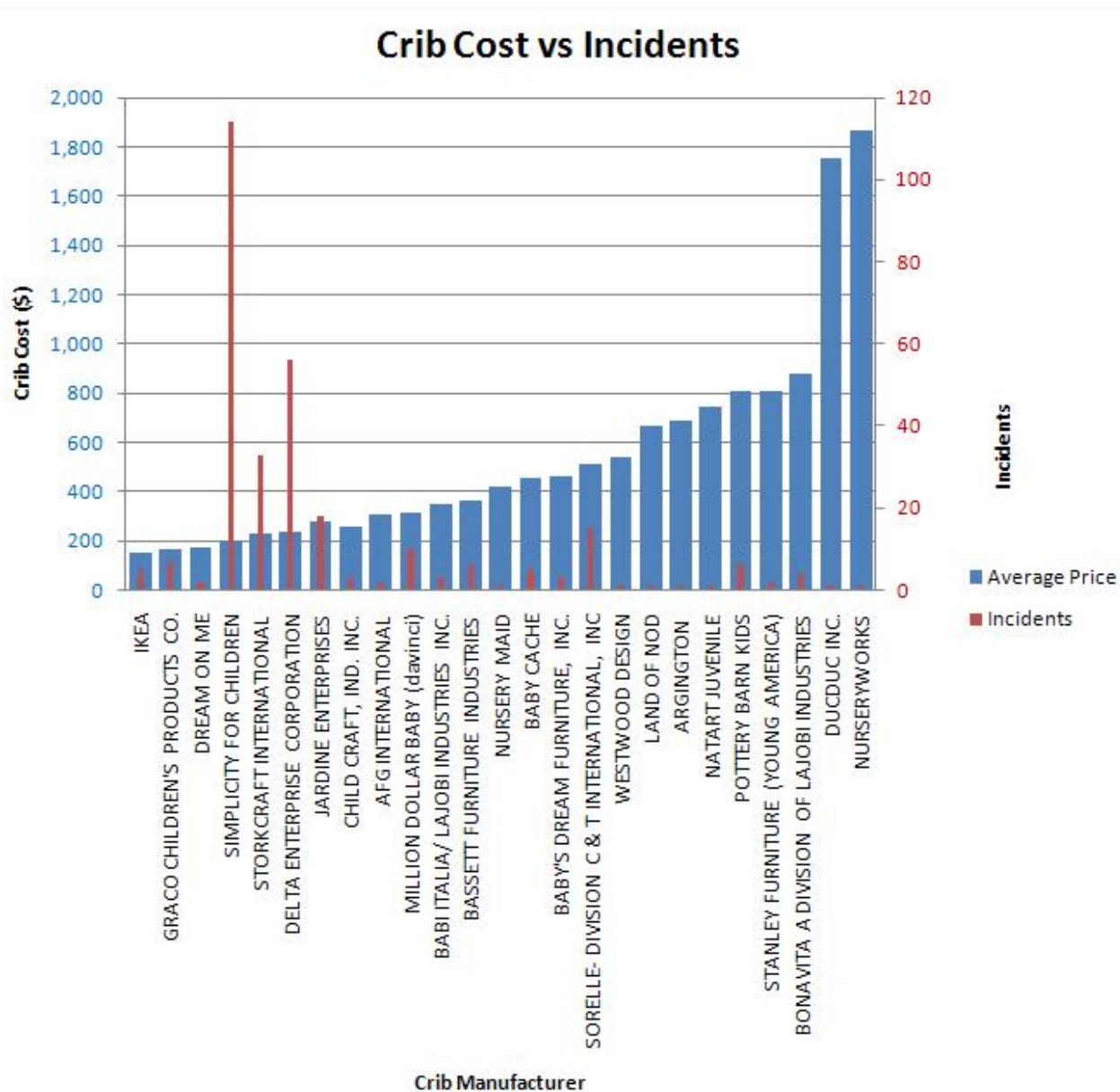


Figure 20: Comparison of Brand Prices to Number of Report Incidents

The figure above show that the crib companies who have the most incidents investigated through the CPSC's IDIs are in the less expensive range. Although there are more consumers spending \$200 on a crib than there are consumers spending \$2000 on a crib, there are still too many incidents happening with the cribs.

The chart above shows the average cost of a Delta Enterprise crib as approximately \$240 with 56 incidents reported from the years of 2007-2009 (information found in Appendix C). Four of these fifty-six reports ended in death and eight of the remaining reports resulted in an injury.

DUCDUC INC., a crib manufacturing company, has an average price of \$1,750 and NurseryWork has an average price of \$1865. DUCDUC INC. has one IDI report initiated by the CPSC for one incident with one of their cribs. NurseryWorks crib manufacturer also has only one IDI report on one of their crib models. No injury or death resulted from either incident.

We analyzed this data in Figure 20 (above) further by making a table with three different categories for the economy cribs, middle cribs, and high end cribs. Figure 21 shows three different price ranges of cribs, the number of manufacturers grouped in this price range, and the number of incidents that have occurred with the companies that fell into this category.

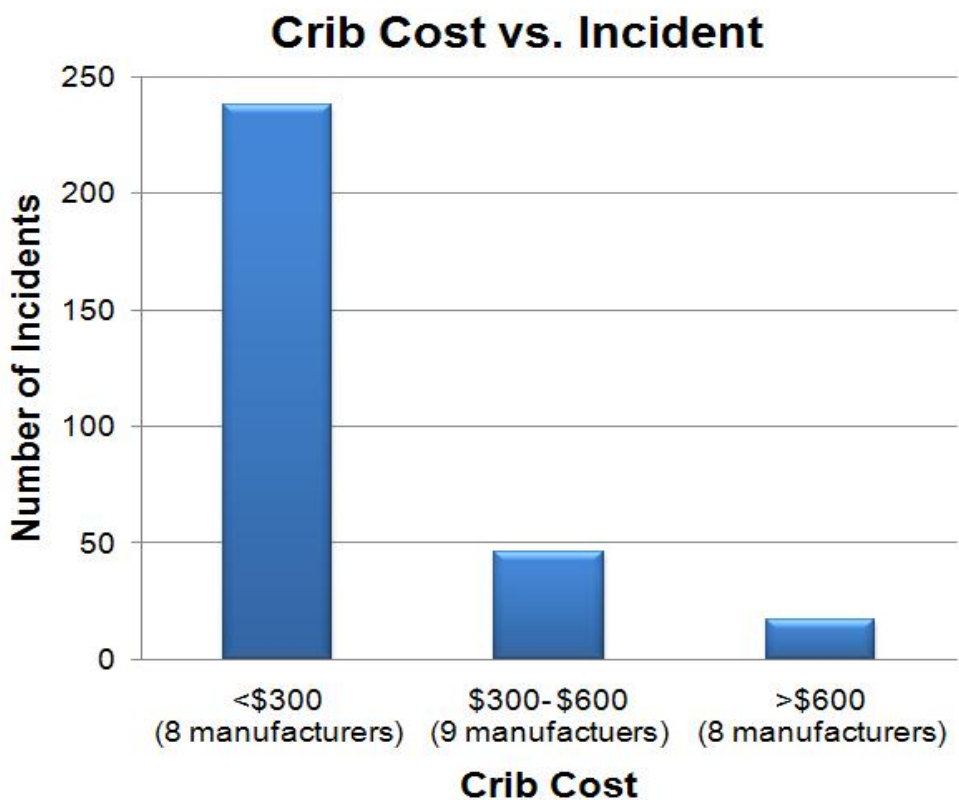


Figure 21: Price categories of Crib cost versus Incidents

There are eight companies that make up the cribs in the less than \$300 price range. This group has the most number of incidents. The highest crib cost range of a crib has the lowest number of incidents with only 17 incidents investigated by the CPSC. The highest range has eight different companies. Even though there are more economy cribs available for purchase, the number of incidents that have occurred in this price range is uncomfortable and with more quality control check, the number may decrease.

#### **4.3.3 Crib Companies Manufacturing Country versus Crib Incidences**

We looked into finding the countries where cribs companies outsourced their manufacturing and in our survey to the manufacturers, we asked they manufactured their cribs. Unfortunately, we only had a response back from one company. Another way we tried to find this information was by looking on the manufacturer's websites. We found that most manufacturers do not display this information and the only place we found this information was through recall announcements. Because not every manufacturer has had a recall, we were unable to find this information for all the manufacturers so we could not get an accurate judgment of the countries in which crib companies outsource their manufacturing.

The table below lists the manufacturers that we used in the crib cost versus incident section. It lists the countries where they outsourced their products and the number of incidents recorded with those companies.

## **4.4 Additional Results**

In addition to the results we found relating to hardware failure, human interaction and economics, we found two other areas that we believe have a place in project.

### **4.4.1 Virginia Tech Instrumented Crib Project**

With the help of Patty Edwards, a crib technical expert at the CPSC, we reviewed the proposal written by the Virginia Tech students for their project on instrumented cribs in response to a CPSC request. We learned that the project involves a naturalistic study that looks at the use of drop-side cribs. Their study, though not complete, hopes to achieve the mission of the CPSC in finding the hazards that are associated with the design of drop-side cribs. This relates in many ways to our project goal.

To complete the study, they will be measuring the forces exerted on the crib by the child while monitoring his or her behavior over a 24-hour period. By analyzing the data, they will look for gaps in the current crib regulations and standards. In addition, the team will have developed a prototype of an instrument for measuring forces on a crib that could be beneficial to the CPSC in the future. The Virginia Tech students' full proposal is in Appendix F.

Unfortunately, since their project is not completed, we cannot use the data to make further recommendations on how children interact with cribs.

### **4.4.2 IDIs**

After studying 687 In-Depth Investigation reports, we found that there were a large number of inconsistencies with them. This made it even more difficult for us to look through and organize the IDI information in a way that would help the CPSC and us. When looking through the excel spreadsheet we developed, we found almost all the manufacturers to be entered in at least more than one way. Delta Enterprise Co. had 11 different ways; Stork Craft had 16 ways and Jardine Enterprises LTD had 19 ways even though in total these 46 entries represented 3 manufacturers. The manufacturer section was not

the only part of the IDIs that had this problem. Other sections include age, trade or brand name and model number.

Photos taken by the inspectors did not always show the component that failed and many photos that did show the component that failed were either too far away or too close and out of focus to understand the problem presented. When they did show a close up they did not include a caption so we did not know what we were looking at. This made it hard to determine the main issue in the incident.

After meeting with Patty Edwards, we learned why we were confused and frustrated. She explained that the inspectors do not specialize in a specific product. IDI investigators instead look at a variety of products that may be unfamiliar to them. Some of the investigators may be unknowledgeable in the field of cribs and it can show in the reports that they write. When assigned a crib IDI, the investigator receives a basic list of crib information including things they should concentrate on. Patty Edwards said that is was not only a problem specific to us and cribs but that all the CPSC engineers run into the same problems while looking through the reports.

While working with the CPSC, we got the opportunity to speak with Shawn Cerruti, a CPSC investigator. She told that the CPSC normally hires outside the organization when hiring investigators. The job description for a CPSC investigator is in Appendix L. Once these new people are hired, they go to new employee orientation at Headquarters and then move into field training with their supervisor. They will train with other people in a mentoring program for one year. She told us that the two most important things to do when conducting an IDI are to prepare and ask the right questions.

She said that one of the problems she sees is that many investigators do not taking the time to prepare and it affecting the quality of questions they are able to ask. This ultimately affects the quality report they are able to write. Another problem she has seen is that investigators are including too much fluff into their reports and they are not getting the right information. The last problem she mentioned is that there are some IDI investigations able to conduct over the phone but instead she has gone to the

location only to find no evidence of the product to investigate. She told us that she believes there is always a need for more training since the CPSC regulates almost 15,000 products.

From the problems Shawn has seen as well as what we saw while looking through the IDI reports, we were able to make the recommendations seen in section 6.4.2.

## **5 Conclusions**

After obtaining our results and analyzing our data, we have developed conclusions. Below are the different conclusions that we developed in the areas of crib component integrity, human interaction and manufacturing issues.

### ***5.1 Crib Component Integrity***

Throughout the IDIs almost every component failed either from misuse or extended cyclical forces. The following conclusions cover the individual components and why we believe they failed.

#### **5.1.1 Mattress Support System**

We believe that the mattress support standards as outlined in the ASTM standards are not sufficient. This piece of hardware is commonly made of plastic; we believe plastic cannot hold a life cycle that a mattress support system requires. The existing vertical impact testing in the ASTM standards is not effective enough in catching possible weak hardware over a period. The welds on the mattress support systems are another area of concern. Many of the incidents were a direct result of the mattress support systems' welds' failing.

#### **5.1.2 Slats**

The number of incidents occurring from a slat is high. Slats should not be breaking as often and as easily as we have seen in the IDI reports. The children at the ages they are in the crib should not be able to break the slats. The current strength standards are not sufficient enough in determining the force a baby can exert on these slats either from shaking motions in everyday use or from accidental impact such as the child falling over.

### **5.1.3 Latch**

Latch failures we believe are a result of their strength and the materials used in making them. We believe that this crib component does not have sufficient testing for strength purposes. The current standards are not sufficient in determining the force a baby can exert through shaking motions. The standards are not sufficient in providing a life cycle expected of a crib for more than one child.

### **5.1.4 Rail**

Many incidents are due to climb-outs. We believe this is due to an insufficient height regulation or the consumers are leaving their child in the crib past the recommended age, or both.



### **5.1.5 Track**

Tracks are another piece that we believe fail because of their strength. Their plastic material is not sufficient since the tracks take a great portion of the vertical force when a drop-side raises and lowers as well as the shaking forces babies create when they are more active. Over time they wear down and cause the failures seen in the IDIs.

### **5.1.6 Connections**

From research and observation we determined that wood screws are prone to stripping especially if they are to assemble a crib more than once. Metal to metal connections decrease the amount of incidents due to screw failure. We found that having different size screws was confusing and was one way that consumers can assemble the crib incorrectly. These connection failures are a result of not only everyday use but disassembly and reassembly of cribs as well. This disassembly is in relation to multiple children within a family or cribs bought used.

## ***5.2 Human Interaction***

After analyzing the results we found from the IDIs, direct observation, research and interviews, we have drawn conclusions to help develop recommendations to improve human interaction with crib.

### **5.2.1 Instructions, Warning Labels and Safety Knowledge**

The average consumer has little knowledge about cribs before using one. The most evident problem we found with instructions and warning labels is that the everyday consumer does not always pay attention to the instructions and warning labels. Furthermore, consumers are not aware of basic crib safety guidelines. We found that most of the time, consumers had to want to learn more about cribs and had to conduct the research on their own to find this information. We determined that you cannot count on people to conduct this research or even count on them to read the entire instruction

booklet. Without knowing it, consumers are ignoring tips and warnings that ultimately could save their child's life.

### **5.2.1.1 Instructions and Warning Labels**

Through the survey we sent out to parents and research, we concluded that consumers do not always read all the instructions and warning labels. Even when consumers do read the instructions booklets, some still have a hard time understanding the instructions. The instructions can be too wordy or not include enough information for consumers to follow. We believe that 15 parents who had difficulty assembling the crib is more than what is acceptable even when compared to the 45 other parents who found it not complicated. No parent should have a difficult time assembling their crib since they should have instructions all the time and those instructions should be easy to follow.

Another conclusion we made was that not many of the consumers remembered any specific warnings while they read the instructions. By only having a couple warning on the actual crib and the rest in the instruction booklet, consumers do not necessarily see every warning.

We believe that losing the instructions to a product can cause problems. Several parents in our survey stated that if they had the instructions while assembling their crib, it would have been much easier. By assembling the crib without instructions, there is the possibility of misconstruction of the crib, possibly causing a hazard. Leaving manufacturers with the option to include a means on the crib to hold the instructions forever is not sufficient.

### **5.2.1.2 Crib Safety Awareness and Education**

"JPMA believes that instead of alarming parents, we should work together to educate them about the importance of the proper use, assembly and reassembly of cribs and how to provide the

safest sleep environment for a child,” said Mike Dwyer, JPMA Executive Director (JPMA, 2009). The absence of crib safety awareness looks to be one of the major problems associated with crib incidents.

We believe that public education about the dangers of cribs and how to use them safely is essential for preventing crib incidents. Through our research we determined that advocacy groups for children’s safety were leading the way for public education. We noticed that with the effort of these groups, parents still need to want to learn about crib safety to locate the safety tips. All the organizations we looked into that were attempting to educate the public did not make it easy for consumers to find the information.

### **5.2.2 Second-Hand Cribs**

Through the IDIs we analyzed and the responses of parents, we found that second-hand cribs are a main problem in the incidents we saw. Since a majority of consumers will use a previously owned crib or use their crib for more than one child, this is an area to address. Most problems relating to the use of second-hand cribs that we saw were avoidable if consumers had inspected the cribs for damaged and missing parts on a regular basis.

### **5.2.3 Cribs Portrayed on Display and in Ads**

From observations and research, we noticed that consumers might be getting the wrong impression about cribs. Nothing should be in the crib beside the baby, especially when they are only a few months old. Parents should never place the crib by windows as stated on warning labels that come with the crib. By displaying the crib with blankets, pillows and stuffed animals in it, and by windows with blind cords hanging down, we believe it is giving the parents the impression that it is okay for them to do that as well.

## **5.3 Manufacturing Issues**

Crib companies designing and manufacturing their products must think of the expenses of paying their workers, the cost of materials, and the cost of facilities. These companies must make sure the quality of their products is the same from the first crib manufactured to their last and every crib in-between. Below are our conclusions for quality checks of domestic and outsourced cribs. The following sections contain the conclusions of what we found through our research and analysis of the results.

### **5.3.1 Material Quality Check**

Through our results, we noticed a correlation of crib cost and the number of reported IDIs for manufacturers. Companies use plastic parts and cheaper woods to lessen the overall cost of designing and manufacturing their cribs. With this, there comes a risk of more crib failures. From the analysis, we determined that the majority of IDIs included breaking components, mainly due to the lack of quality of the materials that the manufacturers use to make their cribs. Since our efforts to contact manufacturers about these problems came up short, with only one company providing feedback, we did not have enough information to draw a proper conclusion in this area of research.

With more manufacturing companies' responses, we would have investigated the differences of each company in regards to outsourcing, materials they use, and who their target consumers are. Although we did not receive feedback from manufacturers as we had hoped, the majority of incidents we saw in the IDIs related to parts breaking. We found there is a problem in the area of quality control with manufacturers.

### **5.3.2 Outsourcing**

From our research and results, we were unable to come to any conclusions about outsourcing crib manufacturing because we did not get responses from the manufacturers. We were unable to find the locations of where each company manufactures their cribs, with the exception of recalled cribs. With only this information, our data would be skewed and inaccurate, and therefore we cannot draw any conclusions.

## ***5.4 Additional Conclusions***

### **5.4.1 Virginia Tech Instrumented Crib Project**

The Virginia tech students study is a great way to get knowledge on forces exerted on a crib although the sample size they are going to use is small.

### **5.4.2 IDIs**

If the IDIs were more consistent this would increase time efficiency as well as the quality of the research done when using the IDIs. The consistency is due to investigator training as well as the format used to create them.

## **6 Recommendations**

Having analyzed our data we have come up with conclusions and developed recommendations for the US Consumer Product Safety Commission to improve crib safety.

### **6.1 Standards**

After analyzing the results we found from the IDIs, direct observation, research and interviews, we have developed recommendations for the standards to improve the structural integrity of cribs in relation to each individual component.

#### **6.1.1 Mattress Support System**

We believe the best material for this hardware is metal. Special attention to the welds is necessary in the testing. Conducting tests to evaluate the strength the system experiences would aid in determining the strength needed of the hardware and welds within the hardware. The existing vertical impact testing in the ASTM standards needs redesigning to test for sudden impacts so as to replicate the motions children make while moving around in the crib.

#### **6.1.2 Slats**

Conducting tests similar to the Virginia Tech students' (See 5.2.4) project would benefit the CPSC in evaluating what forces babies exert and making regulations on the strength of the slats in accordance. Increasing the strength and durability of the slats will decrease the possibility of slats breaking while shipping or assembling cribs.

### **6.1.3 Latch**

Similar to the mattress support system we suggest latches not be made of plastic. The testing for this component should include not only include sudden impact testing but cyclic testing so that the latch can withstand the lifespan of the crib, or if possible, indefinitely.

### **6.1.4 Rail**

The CPSC should look into the height dimensions of the rails and toeholds in relation to the amount of incidents having to do with climb-outs. If necessary, the CPSC should conduct more tests to determine a safe height to avoid future climb-outs. CPSC engineers should make changes to these dimensions as seen fit. Other areas to look into are tolerances for mattress gaps to address the gap related incidents that are still occurring.

### **6.1.5 Track**

A metal track would withstand greater forces and over time would not show as much fatigue as a plastic track. This component should test in the same manner as the latch in section 6.1.3 since these components are part of the same process and should last the lifetime of the crib.

### **6.1.6 Connection Tests**

We recommend not using wood screws when connecting crib sections, especially if crib assembly happens more than once. All connections would benefit from this increase in strength, but even more so would the mattress support as it would make it much harder for the screw to strip out of the leg or side that it connects to. In addition, to aid in the idea of having a “single way constructed

crib” (See 5.2.3) all pieces should use the same type of screw. This includes length, diameter and threading. Doing so would eliminate another area of incorrect assembly for the consumer.

## **6.2 Consumer Knowledge**

After analyzing the results we found from the IDIs, direct observation, research and interviews, we have developed recommendations to improve consumer knowledge of cribs and crib use.

### **6.2.1 Instructions and Warning Labels**

As mentioned below in section 6.2.1.1, a crib with only a single way to construct it would eliminate the possibility of putting the crib together incorrectly. Since there is currently no crib with this design, we believe the instructions for cribs need to be improved. We recommend that assembly instructions show mainly pictures of the assembly process. Since it is sometimes hard to understand a picture, we recommend that underneath the picture is a brief description of what is occurring. This brief description should be in several languages to account for consumers who are not literate in English. In these instructions, it should clearly state the parts used in each picture. By giving parts letters or numbers, consumers can see what parts they are suppose to be using each step of the way.

By placing a warning label on a component in a way that the consumer has to remove it before using the part, ensures that the consumer sees it. This would increase the number of consumers that read the warning labels and possibly prevent many foreseeable misuses from occurring.

Our last recommendation involving crib instructions and warnings does not have to deal with the content, but instead a means of having the instructions forever. Since many consumers had a tough time assembling the crib after they had lost the instructions, it is vital to have them for as long as the crib is around. We recommend that the voluntary standard for a means on the crib to hold the instructions for the crib lifetime, become a federal regulation. Seeing as things happen and instructions



do become lost, manufacturers should have instructions to every crib they manufacturer on their websites so consumers can refer to the instructions even if they have lost them.

#### **6.2.1.1 Single Way Constructed Crib**

Making a crib that is only assembled one way would reduce consumer error that comes because of all consumers having a different mechanical inclination. To do so we recommend using one or more of the following design concepts. First, manufacturers should label each component either using numbers or letters that corresponds to the component it attaches to. For example, the lower right corner of the drop-side would have an “A” stamped on it as would the lower, front-right leg. Figure 22 pictures this concept. As an alternative to this method, manufacturers could color-code components instead of labeled with letters and numbers, similar to many current PCs (See Figure 22). Our last recommendation and the recommendation we believe would work best is as follows; each component would have some sort of groove or extrusion that would prohibit it from pairing with the incorrect co-component (See Figure 22). Ultimately all three of these recommendations can combine not only to make it much easier for the consumer to understand and assemble but make it impossible for incorrect assembly. We believe that if the design of cribs is in such a manner that the components can only be assembled in the way they were designed to be used, it would eliminate the failures due to consumers having different mechanical inclinations.

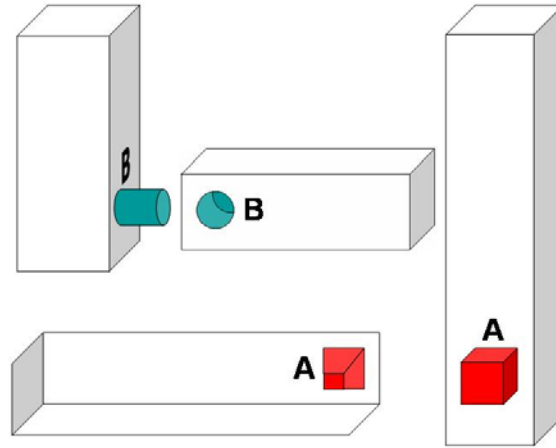


Figure 22: Hardware for Single Way Constructed Crib

## 6.2.2 Crib Safety Awareness and Education

Our recommendation for ways to improve consumer crib safety awareness is for manufacturers, distributors, retailers and the CPSC adapt what advocacy groups have started and take it further.

With an expanded crib safety program, a higher number of consumers will become familiar with the proper safety precautions. Though it may be hard for the government to insure manufacturers, distributors and retailers are helping with the education, the government can set an example and increase their involvement with the issue.

One way to enforce the importance of crib safety is to establish a National Crib Safety Week. During this week, T.V. commercials could show proper use of the products and things to avoid. Radio commercial and newspaper articles could do the same. Main points for cribs would include reminders on checking your crib regularly and tips on checking your crib for broken or missing parts, the importance of not placing unnecessary objects in the crib, and removing the child from the crib completely once they have grown too big.

In addition to the safety week, we recommend that when consumers purchase their crib, they receive a pamphlet discussing crib safety guidelines in a concise manner. The manufacturer could place this pamphlet in the crib packaging so every crib purchased come with a guide to crib safety. A sample

of this pamphlet is located in Appendix D. These pamphlets can be available in places such as children's stores, thrift stores, doctor's offices and hospitals. This will ensure that the consumers are personally receiving the information and do not have to go looking for online or elsewhere. Another potential education program is to run seminars on crib safety in places where crib consumers would likely be. Examples of these places could include hospitals, doctor's offices and daycare centers.

We believe that there is some information that consumer need to learn now about crib safety. Since cribs have been a large topic in the news recently for many reasons, we believe that the time is right for the CPSC to educate the public about past and present issues and how to report to the CPSC if they have had an issue with their crib. By doing this, the CPSC would provide the information to the public that they need to determine if their crib might not be safe for continued use. This awareness might prevent future incidents with potentially dangerous cribs. With cribs being such a big topic right now and the further awareness of their potential hazards, we believe that on the CPSC webpage, there should be a noticeable direct link to crib safety tips and recalls.

#### **6.2.2.1 Second-Hand Cribs**

Included in the crib education campaign above, could be information about using second-hand cribs. Additional information could include the dangers of second-hand cribs, proper inspection and what to do when there is a broken or missing part. If consumers were more knowledgeable about crib use and upkeep, the number of incidents and deaths would most likely decrease. Appendix D shows a sample pamphlet that discusses the usage of second-hand cribs and crib safety.

#### **6.2.3 Marketing Cribs**

Our recommendation is that cribs portrayed in advertisements should look as if they were in the consumer's home and in use. IKEA is one company that portrays their cribs in an appropriate manner as

seen below in Figure 23. By advertising cribs in a plain manner, it will eliminate parents getting the wrong idea about what they can use in their cribs. We believe The CPSC should look into how to set guideline for how to advertise cribs safely and possibly work with the industry to get these guidelines set up.



Figure 23: IKEA Gulliver Crib (IKEA, 2009)

## **6.3 Manufacturing Quality Control Check**

There are two aspects of economic factors relating to cribs: the manufacturing costs and the cost for the consumer. The following sections contain our conclusions and recommendations we found through our research and analysis of the results.

### **6.3.1 Crib Manufacturing**

Through our research, we noticed that quality control could improve within crib companies. In order to help with this problem, we made recommendations in the area of further interviewing crib manufacturers and for annual quality control checks.

### **6.3.1.1 Further Interviewing Crib Manufacturers**

We recommend the CPSC interview crib manufacturers to understand fully the amount of companies that currently outsource their products, what materials the companies are using, and the economic class each company is targeting for the sale of their products. Appendix A shows a protocol of questions to ask crib manufacturers to obtain this information.

### **6.3.1.2 Annual Quality Control Checks**

We recommend the CPSC makes it clear to the manufacturers that they must perform frequent mandatory checks to their cribs. The manufacturers should keep detailed reports of these checks. The companies should have this information available for randomized checks. Quality control is an important part of manufacturing a product, and the crib industry needs to have a more formalized set of quality control standards.

We recommend the CPSC works with JPMA to have annual quality checks to ensure that their products continue to meet the standards and regulations. The cribs should continue to meet the recommendations mentioned in 5.1. Both domestic and outsourced companies would be included in these checks. This would therefore eliminate outsourcing problems such as quality fade. We recommend that the CPSC makes it mandatory for all cribs sold within the United States to obtain certification by JPMA. Not only will this give buyers more assurance of the qualities they are buying, this will help in making sure that every product is a quality product with the above recommendation.

## **6.4 Further Research**

The following topics were either not helpful to us now or were not in direct relation to our project, but we believe they are important to make recommendations for further research in the topics.

### **6.4.1 Virginia Tech Child Behavior Project**

After reviewing the work the Virginia Tech students plan on doing, we believe they are heading in a good direction and that the CPSC should further their research. Since they will not have completed the project until April 2010, we could not evaluate their results to see if this is something that could help the CPSC make further regulations. The Virginia Tech students are only conducting the experiment on a single child. To gain more helpful data, we think the CPSC can conduct this survey on a larger scale with a higher number of babies over a longer period. We believe it is a good way to review if the previous forces used as a model for baby strength is inadequate and in need of revisions. With new data, the CPSC can develop force and impacting test to check the maximum strength a baby can exert on the crib.

### **6.4.2 IDI Improvements**

Our recommendations here cover two aspects; first, the preparation of the investigators and second, their resources for completing an IDI.

The CPSC should stress preparation to the investigators before they conduct an IDI. If possible the investigators should meet with experts on the specific product that they are investigating. In doing so they will learn the common problems of the product as well as have a better understanding how it is to operate. Knowing this information the questions they ask will yield better responses that will help in analyzing the specific incident. This information will then help the CPSC engineers in determining the risk and possible ways to fix the issue. In addition having teams of specialized investigators would help the CPSC. As opposed to having every investigator cover every consumer product, each team of

investigators could cover a portion of the products. Doing so would increase the quality of the IDIs as the investigators would have a greater knowledge on each individual product they cover.

The CPSC should create an electronic form for the IDIs that will automatically submit the IDIs into the database. These forms should include a series of drop-down menus with predetermined causes as well as a choice for an open-ended response. This will reduce multiple entries for the same cause as any issue already established will exist in the drop-down menus.

## **6.5 Summary**

From our results and conclusions, we were able to come up with recommendations for the CPSC in the areas of standards and regulations, consumer interaction, quality control, and further research.

In the area of standards and regulations, we saw the common problematic area was with the components being too weak. Our recommendation in this area is for more extensive testing and the use of only metal hardware and bolts.

Consumer interaction plays a major role in crib use and crib safety. We saw problems with the instructions, warning labels, assembly, and consumer education. For the instructions, our recommendations to the CPSC are clear and written instructions as well as instructions on the manufacturer's website. For warning labels, we recommend the CPSC make it mandatory for warning labels to be on parts and torn off before they can be used. We recommended that the CPSC makes it mandatory for crib manufacturers to produce only error proof cribs to eliminate assembly problems. Finally, in terms of educating the crib consumers, we recommend the CPSC head a National Crib Safety Week and hand out crib safety pamphlets to crib manufacturers, daycares, children's stores, and other places to get the importance of crib safety out.

Through our research of the manufacturers, cost, and incidents, we saw there was a problem with the lack of quality control. We recommend that the CPSC work with manufacturers to set up a more thorough quality control check. We recommend that the CPSC work with JPMA to conduct quality control checks and recertification of products.

The final area of recommendations is for the further investigation of the IDIs and the Virginia Tech study. For the IDIs, we recommend there be an electronic form, and increase of investigator preparation, and specialized investigators. For the Virginia Tech study, we recommend that there be a larger sample.



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# Appendix A: Interview Protocol

Interview Team:

Andreas Gartaganis  
Kimberly Martilla  
Stacey Rauen

Interview Goal: To get some feedback from parents and daycare instructors on their experience in picking out, buying, and putting together their crib.

- 1) Did you use a crib for your child/children?
- 2) During what age period did you keep your infant in a crib?
- 3) Did you purchase your crib:
- 4) From where did you get your crib?
- 5) Did you use your crib for more than one child?
- 6) What information about cribs did you know before using your crib?
- 7) What brand and style of baby crib did you choose (crib with a drop-side, a bassinet, etc.) and what lead you to that decision?
- 8) Did you put the crib together yourself? If so please explain your experience, including the ease or difficulty with instructions and any warnings you remember reading.
- 9) Did you ever experience any problems with the hardware or materials of your crib? If yes, please explain.
- 10) What was the mattress like for your crib (firmness, fitting within the crib, etc.)?
- 11) Did you have to purchase the mattress separately from the crib?
- 12) How did/does your infant act while awake in the crib? Are there any specific incidents worth mentioning?
- 13) Is there any other sleeping surface that you allow/allowed your infant to sleep on?
- 14) Do you have any other comments worth mentioning?

Interview Team:

Andreas Gartaganis

Kimberly Martilla

Stacey Rauen

Interview Goal: To get some feedback from a CPSC Investigator about how IDI investigations are carried out and what the job of an investigator at the CPSC is.

1. What type of training did you receive from the CPSC?
2. How do you think training can improve and is there anything you can recommend for this?
3. What are the main things you look for during an IDI investigation?
4. What is your background (major in college, etc.)?
5. What can be done to make your job easier?
6. Can you please run us through a typical IDI investigation?
7. How do you feel about using a laptop in your investigations? Like what doctors are moving towards.

Interview Team:

Andreas Gartaganis

Kimberly Martilla

Stacey Rauen

Interview Goal: To get some feedback from the human factors department of the CPSC and its relation to crib hazard analysis.

1. What does the human factors department do?
2. How do cribs fit into this department?



Interview Team:

Andreas Gartaganis

Kimberly Martilla

Stacey Rauen

Interview Goal: To get some feedback from the children psychologist in the human factors department at the CPSC on child behavior in relation to cribs.

1. Is there any way in which infants act that should be taken into account when designing/building a crib?
2. Have you ever heard of any crib incidents occurring due to natural infant behavior?
3. Does a child's physical and mental state affect his/her behavior in the crib? Please expand and include how and possible reasons for this.

Interview Team:

Andreas Gartaganis

Kimberly Martilla

Stacey Rauen

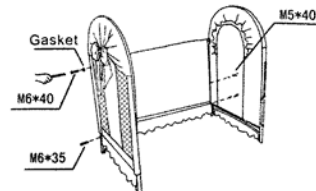
Interview Goal: To get some feedback from safety advocacy groups on what they do to promote safety.

1. In what ways do you educate the public on crib safety hazards and tips?

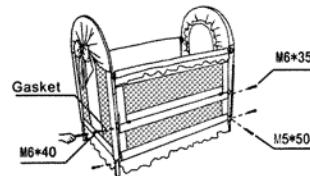
## Appendix B: Assembly Instructions

### Assemble and use instruction of childbed

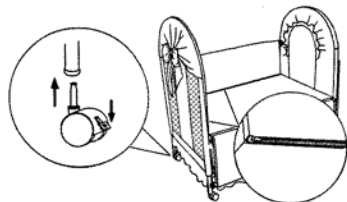
#### I. Assemble instruction



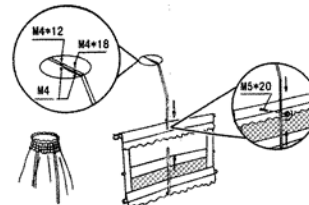
1) Joint the main standing frame, the up protecting bars and the movable board with 2 M6\*35 and 1 M6\*40 screws. Then fix the movable board and the up protecting bars together with 1 M5\*40 screw.



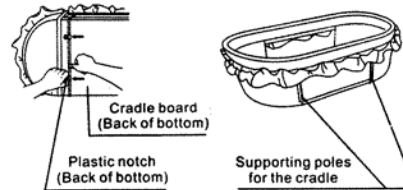
2) Use 3 M6\*35 and M6\*40 to joint the movable protecting bar, arc board and the movable board. Fix the supporting leg to the movable standing frame with 2 M5\*50. (Please make sure that the movable protecting bar can be up and down.)



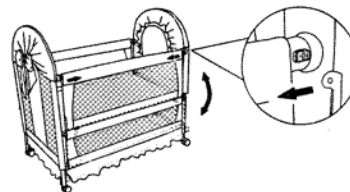
3) Turn down the movable protecting bar, put the board into the ready assembled bed frame, and insert the 4 multi-direction wheels into the foot of the frame. (2 wheels can be used as brakes)



4) Joint the net ring and up tube for the net with M4\*12 screw and M4\*18 screw, then fix tightly with 2 M4 screw caps. Then use the M5\*20 screw and the red knob to fix the tube to the protecting bars. At last, cover the net ring with gauze.

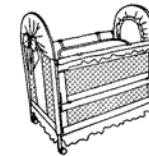


5) Slide the 2 supporting poles for the cradle into the plastic notch, then put the cushion on the bottom of cradle. (Take off the cradle, it can be used as a storage basket.)



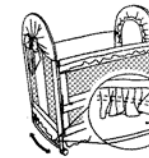
6) As picture showing: Turn over the red top of both sides at same time. You can take off the guarding railings. If you want to lock it, you just need turn to the position as picture is showing.

#### II. Use instruction



##### 1. Baby's Bed

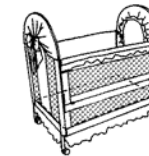
Fix the 4 cradle clips onto the side protecting bars, take out the cradle and it can be a baby's bed.



##### 2. Rocking bed

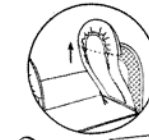
Move the rocking tube down, and it can be a rocking bed. (Following the arrow direction, pull out the button, the rocking tube can be moved up and down.)

Pull button



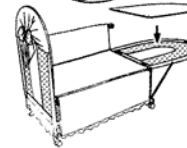
##### 3. Playpen

Put the board on the bottom of the frame and it can be a playpen.



##### 4. Student's bed

Turn down the movable protecting bars, untie the bowknot, then take off the cloth cover, at last, turn down the movable standing frame and put the extra board on it.



## Appendix C: Cost Incident Table

Manufacturer	Style	Average Cost	Most Expensive	Least Expensive	Total Average Cost	# of IDI Incidents	# of injuries	# of deaths	Link of where prices are from
AFG International	Standard Full Size	\$237.00	\$237.00	\$237.00	\$309.86	2	0	0	<a href="http://www.simplybabyfurniture.com/shop-cribs-by-style.html">http://www.simplybabyfurniture.com/shop-cribs-by-style.html</a>
	Convertible	\$394.90	\$380.00	\$288.00					
ARGINGTON	Standard Full Size	\$689.67	\$799.00	\$585.00	\$689.67	1	0	0	<a href="http://www.argington.com/">http://www.argington.com/</a>
	Convertible	NA	NA	NA					
BABI ITALIA/ LAJOBI INDUSTRIES INC.	Standard Full Size	\$325.66	\$559.88	\$149.88	\$350.59	3	0	0	<a href="http://www.toysrus.com/search/index.jsp?fbx=0&amp;kw=&amp;fbc=1&amp;f-Taxonomy%2FTRUS%2F2255957&amp;f=PAD">http://www.toysrus.com/search/index.jsp?fbx=0&amp;kw=&amp;fbc=1&amp;f-Taxonomy%2FTRUS%2F2255957&amp;f=PAD</a>
	Convertible	\$401.37	\$329.99	\$429.99					
BABY CACHE	Standard Full Size	NA	NA	NA	\$455.99	5	0	0	<a href="http://www.toysrus.com/search/index.jsp?fbx=0&amp;kw=&amp;fbc=1&amp;f-Taxonomy%2FTRUS%2F2255957&amp;f=PAD%2FBrand+Na">http://www.toysrus.com/search/index.jsp?fbx=0&amp;kw=&amp;fbc=1&amp;f-Taxonomy%2FTRUS%2F2255957&amp;f=PAD%2FBrand+Na</a>
	Convertible	\$455.99	\$499.99	\$429.99					
BABY'S DREAM FURNITURE, INC.	Standard Full Size	NA	NA	NA	\$461.82	3	2	0	<a href="http://www.babysdream.com/InStorePickUp/Products.asp">http://www.babysdream.com/InStorePickUp/Products.asp</a>
	Convertible	\$461.82	\$672.99	\$327.99					
BASSETT FURNITURE INDUSTRIES	Standard Full Size	\$255.50	\$259.00	\$252.00	\$365.33	6	0	0	<a href="http://www.amazon.com/gp/search/ref=sr_in_2_p_4_13?rh=n%3A165796011%2Cn%3A%2116579701">http://www.amazon.com/gp/search/ref=sr_in_2_p_4_13?rh=n%3A165796011%2Cn%3A%2116579701</a> <a href="http://www.walmart.com/search/search-ng.do?search_constraint=54278ic=48_0&amp;search_query">http://www.walmart.com/search/search-ng.do?search_constraint=54278ic=48_0&amp;search_query</a>
	Convertible	\$396.71	\$599.00	\$249.00					
BONAVITA A DIVISION OF LAJOBI INDUSTRIES	Standard Full Size	NA	NA	NA	\$874.86	4	0	0	<a href="http://bambibaby.com/bonavita/sheffield-collection">http://bambibaby.com/bonavita/sheffield-collection</a>
	Convertible	\$874.86	\$329.99	\$3,299.96					
CHILD CRAFT, IND. INC.	Standard Full Size	\$289.99	\$289.99	\$289.99	\$255.99	3	1	0	<a href="http://www.simplybabyfurniture.com/child-craft-baby-cribs.html">http://www.simplybabyfurniture.com/child-craft-baby-cribs.html</a>
	Convertible	\$238.99	\$249.99	\$227.99					
DELTA ENTERPRISE CORPORATION	Standard Full Size	\$183.32	\$299.99	\$119.99	\$236.66	56	8	4	
	Convertible	\$273.32	\$199.99	\$349.99					
DREAM ON ME	Standard Full Size	\$169.99	\$149.99	\$189.99	\$171.72	2	0	0	<a href="http://www.dream-on-me.com/N-8s0821vzp7bn2ao902aqce/N-e-aq65?ic=48_0&amp;ref=125863_409544+500500_4292594771">http://www.dream-on-me.com/N-8s0821vzp7bn2ao902aqce/N-e-aq65?ic=48_0&amp;ref=125863_409544+500500_4292594771</a>
	Convertible	\$183.46	\$263.99	\$119.95					
DUCDUC INC.	Standard Full Size	\$1,895.00	\$1,995.00	\$1,795.00	\$1,753.33	1	0	0	<a href="http://www.ducducnyc.com/categorydetail.php?categoryid=28&amp;navid=1&amp;ducid=e4ead719e98f0426b884f6">http://www.ducducnyc.com/categorydetail.php?categoryid=28&amp;navid=1&amp;ducid=e4ead719e98f0426b884f6</a>
	Convertible	\$1,725.00	\$2,395.00	\$1,295.00					
GRACO CHILDREN'S PRODUCTS CO.	Standard Full Size				\$166.38	7	5	1	<a href="http://www.walmart.com/browse/Furniture/Cribs/Graco/N-8s0821z0p342ao902aqce/N-e-aq65?ic=48_0&amp;ref=125863_409544+500500_4292594771">http://www.walmart.com/browse/Furniture/Cribs/Graco/N-8s0821z0p342ao902aqce/N-e-aq65?ic=48_0&amp;ref=125863_409544+500500_4292594771</a>
	Convertible	\$166.38	\$100.00	\$259.97					
IKEA	Standard Full Size	\$149.20	\$219.00	\$99.99	\$149.20	5	4	0	<a href="http://www.ikea.com/us/en/catalog/categories/departments/childrens_ikea/10392/">http://www.ikea.com/us/en/catalog/categories/departments/childrens_ikea/10392/</a>
	Convertible	NA	NA	NA					
JARDINE ENTERPRISES LTD.	Standard Full Size	\$275.00	\$330.00	\$220.00	\$275.00	18	0	18	<a href="http://www.jardinecribrecall.com/press_release.php">http://www.jardinecribrecall.com/press_release.php</a>
	Convertible								
LAND OF NOD	Standard Full Size	\$636.50	\$699.00	\$599.00	\$665.25	1	0	0	<a href="http://www.landofnod.com/cribs/baby/1">http://www.landofnod.com/cribs/baby/1</a>
	Convertible	\$694.00	\$759.00	\$659.00					
MILLION DOLLAR BABY (davinci)	Standard Full Size	NA	NA	NA	\$311.64	10	0	0	<a href="http://www.babyongrand.com/catalog/466/million-dollar-baby">http://www.babyongrand.com/catalog/466/million-dollar-baby</a>
	Convertible	\$311.64	\$429.00	\$160.00					
NATART JUVENILE	Standard Full Size	\$679.00	\$679.00	\$679.00	\$743.44	1	0	0	<a href="http://bambibaby.com/cribs/natart">http://bambibaby.com/cribs/natart</a>
	Convertible	\$764.71	\$999.00	\$699.00					
NURSERY MAID	Standard Full Size	\$418.75	\$493.00	\$343.00	\$418.75	1	0	1	<a href="http://www.nurserymaid.com/little_nanny.htm">http://www.nurserymaid.com/little_nanny.htm</a>
	Convertible	NA	NA	NA					
NURSERYWORKS	Standard Full Size	\$1,360.00	\$2,100.00	\$750.00	\$1,865.00	3	0	0	<a href="http://www.nurseryworks.net/catalog/product_info.php?products_id=16">http://www.nurseryworks.net/catalog/product_info.php?products_id=16</a>
	Convertible	\$1,640.00	\$2,380.00	\$1,030.00					
OEUF	Standard Full Size								
	Convertible								
POTTERY BARN	Standard Full Size	\$799.00	\$1,199.00	\$599.00	\$805.82	6	0	1	<a href="http://www.potterybarnkids.com/shop/baby/furniture/cribs/?cm_type=lnav">http://www.potterybarnkids.com/shop/baby/furniture/cribs/?cm_type=lnav</a>
	Convertible	\$638.00	\$1,168.00	\$638.00					
SIMPLICITY FOR CHILDREN	Standard Full Size	\$200.00	\$300.00	\$100.00	\$200.00	114	20	6	<a href="http://www.simplicityforchildren.com/ourproducts/notice_dropside/index.htm">http://www.simplicityforchildren.com/ourproducts/notice_dropside/index.htm</a>
	Convertible								
SORELLE- DIVISION C & T INTERNATIONAL, INC	Standard Full Size	\$473.66	\$590.00	\$399.00	\$512.08	15	3	1	<a href="http://www.bambibaby.com/">http://www.bambibaby.com/</a>
	Convertible	\$524.88	\$415.00	\$779.99					
STANLEY FURNITURE COMPANY, INC.	Standard Full Size	\$771.00	\$979.00	\$729.00	\$806.11	2	0	0	<a href="http://www.simplybabyfurniture.com/baby-cribs.html">http://www.simplybabyfurniture.com/baby-cribs.html</a>
	Convertible	\$845.11	\$1,235.00	\$729.00					
STORKCRAFT INTERNATIONAL	Standard Full Size	\$134.88	\$149.88	\$119.88	\$228.28	33	5	3	<a href="http://www.walmart.com/browse/Furniture/Cribs/Storkcraft/N-8s0821z0p342ao902aqce/N-e-aq65?ic=48_0&amp;ref=125863_409544+500500_4292594771">http://www.walmart.com/browse/Furniture/Cribs/Storkcraft/N-8s0821z0p342ao902aqce/N-e-aq65?ic=48_0&amp;ref=125863_409544+500500_4292594771</a>
	Convertible	\$249.03	\$329.88	\$169.88					
WESTWOOD DESIGN	Standard Full Size	NA	NA	NA	\$542.66	1	0	0	<a href="http://www.babyongrand.com/catalog/1280/westwood_design">http://www.babyongrand.com/catalog/1280/westwood_design</a>
	Convertible	\$542.66	\$599.99	\$419.99					

## Appendix D: Safety Pamphlet

### Crib Safety Tips

- \* Look for a **certification safety seal**.
- \* **Proper assembly** of cribs is paramount – Follow the instructions provided and make sure that every part is installed correctly. If you are not sure, call the manufacturer for assistance.
- \* **Always** hold on to the instructions and warnings for future reference.
- \* **Do not use old, broken or modified cribs.** Infants can strangle to death if their bodies pass through gaps between loose components or broken slats while their heads remains entrapped.
- \* **Never place a crib near window with blind or curtain cords;** babies can strangle on curtain or blind cords.
- \* Check crib regularly for **loose or missing parts and slats** and that hardware is tightly secured.
- \* **Never leave** a child in a crib with the side rail lowered.
- \* **Never allow** your child to crawl underneath the crib. There could be sharp edges.
- \* **Check the mattress** to make sure it is firm and tight fitting.
- \* When your child is able to pull to standing position, be sure to **set mattress support** at lowest position and remove any means that can serve as steps for climbing out.
- \* Once your child can **climb out**, it is time to move them from the crib to a toddler bed.



### U.S. Consumer Product Safety Commission

4330 East-West Highway, 4th Floor  
Bethesda, MD 20814  
Phone: 301-504-7923  
[www.cpsc.gov/cribs.html](http://www.cpsc.gov/cribs.html)



### Crib Safety Tips

U.S. Consumer Product Safety Commission



*Educating the Public to  
Protect Children and Save  
Lives*

Tel: 301-504-7923

## Is Your Crib Safe?

More than 5 million cribs, bassinets and play yards have been recalled in the last two years.

Babies spend much of their time sleeping; therefore, the nursery should be the safest room in the house. Frequently check to see if your crib has been recalled.

Follow the safety tips in this packet to keep your crib safe and your children out of harm.



**If your crib is NOT SAFE, DON'T USE it!!**

**It could SAVE your baby's life!!**

## SIDS

For infants less than 12 months of age, follow these practices to reduce the risk of SIDS (sudden infant death syndrome) and prevent suffocation:

\* **Place** your baby on his or her back on a firm, tight-fitting mattress.

\* **Remove** all pillows, quilts, comforters, sheepskins, stuffed toys and other soft products from the crib.

\* Consider using a **sleepers** as an alternative to a blanket.

\* Make sure your baby's **head remains uncovered** during sleep.

\* **Do not** place your baby on waterbed, sofa, soft mattress, pillow or other soft surface to sleep. This includes an adult-sized bed.

## Important Numbers

- **23/8 inches** – slats should not be wider than this. If wider, infants could strangle if they slip between the slats and their head gets caught.
- **1/16 inch** – corner posts should be no higher than this. If higher, children's clothing could be caught.
- **35 inches** – child's height at which parents should consider moving their child out of the crib. Usually occurs when the child is around 2 1/2 years.

## Second Hand-Cribs

Many parents receive their cribs used from relatives, family friends or co-workers. Most families will use their crib for more than one child. If this is you, follow the steps below to ensure it is safe to use:

- Check that the crib has not been recalled
- Conduct a thorough check of all the hardware and parts before using.
- If you find a broken or missing part, **DISCONTINUE USE**, and contact the manufacturer for a replacement.
- Perform checks regularly

## U.S. CONSUMER PRODUCT SAFETY

4330 East-West Highway, 4th Floor  
Bethesda, MD 20814  
Phone: 301-504-7923  
[www.cpsc.gov/cribs.html](http://www.cpsc.gov/cribs.html)

## Appendix E: IDI Spreadsheet

	A	B	C	D	E	F	G	H
1	IDI # (Task #)	Problematic Product	Used?	Trade/Brand Name	Model Number	Manufacturer	Age (Months)	Death (Y/N)
2	070828HCC2754	1543 - Cribs		ASPEN 3 IN 1 CRIB	8740KCW-SC	SIMPLICITY FOR CHILDREN	24	N
3	080602CNE3438	1542 - Baby Mattresses Or Pads		BABI ITALIA		LAJOBI INDUSTRIES, INC.	4	N
4	080722CNE3615	1542 - Baby Mattresses Or Pads		ESPECIALLY FOR BABY ULTIMATE SLE		BABIES 'R' US	1	N
5	080814HCC1833	1542 - Baby Mattresses Or Pads		CIRCO JUNGLE BUMPER SET		TRIBORO QUILT MFG. CO.	6	N
6	080904CCC1892	4054 - Other Bedding		TOYS R US, INC.		KOALA BABY	6	N
7	080918HCC1939	1543 - Cribs		UNKNOWN		UNKNOWN	3	Y
8	081106HCC1149	4050 - Pillows		UNKNOWN		UNKNOWN	2	Y
9	081106HCC2108	1542 - Baby Mattresses Or Pads		ESPECIALLY FOR BABY		TOYS "R" US INC.	3	N
10	090307HCC1471	689 - Blankets. Not Specified		UNKNOWN		UNKNOWN	3	Y

	I	J	K	
1	Injury (Y/N)	Reason of Death or Injury	Problematic Hardware	Comments/Brief Description
2	Y	53 - Cont./Abrs.	Mattress Gap	neck became entrapped between the toddler bed frame and the mattress. Product was already identified as previously recalled crib
3	N	0 - No Injury	Bedding Material	baby's face was pressed up close to the bumper pads on the crib rail
4	N	0 - No Injury	Bedding Material	lying on his back with his head and shoulders hanging off the sleep positioner
5	Y	65 - Anoxia	Bedding Material	head was lodged between the crib and the bumper pad
6	N	0 - No Injury	Bedding Material	entrapped under a tightly secured infant sheet saver
7	N	65 - Anoxia	Bedding Material	sleeping amidst thick bedding and stuffed animals-placed on back but found on stomach
8	N	65 - Anoxia	Bedding Material	victim was found by her parents lying on top of a pillow on her stomach
9	N	0 - No Injury	Bedding Material	positioner flipped when the child moved-wedged between the sleep positioner and the side of the crib
10	N	65 - Anoxia	Bedding Material	suffocation due to bedding in her crib

## Appendix F: Virginia Tech Project

### Instrumented Crib Design

for the  
Consumer Product Safety Commission (CPSC)  
Director: Robert B. Ochsman

Design Team:  
Anuja Agnihotri  
Seul Kim  
Christian Phelan  
Edwin Yusman

Technical Advisor:  
Dr. Tonya L. Smith-Jackson





## **Executive Summary**

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The defects and hazards of cribs is a growing concern for the United States Consumer Product Safety Commission (CPSC). The CPSC wishes to reevaluate current standards and regulations for cribs and attribute these hazards to the actions and behavior of children in the crib when the crib is in use. The HoklSE Industrial Projects consulting team at Virginia Tech has been drafted to support this process.

In response to CPSC's request, the team is conducting a naturalistic study involving the use of a drop-side crib by a child. The study will achieve the mission of the CPSC as it relates to hazards associated with the design of the drop-side crib. During this study, the team will collect measurements of forces exerted on a crib by the child and monitor his or her behavior in a crib environment for a timeframe of 24 hours.

Once the study is conducted, the collected data will be analyzed to refine current regulations and standards for cribs. The data will support a design of a prototype crib that may reduce some of the risks associated with industry crib designs and enable real-time field data collection of forces exerted by children in cribs. CPSC will then use the analyses, design, and recommendations that the consulting team provides to evaluate whether or not current standards and regulations are appropriately established to ensure safety of crib products.

## **1.0 Technical Plan**

### **1.1 Problem Statement**

---

The United States Consumer Product Safety Commission (CPSC) is an arm of the United States government established to protect the common public from unreasonable or substantial risks of injury or death associated with consumer products. It was formed in 1972 through the Consumer Product Safety Act and has since worked toward ensuring the safety of consumer products by developing and regulating product standards, issuing product recalls, and researching potential dangers associated with consumer products amongst other efforts. The agency's efforts have contributed to a significant decline in the rate of consumer product-related deaths and injuries since its inception 30 years ago ("CPSC Overview").

Amid the collection of more than 15,000 consumer products under the jurisdiction of the CPSC are cribs. Crib safety is a critical aspect of making certain that the sleeping environment of babies and young children is as safe as possible.

In the past couple of years, over five million cribs, bassinet, and play yards have been recalled due to defects and hazards. These defects and hazards have ranged from issues such as hardware and stability problems to fall and entrapment dangers. The point of emphasis is that the definitive forces generated by infants on cribs in actual field settings are not well studied and due to this, existing American Society for Testing and Materials (ASTM) crib standards may be inadequate. These force characteristics may help to impose stricter and more accurate guidelines for crib safety with regards to the design and construction of cribs.

The instrumented crib design project seeks to absolve the shortcoming in crib standards through the use of data collection and analysis of various forces of interest. This information will aid the CPSC in the refinement of crib standards. In addition, this data will be used to support the design of an engineering prototype or proof of concept of an instrumented crib to enable real-time field data collection of forces exerted on a crib by an infant. The project will be done within the timeframe of one year at a cost of approximately \$56,185. This figure comprises both actual and simulated expenditures.

## **1.2 Proposed Approach**

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The consulting team has decided to conduct a naturalistic study to obtain updated descriptive data that will help to refine crib standards. This method was chosen above other alternative methods due to the fact that CPSC is interested in how cribs are being used by families and their children in a natural environment. The data collection will consist of acquiring various force measurements, which will translate to identifying specific activities that can potentially compromise the safety and functionality of cribs.

### *Phases of the Study*

The consulting team identified several major phases of the study. These include obtaining study approval, selecting a participant, extracting force measurements, and analyzing the data.

The study will go through an approval process with the Institutional Review Board (IRB) at Virginia Tech. This is required because the study involves human subjects whose rights and

welfare must be protected. The process consists of specifying the details of the naturalistic study with the goal of achieving IRB certification.

Isabel Bradburn, the Research Director of the Child Development Center for Learning and Research at Virginia Tech (CDCLR), will assist the consulting team in obtaining IRB approval. Isabel and the CDCLR will also help the team contact and select potential participants. As the CDCLR conducts their own research involving infants and young children and have blanket IRB approval in place, they are in an ideal position to help the team recruit participants and quickly attain study approval.

Forces exerted by the child on the crib will be recorded and measured. These measurements will be linked to the corresponding child behavior by monitoring the child using a live video feed during the duration of the study. Also, at the end of the study, the child will be asked to voluntarily exert forces on the crib. This aspect of the study will be done in order to quantify maximum forces generated by a child on a crib.

The resulting data will be coded to provide simplification and organization that will allow the consulting team to appropriately identify forces and behavior. The data will be compared to the requirements in the Code of Federal Regulations in Title 16, Part 1508 (16 C.F.R. 1508) (Packett, 5). In addition, physical dimensions, materials, screws, paint, and other attributes for the cribs in the study and design must also comply with the aforementioned standards prior to the conduction of the study.

### *Aspects of the Study*

CPSC has identified criteria for the installation of force sensors. The sensors and their supplementary equipment cannot alter the dimensions of the crib, and the hardware such as wiring has to be placed away from the child. These precautions are to ensure the validity of the measurements and to avoid reducing crib functionality and safety. This is also done to reduce measurement reactivity such that the behavior of the child in the crib is as natural as possible. In addition, the study should be set should be an ordinary infant bedroom, where parent interference and maintenance of the crib is minimal.

A drop-side crib will be used during the study because of the high percentages of recalls and defect- rates in the crib industry that are related to this crib style. The team will select a used crib to account for natural wear and deficiencies and address issues with the longevity in crib use.

Choosing an optimal participant will help to provide data most pertinent to defects and hazards associated with high forces. A 95<sup>th</sup> percentile child at the age of 24 to 32 months will be chosen.

### *Technical Methods*

The required technical materials will be in accordance with CPSC requirements. The force sensors and the software to collect force measurements will be provided by the Industrial and Systems Engineering Department at Virginia Tech.

General software programs such as Minitab and JMP will be used to test statistical significance of data points. Common measuring tools such measuring tapes, dial calipers, and protractors will also be used to quantify the dimensions of cribs.

### *Verifying Proposal Approach*

The consulting team has placed great emphasis on accounting for variability of data by decreasing the influences of confounding variables of the characteristics from the crib, infant, and atmosphere. By potentially eliminating the influences of adverse external factors, it is hoped that data measurements are obtained that can account for worse-case scenarios in real life applications. Lastly, this experimental approach has been attempted to fulfill the aims of the CPSC throughout the course of the project.

## **1.3 Deliverables**

---

A design prototype and a final report will be delivered to CPSC. The final report will be a document summarizing the findings of the study. It will identify child behaviors corresponding to coded force measurements obtained from the study as well as the significant trends and statistics revealed through data analysis. The team will then apply the analysis to determine if current CPSC regulations and standards should be refined or supplemented.

CPSC has also asked the team to provide recommendations to alternative approaches to conducting a similar study in the future. These recommendations will be on the basis of modifying study specifics such as increasing the timeframe of the study, increasing the number of participants, or using different crib styles.

Furthermore, the team will construct a design prototype of an instrumented crib that may be used in families' homes to obtain supplemental data for more extensive future

analysis. In accordance with corporate policy, three design alternatives will be provided. The team will construct a small-scale model prototype of the primary design and two computer aided designs (CAD) drawings of the secondary and tertiary designs to promote a thorough exploration of design possibilities. Secondary and tertiary prototypes will be in the form of a CAD drawing and not a physical model due to limited time and resources.

#### **1.4 Expected Benefits to Client**

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Benefits that can be expected after completion of the instrumented crib design include access to descriptive force data on cribs' critical structural points, improved, cost-effective crib design modifications ASTM crib safety standards, and reductions in crib failures and recalls due to the improved ASTM crib safety standards. Also, the deaths and injuries directly resulting from crib failures will decrease.

Data analysis could reveal less obvious flaws overlooked by conventional crib assessment techniques. A crib which can accurately collect force data in an actual field setting will allow a more detailed analysis of existing ASTM crib standards. From this analysis more stringent standards and revision of existing design techniques and principles may arise, providing more reliable future products and further reduction in the occurrence of injury and death.

Most crib recalls are due to design flaws and failure of one crib component or another. Overlooked or unseen high stress areas of the crib may be discovered through field-data analysis, providing critical reinforcement points lab testing cannot accurately produce. The consulting team suspects lab testing possesses confounding variables that limit reproduction of conditions experienced in a crib's natural environment. Attention to these previously undiscovered forces should lead to changes that will have a positive impact on future product design as well as safety.

The crib force analysis will incorporate a fine balance between cost and effectiveness. This project has high potential for success and for providing lasting benefits to the CPSC and future crib development; most importantly, minimization of crib failures and recalls with a positive correlation to reductions in infant deaths and injury.

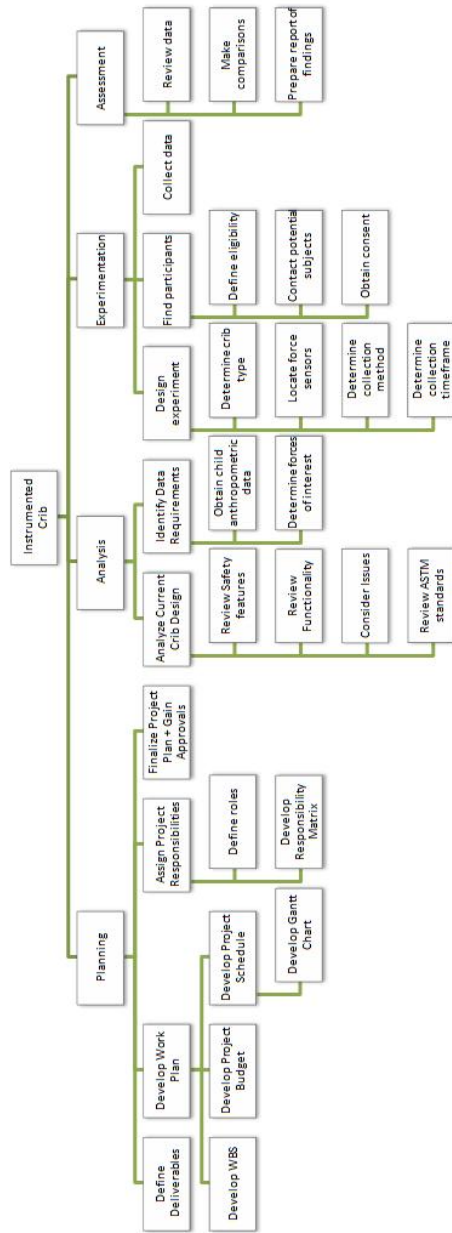
Considering the CPSC is charged with protecting the public from unreasonable risks of serious injury or death from thousands of types of consumer products such as cribs; performance of the CPSC is measured largely by safety metrics such as total recalls of the products they supervise, deaths due to these products, injury rates, etc. The quantitative benefit that can be anticipated after completion of this project is an improvement in all of these metrics. Improvement in all metrics is certainly expected since the product is the source of all injuries and deaths that occur from a particular product. And certainly a recall cannot occur without a product associated with it. Therefore this product, all cribs, and the CPSC's performance measures directly affected by this product can be improved by improving ASTM crib standards, which is the proposed direct result of analysis of critical force data supplied by the consulting team.

## **2.0 Management and Implementation Plan**

### **2.1 Work Breakdown Structure**

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The project has been broken down into a collection of work tasks, which are linked together and organized by their function and place in the phases of project management. This structure is illustrated in the work breakdown structure of Figure 1.



**Figure 1. Work Breakdown Structure**

## 2.2 Project Schedule

The instrumented crib design project is slated to run from November 2009 to the end of April 2010. The entire schedule is shown in Figure 2. Breaks in service will occur on three occasions – for one week in November in observance of the Thanksgiving holidays, mid-December to mid-January for the winter holidays, and the second week of March in observance

of spring break. The project is broken down into four primary phases: planning, analysis, experimentation, and assessment.

During the planning or preparation phase, the consulting team works on defining the work plan and budget parameters. In addition, roles within the consulting team are established and project responsibilities are assigned to consulting team members. One of the key aspects of this phase is obtaining Institutional Review Board (IRB) approval for the experimental research that will be done. This approval should be obtained by the first week of December in order to provide some flexibility for the latter stages of the project.

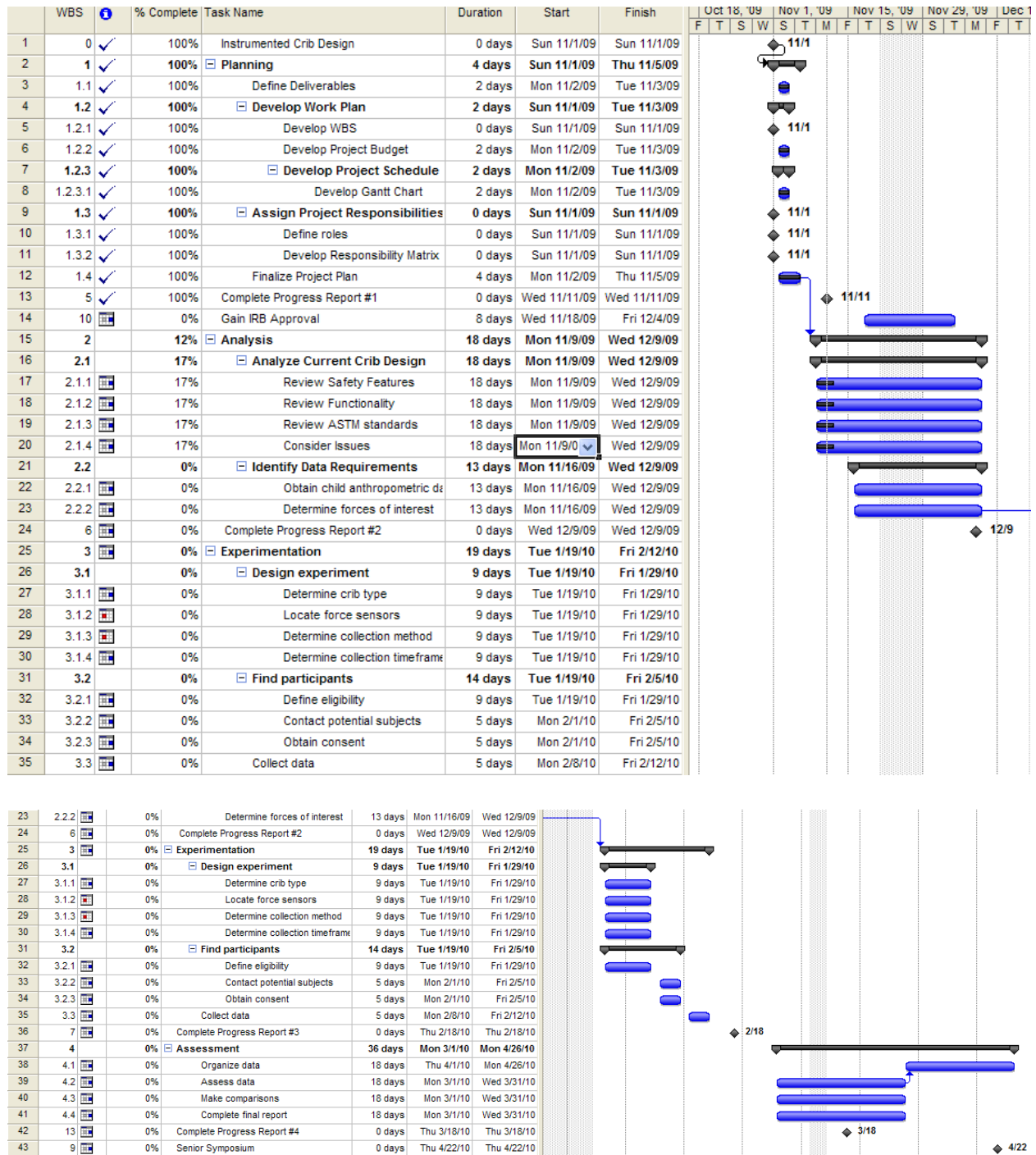
The analysis phase requires the consulting team to examine current crib designs in order to obtain an idea of existing safety features, functionalities, and ASTM standards that are in place. Furthermore, data requirements for the project are to be identified and acquired. These consist of child anthropometric data to be used to determine target subjects and forces of interest relevant in establishing crib standards. This information will be sought and researched during the bulk of November. Analysis should be complete by the third week of December.

The experimentation phase entails the actual design and conduction of the research. From mid-January until the end of January, the consulting team will design an experiment that seeks to quantify the forces of interest through figuring out how to instrument a crib with force sensors and how to collect usable data. At the same time, a search for participants will be undertaken. Potential subjects will be contacted and the appropriate consent will be obtained. Actual data collection at the home of a subject will be completed at the very latest by the second week of February.

Following data collection, the assessment phase will be initiated. Data from the experiment will be organized and assessed by the consulting team throughout the month of March. Comparisons will be made to prior force guidelines. Once all assessments have been put forth and collected, a final report of the data will be put together for the CPSC and a presentation will be made for the Senior Symposium at Virginia Tech.



Figure 2. Gantt Chart



## 2.3 Project Organization

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The work breakdown structure and responsibility matrix have been constructed to aid in the management of individual duties and tasks/activities. The responsibility matrix is shown on the following page in Figure 3 and highlights the responsibilities of the design team as well as the client, the CPSC. This definitive organization of team member assignments and their associated duties is certain to minimize confusion and assist in overall team organization. Most time sensitive organization of the project will be monitored with the help of the Gantt chart from Section 2.2. As Gantt charts are very complex yet flexible and easy to use, they will aid in keeping the project up to date and on schedule.

Legend:	
<b>R</b>	<i>Responsible</i>
<b>S</b>	<i>Support</i>
<b>N</b>	<i>Notification</i>
<b>A</b>	<i>Approval</i>

## Responsibility Matrix

Task	Team Member				Advisor	Client
	Anuja Agnihotri	Edwin Yusman	Christian Phelan	Seul Kim	Dr. Smith-Jackson	CPSC
<b>Planning</b>						
1.1.1 Define Deliverables	R	S	S	S	N	N
1.1.2 Develop Work Plan						
1.1.2.1 Develop WBS	S	S	R	S		
1.1.2.2 Develop Project Budget	R	S	S	S		
1.1.2.3 Develop Project Approval	S	S	S	R		
1.1.2.3.1 Develop Gantt Chart	S	R	S	S		
1.1.3 Assign Project Responsibilities						
1.1.3.1 Define Roles	S	S	R	S	N	
1.1.3.2 Develop Responsibility matrix	R	S	S	S	N	
1.1.4 Finalize Project Plan + Gain Approval	S	S	S	R	N	A
<b>Analysis</b>						
1.2.1 Analyze Current Crib Design						
1.2.1.1 Review Safety Features	S	R	S	S	N	
1.2.1.2 Review Functionality	S	S	S	R	N	
1.2.1.3 Consider Issues	S	S	R	S	N	
1.2.1.4 Review ASTM Standards	R	S	S	S	N	
1.2.2 Identify Data Requirements						
1.2.2.1 Obtain child anthropometric data	S	S	S	R	N	N
1.2.2.2 Determine forces of interest	S	S	R	S	N	A
<b>Experimentation</b>						
1.3.1 Design Experiment						
1.3.1.1 Determine crib type	R	S	S	S	A	A
1.3.1.2 Locate force sensors	S	S	R	S	A	N
1.3.1.3 Determine collection method	S	S	S	R	N	A
1.3.1.4 Determine collection timeframe	S	R	S	S	N	A
1.3.2 Find Participants						
1.3.2.1 Define eligibility	S	S	S	R	N	A
1.3.2.2 Contact potential subjects	R	S	S	S	N	N
1.3.2.3 Obtain consent	S	S	R	S	N	N
1.3.3 Collect Data	S	R	S	S	N	N
<b>Assessment</b>						
1.4.1 Review data	R	S	S	S	N	N

1.4.2 Make comparisons	S	R	S	S	N	N
1.4.3 Prepare report of findings	S	S	R	S	A	A

**Figure 3. Responsibility Matrix**

In addition to these tools, facilitation and monitoring of proper communication, effective and efficient work methods, and work completion are to be overseen by the project manager. Christian Phelan has been handed the role of project manager for the course of the project, primarily due to his previous experience as a project manager. During his ten week internship at Freddie Mac he was given the assignment of managing a sub-project. Although it was a sub-project it was complex and required all, if not more, of the core skills a solid project manager should always have. The project was a success and earned Christian a full time position at Freddie Mac. The consulting team unanimously decided he would be an excellent leader through the easiest and most difficult stages of the instrumented crib design project. There is no doubt that Christian can lead the team to a complete, meaningful and successful project well within schedule.

## 2.4 Related Experience

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### *Anuja Agnihotri*

Anuja Agnihotri is currently pursuing an undergraduate degree in Industrial and Systems Engineering with a Business minor. She has been involved in Council of International Student Organizations as the Public Relations Officer (2008-2009) and Event Coordinator (2009-2010) for the past two years and loves working with international organizations and students. Anuja worked at the Math Emporium as a helper for one and half years and helped freshmen and sophomores with math quizzes. She is interested in a variety of ISE topics but would like to get involved in a consulting firm after she graduates.

### *Seul Kim*

Seul Kim is a current senior studying Industrial and Systems Engineering at Virginia Tech and plans to graduate in May 2010. Seul Kim has great interest in Human Factors and hopes to obtain a job related to industrial ergonomics.

### *Christian Phelan*

Christian Phelan resides in Virginia Beach, VA and a few of his favorite activities includes a good book, a good movie, traveling to new and exciting places, listening to a wide range of music, playing golf, and watching all types of sports especially Hokie football games in person. Throughout his life he has always been an aspiring engineer and he is anxious to apply his Virginia Tech industrial engineering skills to this exciting project. He interned with Freddie Mac this past summer as a business technology intern and has a lot of past experience in troubleshooting and mechanical design which he hopes to bring to the table throughout the undertaking of this project, particularly during the design phase. His business experience this summer shaped and refined his interpersonal skills which he also believes will be an invaluable asset to this project.

#### *Edwin Yusman*

Edwin Yusman is a senior in ISE, currently working on obtaining his Bachelor's degree with a minor in Business. Before joining Hokie Industrial Projects, Edwin interned with the United States Postal Service, working on a project to establish correct inventory procedures and reallocate mail transportation equipment repair parts at distribution centers around the country. He has been involved with the Council of International Student Organizations as their secretary and enjoys experiencing new cultures and meeting new people. His research and career interests are related to human factors engineering and ergonomics, particularly human computer interaction and biomechanics, along with financial engineering.

#### *Advisor: Dr. Tonya Smith-Jackson*

Tonya Smith-Jackson, Ph.D. is an Associate Professor in the Grado Department of Industrial and Systems Engineering. She is an affiliate faculty member in the Department of Psychology, the Center for Human-Computer Interaction, the Center for Gerontology, and the Myers-Lawson School of Construction. She graduated from NC State University (Ph.D.) and the University of North Carolina, Chapel Hill (B.A.). She is founder and director of the Assessment and Cognitive Ergonomics (ACE) Lab and is co-director of the Human-Computer Interaction and Safety Engineering Labs. She teaches human information processing, safety engineering, and cultural ergonomics courses at Virginia Tech.

## **2.5 Equipment and Facilities**

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Throughout the duration of the project the consulting team will have access to advisor Dr. Tonya Smith-Jackson's ergonomics research lab, required force sensors, all necessary cables and connections from computer to sensors, compatible software for reading and storing data retrieved by the force sensors. In addition, a drop-side crib and infant subject will be provided for the field experiment by the participating family.

## 3.0 Economic Justification

### 3.1 Consulting Budget Overview

The budget consists of actual, billable costs as well as simulated costs. It includes the following elements as shown in Figure 4.

Consulting Budget Overview			
Line Item	Description	Hypothetical	Billable
Labor	Team labor, consultants to the team using industry standards. Client costs are not necessary	\$30,000.00	
Consultants/Subs	Technical advisor and other faculty can be priced as "consultants" using industry standards	\$11,250.00	
Materials/Software/Equipment/Facilities	Equipment or facilities rented or borrowed for the project		\$0.00
Travel	Based on estimated number of trips, include mileage, lodging, food etc. where applicable using corporate rates.		\$4,502.00
Documentation	Costs related to printing, copying, binding etc.		\$50.00
Overhead	Usually expressed as percentage to support indirect costs using corporate rates	\$383.00	
Escalation	Inflation-related costs	\$0.00	
Contingency	Uncertainty costs	\$10,000.00	
Fee or Profit	Additional profit added to costs	NA	
Total		\$51,633.00	\$4,552.00

## Figure 4. Budget Overview

With regards to actual spent cost, the consulting team made one visit to the client's laboratory in Gaithersburg, MD on October 23<sup>rd</sup>. The team departed from Blacksburg, VA at 10:00 am and returned at 11:00 pm the same day. The total number of miles covered in that trip was 560 miles. Taking a per diem rate of \$0.55 per mile, the team spent \$310 for travel. Since they returned the same day, there was no cost for lodging. The meals were bought from Chipotle, and were well within the maximum limit of \$64.

### 3.2 Budget Justification

---

The actual and simulated costs of the project need to be considered when forming the budget. A large amount of data is required to make sure the budget estimation is accurate.

The labor and consultant costs for the project will be hypothetical since no monetary returns would be reaped for the efforts put forth for the project. The consulting team would be working for 650 hours and would be getting paid \$45.63 each. Therefore, the total hypothetical labor cost would amount to \$30,000. The consulting team plans to meet the technical advisor 25 times throughout the duration of the project. The technical advisor will be paid \$450 per day, bringing the total hypothetical consultant cost to \$11,250.

After negotiations with the client, the decision was made to utilize a used crib from a family who would volunteer their home for the experiment. The sensors needed to measure the forces of interest will be provided by the technical advisor. Paying for rental of any facilities is not a matter of question since the Industrial & Systems Engineering department at Virginia Tech will be providing the required labs and software. As a result, there is no billable cost for materials, software, equipment and facilities.

With regards to client visitation, the number of miles travelled would have to be recorded, since the federal transportation rate is \$0.55 per mile if a personal car is used for travel (GSA, 1). The round trip mileage from Blacksburg, VA to Bethesda, MD is 560 miles, so the travelling cost would come up to \$310. The CPSC will be billed for the travel expenses. Furthermore, as per the per diem rates of the Washington, DC Metro area between November 1 and June 30, \$209 can be appropriated for lodging and \$64 for meals & incidental expenses,

resulting in a total of \$273 (GSA, 2). The team hopes to visit the client five times throughout the duration of the project. Consequently, the total billable cost for travel is \$4,502 for four team members for five trips.

All required documentation is considered billable and would amount to \$50. This comprises printing, copying and binding and would entail collection of all receipts for documentation. The overhead costs would be 58.6% of the hypothetical cost since we are conducting a research on campus. From this, the overhead hypothetical cost for the project is \$383. Since the project is going to be completed over the period of one year, there would not be any inflation costs. In the event that there are any injuries during conduction of the field experiment, contingency costs are accounted for which amount to about \$10,000. Therefore, the overhead costs, escalation costs and contingency costs are hypothetical and sum to \$10,383.



### **3.3 Implementation Costs**

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The analysis of the experiment data would be done by the CPSC, after which the standards would be updated. It is then the duty of the manufacturer to adhere to these standards for crib design and production. In turn, for the purpose of this project, there is no implementation cost to the client.

### **3.4 Investments**

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Following acquisition of all budget-related data necessary for the project, the Net Present Value method will be utilized to calculate the project's present value. Calculation of the reduction in product recalls would be necessary for the reason that the change in design would increase the safety level, thus decreasing the number of recalls. Once analysis of the experiment is done by the CPSC, revisions of their crib standards may be necessary. The costs that the CPSC would take on would be to pay for the expenses incurred by the consulting team and the cost incurred to analyze the data acquired from the field experiment. These reasons justify the fact that the project is a good investment in the portfolio of the client.



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## Appendix G: ASTM Standards

### Standard Specification for Full-Size Baby Crib<sup>1</sup> Designation: F 1169 – 07

This standard is issued under the fixed designation F 1169; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (e) indicates an editorial change since the last revision or reapproval.

#### INTRODUCTION

This consumer safety specification addresses crib accidents that were identified by the U.S. Consumer Product Safety Commission (CPSC).

CPSC received reports of strangulations incidents associated with crib corner post extensions and incidents concerning failure of crib hardware and other structural components of cribs that also resulted in fatalities

In response to the accident data collected by the CPSC, this consumer safety specification attempts to minimize the risk of injury or death due to: failure of mattress support hardware, failure of glued or bolted connections, dropside latch failure, and dislodgment of teething rails. This safety specification also addresses incidents associated with poor maintenance or assembly by means of requirements for the contents of instructional literature that must accompany a crib.

#### 1. Scope 16 CFR 1500.50–.52 Test Methods for Simulating Use and Abuse of Toys and Other Articles Intended for Use by Children

1.1 This consumer safety specification establishes performance requirements and test procedures to determine the structural integrity of cribs. It also contains design requirements addressing entanglement on crib corner post extensions, of Age Which Present Choking, Aspiration or Ingestion and requirements for warning labels and instructional material. Hazards Because of Small Parts

1.2 No crib produced after the approval date of this consumer safety specification shall, either by label or other means, indicate compliance with this specification unless it conforms to the requirements contained herein.

1.3 The following safety hazards caveat pertains only to the test methods portion, Section 7, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

#### 2. Referenced Document manufacturer's recommended use position to provide easier access to the occupant.

##### 2.1 Federal Standard:

16 CFR 1303 Ban of Lead-Containing Paint and Certain sleeping accommodations for an infant having more than 28 6 5/8 in. (710 6 16 mm) wide and 52 3/8 6 5/8 in. (1330 6 16 mm) long.

#### 3. Terminology

3.1 *drop side/drop gate, n*—a side that is intended to slide with respect to the frame when the product is in the manufacturer's recommended use position to provide easier access to the occupant.

3.2 *dynamic load, n*—application of an impulsive force by a free falling mass.

3.3 *folding side, n*—a side, or a part thereof, that is intended to fold with respect to the frame when the product is in the

3.4 *full size crib, n*—a bed that is designed to provide

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F15 on Consumer Products and is the direct responsibility of Subcommittee F15.18 on Cribs, Toddler Beds, Play Yards, Bassinets, Cradles and Changing Tables.

<sup>2</sup> Current edition approved Sept. 15, 2007. Published October 2007. Originally Available from the Consumer Product Safety Commission, Washington, DC approved in 1988. Last previous edition approved in 2003 as F 1169 – 03. 20207.



3.5 *occupant, n*—that individual who is in the product when it is setup in one of the manufacturer's use positions.

3.6 *static load, n*—a vertically downward force applied by a calibrated force gage or by dead weights.

3.7 *stationary side, n*—a side or end panel that is not intended to fold, slide or move with respect to the frame when the product is in the manufacturer's recommended use position.

3.8 *structural failure, n*—damage to a component(s) or assembly resulting in partial separation (greater than 0.040 in. (1.00 mm) over original configuration), or complete separation of the component(s) or assembly.

#### 4. Calibration and Standardization

4.1 All testing shall be conducted on a concrete floor which may be covered with 1/8-in. (3-mm) thick vinyl floor covering.

4.2 The crib shall be completely assembled, unless otherwise noted, in accordance with the manufacturer's instructions.

4.3 No testing shall be conducted within 48 h of gluing.

1 The item to be tested shall be in a room with ambient temperature of 73.4 ± 9°F (23.6 ± 5°C) for at least 24 h prior to testing. Testing shall then be conducted within this temperature range.

#### 2 General Requirements

5.1 Before performing any of the tests in this specification all wood parts shall be smooth and free of splinters.

5.2 *Surface Coatings*—The paint or surface coating on the product shall comply with 16 CFR 1303.

5.3 *Small Parts*—There shall be no small parts as defined by 16 CFR 1501 before testing or liberated as a result of testing to this specification.

5.4 *Corner Posts*:

5.4.1 No corner post assembly shall extend more than 0.06 in. (1.50 mm) above the upper edge of an end or side panel, whichever is higher, when measured from the lowest point on the upper edge of the end or side panel within 3 in. (76 mm) from the outermost contour of the post or elbow (see Fig. 1).

5.4.1.1 This requirement applies when any drop side/drop gate is in either the raised or lowered position.

5.4.2 The limitations in 5.4.1 do not apply to a corner post assembly that extends at least 16 in. (400 mm) above the uppermost surface of the side rail in its highest position.

1 Corner posts intended to accept removable vertical extensions made up of two or more segments (such as canopy post extensions) shall not permit the attachment of individual segments such that the resultant vertical extension would be in violation of the dimensional requirements of 5.4.

#### 2 Performance Requirements

6.1 *Mattress Support System Vertical Impact Test Requirements*:

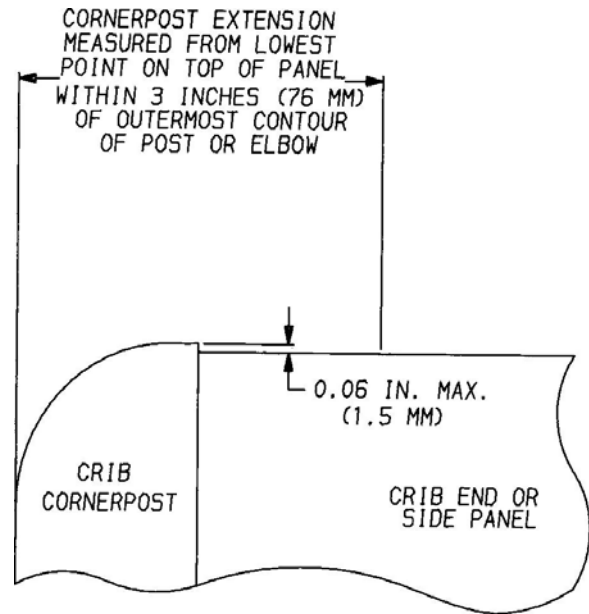
6.1.1 After testing in accordance with the procedure in 7.1, the crib shall comply with 16 CFR Part 1508. Components attached by screws shall not have separated by more than 0.04 in. (1.00 mm) upon completion of testing.

6.2 *Crib Side Test Requirements*:

6.2.1 After completion of the cyclic and static portions of either the drop side or stationary side test as appropriate, the

FIG. 1 Illustration of Requirements for Crib Corner Post Extensions

crib shall comply with 16 CFR Part 1508 and no spindles or slats shall have completely separated from the top or bottom rail. Complete separation shall be determined by placing a right triangular prism shaped wedge (see Fig. 1 in 16 CFR Part 1508) between two spindles or slats adjacent to the rail from which these have separated and applying a 20-lbf (90-N) pull force to the wedge in a direction normal to the plane of the crib side. If a spindle or slat moves away from the hole in the rail in which it was formerly secured, complete separation has occurred.



6.2.2 Components attached by screws shall not have separated by more than 0.04 in. (1 mm) upon completion of testing.

6.2.3 Any spindles or slats that could be rotated during the torque test shall comply with the spacing of crib components at **16 CFR Section 1508.4** when turned to their most adverse position.

6.2.4 Breakage of a wooden crib side component in any location other than a joint during testing does not constitute a failure. However, if this type of breakage should occur, an additional side must be tested.

NOTE 1—A wood failure within a joint does constitute a test failure.

#### 6.3 Mattress Support System Test Requirement:

6.3.1 When tested in accordance with the procedure in **7.3**, the mattress support system shall not detach from the crib at any point of attachment, or the force applied in **7.3.3.6** cannot be maintained for 10 s.

#### 6.4 Crib Side Latch Test Requirements:

6.4.1 The latching mechanism securing a drop or folding side of a crib shall automatically engage when the side is placed in the normal use position.

1 The latching mechanism shall not disengage during the tests conducted in accordance with the procedure in **7.4.4** or

2 (whichever is appropriate), and shall continue to function in the latching position upon completion of the tests. **116**  
 5.5.1.1 The latching mechanism shall not enter any gap created by the specified in **7.5.2.1** shall not enter any gap created by the

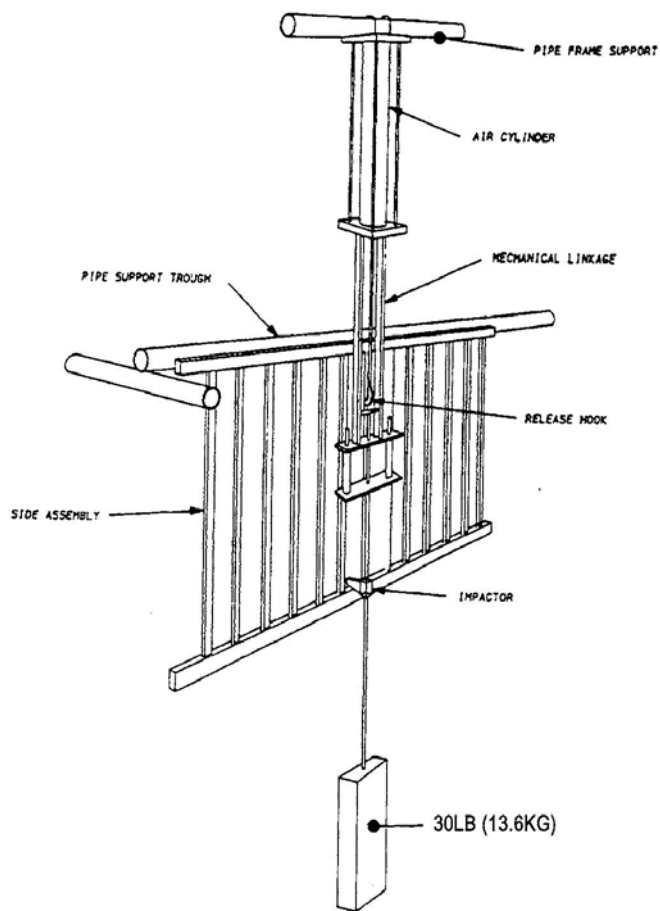
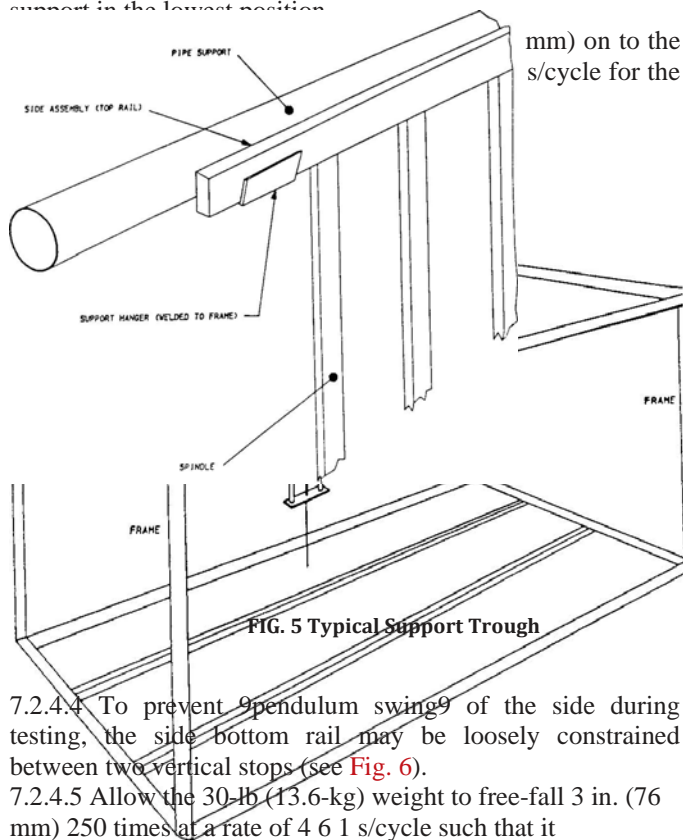


FIG. 5 Typical Support Trough

7.1.3.3 All testing shall be conducted with the mattress support in the lowest position.



7.2.4.4 To prevent pendulum swing of the side during testing, the side bottom rail may be loosely constrained between two vertical stops (see Fig. 6).  
7.2.4.5 Allow the 30-lb (13.6-kg) weight to free-fall 3 in. (76 mm) 250 times at a rate of 4.6 1/s/cycle such that it

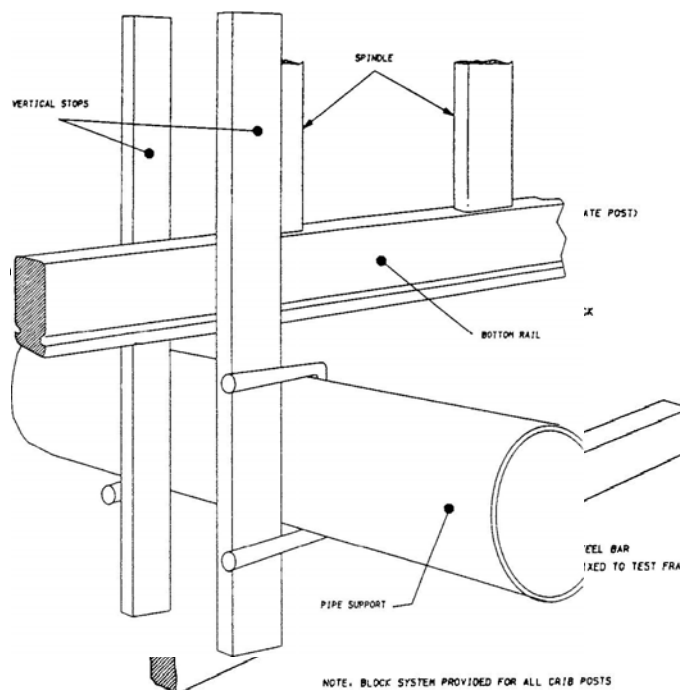


FIG. 6 Typical Side Test Vertical Stop Detail

7.1.3.5 500 cycles within 1/4 in. (6.4 mm) of the geometric center of the mattress.

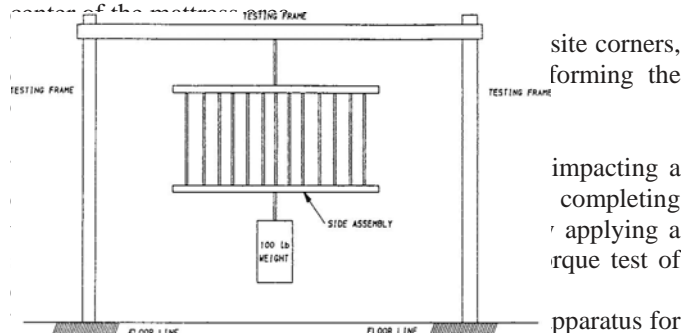
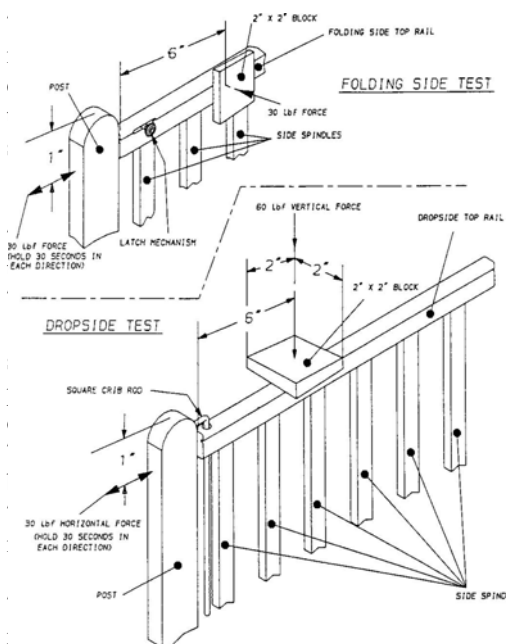


FIG. 7 Typical Testing Frame

7.2.2.1 A 30-lb (13.6-kg) weight.  
7.2.2.2 A 0.375-in. (9-mm) thick 30 Type A durometer rubber pad large enough to cover the impact area.  
7.2.2.3 Impact is directly supported by the 0.375-in. (9-mm) thick drop side pad located on the top surface of the bottom rail between two adjacent spindles or slats as near the center of the rail as possible.  
7.2.2.4 Two vertical stops (see Fig. 6) for drop side only.  
7.2.2.5 Upon completion of the cyclic test, apply a static load of 100 lb (45.4 kg) at the point of impact testing while the side is supported by the top rail at a point vertically in line with the point of load application (see Fig. 7).  
7.2.2.6 The contact area for the load and reaction support shall be the same as the impact area previously defined.  
7.2.2.7 Apply the load gradually within a period of 5 s and maintain it for 1 min.  
7.2.2.8 Remove the side from the crib assembly.  
7.2.2.9 Mount the Side Crib Test fixture so that it will hang vertically as in the schematic diagram of the crib in accordance with the support instructions within 2 in. (50 mm) of each end of the top rail by placing the top rail in a trough to eliminate horizontal motion at the base.





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**7.3.1 General**—This test assists in evaluating the integrity of the attachment of the mattress support to the crib. A vertically upward force is applied to the mattress support to evaluate its attachment to the crib.

#### 7.3.2.1 Corner Block, See 9 Crib Side Latch Test

force should be in the plane of the folding rail and on 1 in (25 mm) down from the top of the crib corner post (or crib end panel) for a procedure not in incorporating crib corner posts (see Fig. 90). Maintain this horizontal force for 30 s then reverse its direction and maintain it for an additional 30 s.

7.4.5.2 Place the folding side rail in the latched position. Through a hardwood block with contact area of 2 by 2 in. (50 by 50 mm), gradually apply within 5 s a force of 30 lbf (133-N) horizontally inward, perpendicular to, and at a point that is 6 in. (150 mm) from one end of the folding side upper rail. While this 30 lbf (133-N) force is applied to the crib side, gradually apply within 5 s a 30 lbf (133-N) horizontal force in a direction parallel to the folding side. The point of application of this force shall be in the plane of the folding side and 1 in. (25 mm) down from the top of the crib corner post (or crib end panel for construction not incorporating crib corner posts-see Figure 9.1.1). Maintain this horizontal force for 30 s then reverse its direction and maintain it for an additional 30 s.

7.4.5.3 Repeat the procedures defined in 7.4.5.1 and 7.4.5.2 at the other end of the folding side. If the crib has more than one folding side, perform this test at each end of each folding side.

7.4.5.4 Upon completion of the test, release the folding side latches and lower the crib side. Then raise the side and observe whether the latches automatically engage in the manner intended by the manufacturer.

**7.5.1 General**—This test consists of deforming the plastic teething rail under load to determine the security of the attachment.

7.3.5.3.2 *AppheannaftresBlasuppOetkysteRuithizes* a common support. *llesagtenGallp010406byattacht00, by25gm* required in 50. By *Harborner*. *Bforikorewithan2oby* *Suppor(50sign 50 used)*, each point of attachment utilizing a different design must be tested. 2. *Applytheforceapply 50lb in 225N* *suppockn* each of the 7. 5. *Proceeders for Blastic Teething Rail Test:*

7.5.3.3.3 Apply the 254 N (57 lbf) force normal to the teething member, diagonally positioned test member such that the centerline of the plastic teething rail assembly is perpendicular to the rail. With the plastic teething rail assembly held in the top rail, apply a 500 N (112 lbf) vertically downward force on the top of the teething rail through the handle provided on the center top support teething rail. While maintaining this force, determine if the 0.040 (1.00 mm) feeler gauge can be inserted between the vertical surfaces of the top rail and the inside surface of the edge of the plastic teething rail (see Fig. 10).

1.4.1 **General** This test assists in evaluating the integrity of the crib labeling system under abusive load conditions

The test applies a force to a movable crib side in a direction tending to cause latch failure while a horizontal force is applied parallel to the major axis of the crib.

7.4.2.1 Hardwood block with a contact area of 2 by 2 in. (50 by 50 mm) for distribution of applied loads.

7.4.3.1 Casters shall not be installed on crib. Secure the bottom of the crib in a manner that will prevent horizontal motion.

7.4.4.1 Gradually apply within5sa vertically downward force of 60 lbf (270 N) through a hardwood block witha2by 2 in. (50 by 50 mm) contact area to the upper horizontal rail of the crib side at a point that is 6 in. (150 mm) from one end of the rail. While the 60-lbf (270-N) downward force is applied to the crib side, gradually apply within5sa 30-lbf (133-N) horizontal force in a direction parallel to the drop side. The point of application of this force shall be in the plane of the drop side and 1 in. (25 mm) down from the top of the crib corner post (or crib end panel for construction not incorporating crib corner posts (see Fig. 9). Maintain this horizontal force for 30 s then reverse its direction and maintain it for an additional 30 s.

7.4.4.2 Repeat this procedure at the other end of the crib drop side and, if the crib has more than one drop side, perform the test at each end of each drop side.

7.4.4.3 Upon completion of the test, release the drop side latch and lower the crib side. Then raise the side and observe whether the latch automatically engages in the manner intended by the manufacturer.

7.4.5.1 Place the folding side in the latched position. Through a hardwood block with contact area of 2 by 2 in. (50 by 50 mm), gradually apply within 5 s a force of 30 lbf (133-N) horizontally outward, perpendicular to, and at a point that is 6 in. (150 mm) from one end of the folding side upper rail. While this 30-lbf (133-N) force is applied to the crib side, gradually apply within 5 s a 30-lbf (133-N) horizontal force in a direction parallel to the folding side. The point of application of this



8.1 Warning statements shall be easy to read and understand. The warning statements shall be in contrasting color(s) and permanent. The text shall be in sans serif type. The safety alert symbol “” and the word “WARNING” shall not be less than 0.2 in. (5 mm) high and the remainder of the text shall be in characters whose upper case shall be at least 0.1 in. (2.4 mm) high.

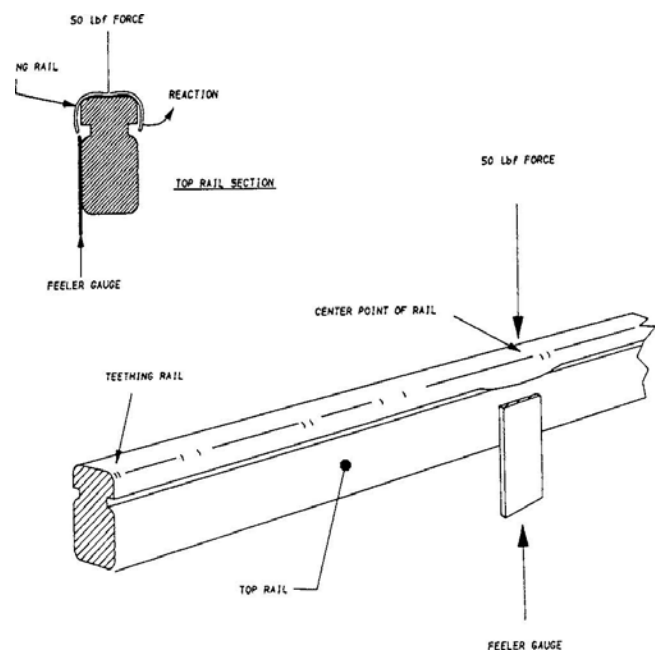
8.2 The following warning must be visible in its entirety with the crib assembled according to the manufacturer’s instructions and the recommended maximum thickness mattress in place.

8.2.1 The warning shall state:

" WARNING: Infants can suffocate on soft bedding. Never add a pillow, comforter or padding.

8.3 Additional warning statements shall address the following and must be visible in their entirety when the product is in the manufacturer’s recommended use position, or product must

have a visible warning giving the location of these warning statements as follows:





WARNING See (*insert statement indicating to the user where to find the warning*) for warnings.

The warning shall state: " WARNING: Failure to follow these warnings and the assembly instructions could result in serious injury or death.

8.3.1 The warnings shall address the following including the hazard where identified. The warnings may be expressed in different words if those words convey clearly the same warning.

8.3.1.1 To reduce the risk of SIDS, pediatricians recommend healthy infants be placed on their backs to sleep, unless otherwise advised by your physician.

#### 8.3.1.2 Strangulation Hazard:

\*Strings can cause strangulation! Do not place items with a string around a child's neck, such as hood strings or pacifier cords. Do not suspend strings over a crib or attach strings to toys.

\*To help prevent strangulation tighten all fasteners. A child can trap parts of the body or clothing on loose fasteners. \*DO NOT place crib near window where cords from blinds or drapes may strangle a child.

#### 8.3.1.3 Fall Hazard:

\*When child is able to pull to a standing position, set mattress to lowest position and remove bumper pads, large toys and other objects that could serve as steps for climbing out.

\*After raising side, make sure ~~latches~~ are secure (*omit for stationary side cribs*).

\*DO NOT leave child in crib with side lowered. Be sure side is in raised and locked position whenever child is in crib (*omit for stationary side cribs*).

\*When child is able to climb out or reaches the height of 35 in. (90 cm), the crib shall no longer be used.

8.3.1.4 Check this product for damaged hardware, loose joints, missing parts or sharp edges before and after assembly and frequently during use. DO NOT use crib if any parts are

missing, damaged or broken. Contact (*insert manufacturer's name*) for replacement parts and instructional literature if needed. DO NOT substitute parts.

8.4 Additional warning statements must be permanently affixed to either the headboard, footboard, or mattress support and visible in their entirety when the crib mattress is removed. The warnings must address the following:

8.4.1 Cribs not intended to hold water mattresses must include a statement addressing: \*DO NOT use a water mattress with this crib.

8.4.2 Products designated to use a water mattress must specify the maximum thickness and weight of the water mattress.

8.4.3 Cribs equipped with teething rails must include a statement addressing: \*Replace teething rail if damaged, cracked or loose.

1 If refinishing, use a non-toxic finish specified for children's products.

## 2 Instructional Literature

9.1 Instructions shall be provided with the crib and shall be easy to read and understand. These instructions shall include information on assembly, maintenance, cleaning, storage and use. A means shall be provided to keep the instructions with the crib.

9.2 Instructions shall contain warnings as per Section 8. In addition, instructions shall have warnings addressing: \*Read all instructions before assembling crib. Keep instructions for future use. \*Never use plastic shipping bags or other plastic film as mattress covers because they can cause suffocation.

\*Infants can suffocate in gaps between crib sides and a mattress that is too small.

## 10. Keywords

10.1 crib corner post entanglement; crib structural integrity; crib warning labels and instructional material

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## Appendix H: 16 C.F.R. Part 1508 (2001, Full Size Crib)

**Authority:** Secs. 2(f)(1)(D), (q)(1)(A), (s), 3(e)(1), 74 Stat. 372, 374, 375, as amended, 80 Stat. 1304–05, 83 Stat. 187–89 (15 U.S.C. 1261, 1262).

**Source:** 38 FR 32129, Nov. 21, 1973, unless otherwise noted.

### § 1508.1 *Definitions.*

 [top](#)

For the purposes of this part:

(a) *Full-size baby crib* means a bed (1) that is designed to provide sleeping accommodations for an infant, (2) that is intended for use in the home, and (3) that is within a range of  $\pm 5.1$  centimeters ( $\pm 2$  inches) of the interior length or width dimensions specified for full-size baby cribs in §1508.3.

### § 1508.2 *Scope of part.*

 [top](#)

This part sets forth the requirements whereby full-size baby cribs (as defined in §1508.1(a)) are not banned articles under §1500.18(a)(13) of this chapter.

### § 1508.3 *Dimensions.*

 [top](#)

Full-size baby cribs shall have dimensions as follows:

(a) *Interior.* The interior dimensions shall be  $71 \pm 1.6$  centimeters ( $28 \pm 5/8$  inches) wide as measured between the innermost surfaces of the crib sides and  $133 \pm 1.6$  centimeters ( $52 3/8 \pm 5/8$  inches) long as measured between the innermost surfaces of the crib end panels, slats, rods, or spindles. Both measurements are to be made at the level of the mattress support spring in each of its adjustable positions and no more than 5 centimeters (2 inches) from the crib corner posts or from the first spindle to the corresponding point of the first spindle at the other end of the crib. If a crib has contoured or decorative spindles, in either or both of the sides or ends, the measurement shall be determined from the largest diameter of the first turned spindle within a range of 10 centimeters (4 inches) above the mattress support spring in each of

its adjustable positions, to a corresponding point on the first spindle or innermost surface of the opposite side of the crib.

(b) *Rail height.* The rail height dimensions shall be as follows:

(1) The height of the rail and end panel as measured from the top of the rail or panel in its lowest position to the top of the mattress support in its highest position shall be at least 22.8 centimeters (9 inches).

(2) The height of the rail and end panel as measured from the top of the rail or panel in its highest position to the top of the mattress support in its lowest position shall be at least 66 centimeters (26 inches).

[38 FR 32129, Nov. 21, 1973; 38 FR 33593 Dec. 6, 1973]

#### **§ 1508.4 *Spacing of crib components.***

 [top](#)

(a) The distance between components (such as slats, spindles, crib rods, and corner posts) shall not be greater than 6 centimeters (23/8inches) at any point. Measurement of distance between contoured or irregular slats or spindles shall be done by a 6-centimeter wide by 10-centimeter high by 10-centimeter long (23/8-inch wide by 4-inch high by 4-inch long) rectangular block which shall not pass through the space.

(b) The distance between such components shall not exceed 6.3 centimeters (21/2inches) when a 9-kilogram (20-pound) direct force is applied in accordance with the test method in §1508.5. For contoured or irregular slats or spindles, the spacing shall not permit passage of a 6.3-centimeter wide by 8.2-centimeter high by 8.2-centimeter long (21/2-inch wide by 31/4-inch high by 31/4-inch long) rectangular block above and below the loading wedge when a 9-kilogram (20-pound) direct force is applied in accordance with said test method.

#### **§ 1508.5 *Component spacing test method for §1508.4(b).***

 [top](#)

(a) Construct a right triangular prism-shaped wedge from a rigid material (steel, wood, aluminum, or equivalent) as shown in figure 1.

(b) Place the wedge midway between two vertical components and midway between the top and bottom horizontal rails. Attach a dial push-pull gauge (Chatillon model DPP-50, or equivalent spring scale) to the eyebolt and exert a 9-kilogram (20-pound) direct pull on the wedge. The test may be performed by suspending a 9-kilogram (20-pound) weight from the eyebolt with the crib component placed in a horizontal position.

#### **§ 1508.6 *Hardware.***

 [top](#)

(a) A crib shall be designed and constructed in a manner that eliminates from any hardware accessible to a child within the crib the possibility of the hardware's presenting a mechanical hazard through pinching, bruising, lacerating, crushing, breaking, amputating, or otherwise injuring portions of the human body when the crib is in normal use or when subjected to reasonably foreseeable damage or abuse.

(b) Locking or latching devices used to secure dropside rails shall require a minimum force of 4.5 kilograms (10 pounds) to activate the release mechanism or shall consist of a double-action device requiring two distinct actions to release.

(c) Wood screws shall not be used in the assembly of stationary sides, dropside rails, folding rails, or stabilizing bars to crib ends or other components that must be removed by the consumer in the normal disassembly of a crib.

### **§ 1508.7 Construction and finishing.**

 [top](#)

(a) All wood surfaces shall be smooth and free from splinters.

(b) All wood parts shall be free from splits, cracks, or other defects which might lead to structural failure.

(c) Crib end panels and sides or any attachment thereto shall have no horizontal bar, ledge, projection, or other surface accessible to a child inside the crib capable of being used as a toehold located less than 51 centimeters (20 inches) above the mattress support in its lowest position when the side rail is in its highest position, except the lower horizontal bar of the crib rail may have a vertical dimension that extends no higher than 7.6 centimeters (3 inches) above the mattress support in its lowest position. In no case will any gap between the top surface of the mattress support and the bottom of the lower horizontal rail be permitted. For the purposes of this paragraph, any ledge or projection with a depth dimension greater than 1 centimeter (3/8inch) shall constitute a toehold.

### **§ 1508.8 Assembly instructions.**

 [top](#)

(a) Cribs, when shipped other than completely assembled, shall be accompanied by detailed instructions that include an assembly drawing, a list and description of all parts and tools required for assembly, and a full-size diagram of the required bolts and other fasteners.

(b) The instructions shall:

- (1) Be so written that an unskilled layman can correctly assemble the crib without making errors that would result in improper and unsafe assembly.
- (2) Include cautionary statements concerning the secure tightening and maintaining of bolts and other fasteners.
- (3) Contain a cautionary statement that when a child's height reaches 90 centimeters (35 inches), the child should be placed in a youth or regular bed.
- (c) The warning relative to mattress size for full-size cribs in §1508.9(c) shall be included in the instructions.

### **§ 1508.9 *Identifying marks, warning statement, and compliance***

#### ***declaration.***

 [top](#)

(a) All cribs and retail cartons thereof shall be suitably marked and labeled in accordance with this section.

(b) A crib shall be clearly marked to indicate:

(1) The name and place of business (city and State) of the manufacturer, importer, distributor, and/or seller; and

(2) A model number, stock number, catalog number, item number, or other symbol expressed numerically, in code or otherwise, such that only articles of identical construction, composition, and dimensions shall bear identical markings.

(c) The following warning shall appear on the retail carton and on the inside of the head end panel or on the top surface of the mattress support in a type size of at least one-fourth inch:

“CAUTION:Any mattress used in this crib must be at least 27 1/4 inches by 51 5/8 inches with a thickness not exceeding 6 inches,” or “CAUTION: Any mattress used in this crib must be at least 69 centimeters by 131 centimeters with a thickness not exceeding 15 centimeters.”

The marking shall appear in block letters, shall contrast sharply with the background (by color, projection, and/or indentation), and shall be clearly visible and legible. The dimensions of the mattress shall be taken from seam to seam or edge to edge where appropriate.

(d) Markings on a crib shall be of a permanent nature such as paint-stenciled, die-stamped, molded, or indelibly stamped directly thereon or permanently affixed, fastened, or attached thereto by means of a tag, token, or other suitable medium. The markings shall not be readily removable or subject to obliteration during normal use of the article or when the article is subjected to reasonably foreseeable damage or abuse.

(e) The retail carton of a crib shall clearly indicate:

(1) The name and place of business (mailing address including ZIP code) of the manufacturer, importer, distributor, and/or seller; and

(2) The model number, stock number, catalog number, item number, or other symbol described in paragraph (b)(2) of this section.

(f) Each crib and its retail carton shall bear a conspicuous label stating that the crib conforms to applicable regulations promulgated by the Consumer Product Safety Commission. The label need not be permanently attached to the crib, nor is any particular wording required for the statement. The label on the crib must be conspicuous under normal conditions of retail display. Any full-size baby crib introduced into interstate commerce on or after February 1, 1974, through January 31, 1976, must bear this label.

[38 FR 32129, Nov. 21, 1973, as amended at 38 FR 35454, Dec. 28, 1973]

### **§ 1508.10 *Recordkeeping.***

 [top](#)

A manufacturer or importer of cribs shall keep and maintain for 3 years after production or importation of each lot, or other suitable identifying unit, records of sale, distribution, and results of all inspections and tests conducted in accordance with this part 1508. These records shall be made available upon request, at reasonable times to any officer, employee, or agent action on behalf of the Consumer Product Safety Commission. The manufacturer or importer shall permit such officer, employee, or agent to inspect and copy such records, to make such inventories of stock as he deems necessary, and to otherwise verify the accuracy of such records.

### **§ 1508.11 *Requirements for cutouts.***

 [top](#)

Full-size baby cribs shall comply with the following test requirements:

(a) Place the neck of the headform probe shown in Figure 2 into any cutout (partially-bounded opening) located along the upper edges of an end or side panel. The axis of the neck shall be horizontal and at right angles to the plane of the panel at the point of contact. The head portion of the probe shall be on the outer side of the panel. With the neck resting on the panel at any point within the cutout area (for compliance purposes, the Commission may test at all points that could result in a failure), and the front of the probe pointing downwards, draw the head of the probe towards the panel until surface “A” makes contact with the outer side of the panel (see Figure 3).

(b)(1) Press down on the neck to cause the head to swing upwards through the cutout in the panel. The probe shall not be rotated about the major axis of the neck during this procedure.



The arc through which the head is swung shall be in a vertical plane and shall terminate when the major axis of the neck attains an upright position or is prevented from attaining an upright position by an obstruction. During the test, contact shall be maintained between surface "A" (or at least one of edges "AB"), the neck of the headform probe and the panel. If, during the swing to the upright position, an edge or surface other than surface "D" is contacted, sideways motion of the headform shall not be restrained, but the arc through which the headform is swung shall remain vertical

(2) If a cutout is V-shaped (the side boundaries or the tangents to the side boundaries are nowhere parallel), an additional test shall be performed on the cutout. Upon completion of the swing to the upright position, rock the headform sideways parallel to the plane of the panel while maintaining contact between surface "A" or an edge "AB" and the panel. This will result in the probe sliding toward the bottom of the cutout. The maximum angle through which the headform is rocked shall be determined by contact with the panel by a surface or edge other than "A" or "AB" or until one of the surfaces "B" is in a vertical plane.

(c) During the test described in paragraph (b) of this section, no portion of the panel shall contact:

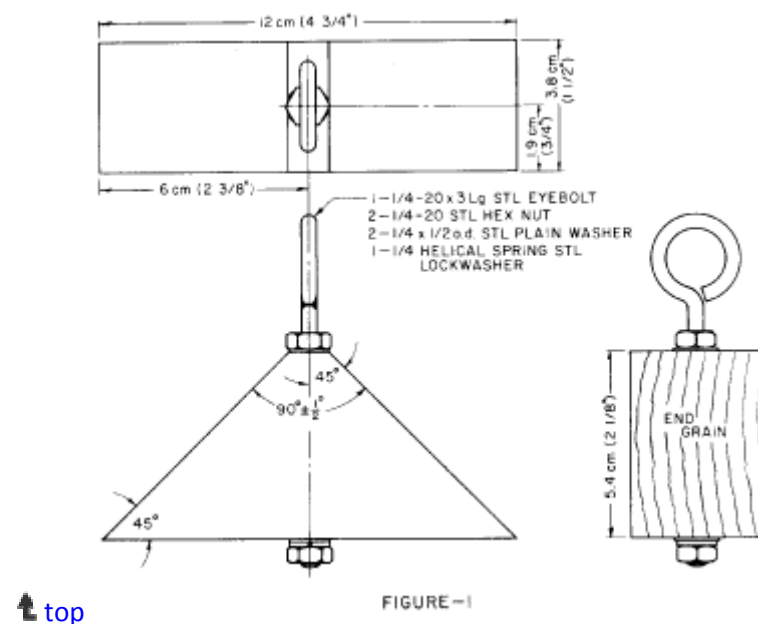
(1) Simultaneously, more than one of surfaces "B", "C" or edges "BC," "CC," or "CD," in any combination if they are on opposing sides of the headform.

(2) Any of surfaces "D".

Note: Edges are identified by the letter designations for surfaces that lie on either side of the edge.

[47 FR 47541, Oct. 27, 1982]

**Figure 1 to Part 1508—Crib Slat Loading Wedge**



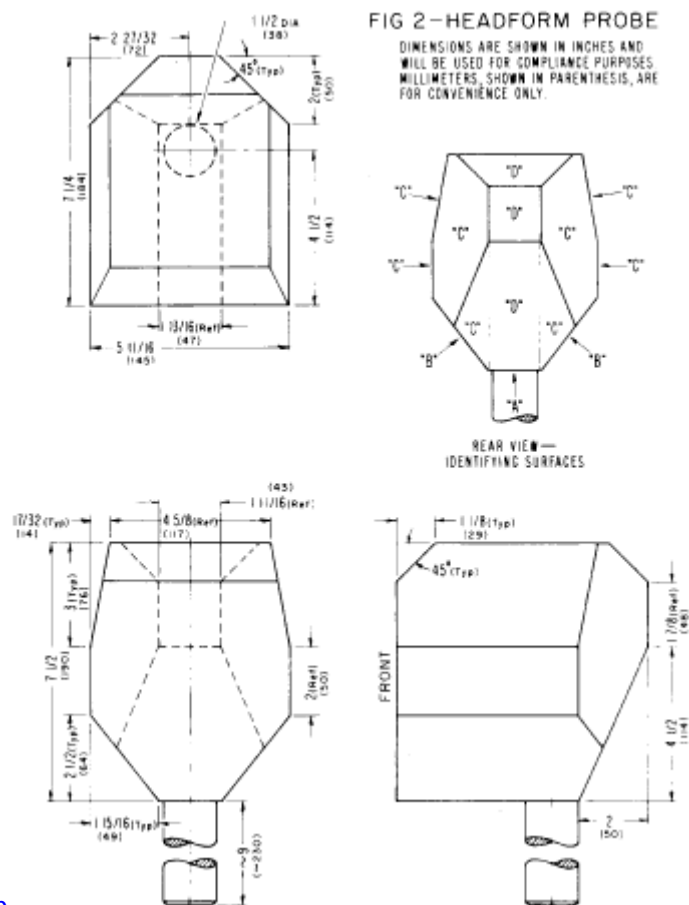
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(Secs. 2(f)(1)(D), (q)(1)(A), (s), 3(e)(1), 74 Stat. 372, 374, 375, as amended, 80 Stat. 1304–05, 83 Stat. 187–89 (15 U.S.C. 1261, 1262); Pub. L. 92–573, sec. 30(a), 86 Stat. 1231 (15 U.S.C. 2079(a)))

[38 FR 32129, Nov. 21, 1973, as amended at 45 FR 37419, June 3, 1980]

### **Figure 2 to Part 1508—Headform Probe**



[top](#)

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[47 FR 47544, Oct. 27, 1982]

### **Figure 3 to Part 1508**

[↑ top](#)

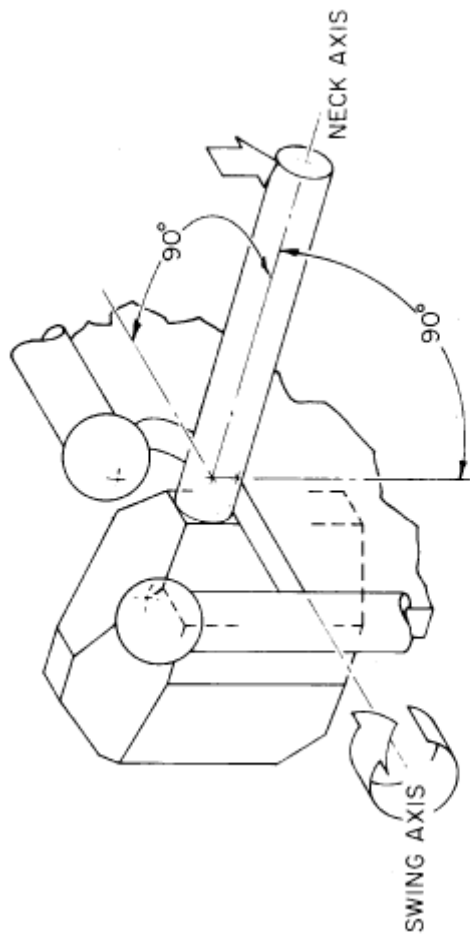


FIG 3

## Appendix I: 16 C.F.R. Part 1509 (2001, Non-Full Size Crib)

**Authority:** Secs. 2 (f)(1)(D), (q)(1)(A), (s), 3(e)(1), 10(a), 74 Stat. 372, 374, 375, 378, as amended, 80 Stat. 1304–05, 83 Stat. 187–89 (15 U.S.C. 1261, 1262, 1269).

**Source:** 41 FR 6240, Feb. 12, 1976, unless otherwise noted.

### § 1509.1 *Scope of part 1509.*

 [top](#)

This part 1509 sets forth the requirements whereby non-full-size baby cribs, as defined in §1509.2, are not banned articles under §1500.18(a)(14) of this chapter. For purposes of compliance with this part, the metric figures shall be used. The English approximations are provided in parentheses for convenience and information only, and do not specify complying dimensions.

### § 1509.2 *Definitions.*

 [top](#)

For the purposes of this part 1509:

(a) *Crib* or *baby crib* means a bed designed to provide sleeping accommodations for an infant.

(b)(1) *Non-full-size baby crib* means a crib that (i) is intended for use in or around the home, for travel and other purposes and (ii) has an interior length dimension either greater than 139.7 centimeters (55 inches) or smaller than 126.3 centimeters (49 3/4 inches), or, an interior width dimension either greater than 77.7 centimeters (30 5/8 inches) or smaller than 64.3 centimeters (25 3/8 inches), or both. Mesh/net/screen cribs, nonrigidly constructed baby cribs, cradles (both rocker and pendulum types), car beds, baby baskets and bassinets (also known as junior cribs) are not subject to the provisions of §1500.18(a)(14) of this chapter and this part 1509.

(2) *Non-full-size baby crib* includes, but is not limited to, the following:

(i) *Portable crib.* A non-full-size baby crib designed so that it may be folded or collapsed, without disassembly, to occupy a volume substantially less than the volume it occupies when it is used.

(ii) *Crib-pen.* A non-full-size baby crib the legs of which may be removed or adjusted to provide a play pen or play yard for a child.

(iii) *Specialty crib.* An unconventionally shaped (circular, hexagonal, etc.) non-full-size baby crib incorporating a special mattress or other unconventional components.

(iv) *Undersize crib.* A non-full-size baby crib with an interior length dimension smaller than 126.3 centimeters (493/4inches), or an interior width dimension smaller than 64.3 centimeters (253/8inches), or both.

(v) *Oversize crib.* A non-full-size baby crib with an interior length dimension greater than 139.7 centimeters (55 inches), or an interior width dimension greater than 77.7 centimeters (305/8inches), or both.

### **§ 1509.3 Crib-side height.**

 [top](#)

(a) With the mattress support in its highest adjustable position and the crib side in its lowest adjustable position, the vertical distance from the upper surface of the mattress support to the upper surface of the crib side and/or end panel shall not be less than 12.7 centimeters (5 inches).

(b) With the mattress support in its lowest adjustable position and the crib side in its highest adjustable position, the vertical distance from the upper surface of the mattress support to the upper surface of the crib side and/or end panel shall not be less than 55.9 centimeters (22 inches).

### **§ 1509.4 Spacing of unit components.**

 [top](#)

(a) *Uniformly spaced components.* The distance between adjacent, uniformly spaced components (such as slats, spindles, and/or corner posts) shall not be greater than 6 centimeters (23/8inches). The distance between any such adjacent components shall not exceed 6.3 centimeters (21/2inches) at any point when subjected to the test procedure specified in §1509.6.

(b) *Nonuniformly spaced components.* (1) The distance between adjacent nonuniformly spaced components (such as slats, spindles, and/or corner posts) shall preclude passage of block A, specified in §1509.5(b), when inserted in any orientation (nonuniformly spaced components refers to irregularly shaped crib slats whether parallel to each other or not).

(2) The spacing between any such adjacent components shall preclude passage of block B, specified in §1509.5(c), when inserted in any orientation immediately above and below the loading wedge specified in §1509.5(a) while the components are being subjected to the test procedure specified in §1509.6.

### **§ 1509.5 Component-spacing test apparatus.**

 [top](#)

(a) *Loading wedge.* The loading wedge shall be a right triangular prism constructed of a smooth, rigid material conforming to measurements shown in Figure 1.

(b) *Block A.* Block A shall be a rectangular block, constructed of a smooth, rigid material, measuring 6 centimeters wide by 10 centimeters high by 10 centimeters long (23/8inches wide by 4 inches high by 4 inches long).

(c) *Block B.* Block B shall be a rectangular block, constructed of a smooth, rigid material, measuring 6.3 centimeters wide by 8.2 centimeters high by 8.2 centimeters long (21/2inches wide by 31/4inches high by 31/4inches long).

#### **§ 1509.6 *Component-spacing test method.***

 [top](#)

The apex of the wedge (see §1509.5(a)) shall be placed midway between two vertical components and midway between the uppermost and lowermost horizontal surfaces of the crib side. A 9-kilogram (20-pound) tensile force shall be applied to the wedge perpendicular to the plane of the crib side.

#### **§ 1509.7 *Hardware.***

 [top](#)

(a) The hardware in a non-full-size baby crib shall be designed and constructed to eliminate pinching, bruising, lacerating, crushing, amputating and/or other potentials for injury when the crib is in normal use or when subjected to reasonably foreseeable damage or abuse.

(b) Non-full-size baby cribs shall incorporate locking or latching devices for dropsides or folding sides or end panels. These devices shall require either a minimum force of 4.5 kilograms (10 pounds) for activation or at least two distinct actions to release them.

(c) Woodscrews shall not be used in the assembly of any components that must be removed by the consumer in the normal disassembly of a non-full-size baby crib.

#### **§ 1509.8 *Construction and finishing.***

 [top](#)

(a) All wood surfaces of non-full-size baby cribs shall be smooth and free from splinters.

(b) All wood parts of non-full-size baby cribs shall be free from splits, cracks, or other defects that might lead to structural failure.

(c) Ends and sides of non-full-size baby cribs shall have no horizontal bar, ledge, projections, or other surface accessible to the child inside the crib that could be used as a toehold (any ledge or projection with a depth dimension greater than 1 centimeter (3/8inch) located less than 40.6 centimeters (16 inches) above the mattress support in its lowest adjustable position when the crib side is in its highest adjustable position).

## **§ 1509.9 Mattresses.**

[↑ top](#)

(a) *Mattress thickness.* (1) A mattress supplied with a non-full-size crib shall, in a noncompressed state, have a thickness that will provide a minimum effective crib-side height dimension of at least 50.8 centimeters (20 inches) as measured from the upper surface of the crib side and/or end panel. For this measurement, the crib side shall be in its highest adjustable position and the mattress support in its lowest adjustable position.

(2) A mattress supplied with a non-full-size crib shall, in a noncompressed state, have a thickness that will provide a minimum effective crib-side height dimension of at least 7.6 centimeters (3 inches) as measured from the upper surface of the mattress to the upper surface of the crib side and/or end panel. For this measurement, the crib side shall be in its lowest adjustable position and the mattress support in its highest adjustable position.

(b) *Mattress dimensions.* The dimensions of a mattress supplied with a non-full-size baby crib shall be such that the mattress, when inserted in the center of the crib, in a noncompressed state at any of the adjustable positions of the mattress support, shall not leave a gap of more than 1.3 centimeters (1/2inch) at any point between the perimeter of the mattress and the perimeter of the crib. When the mattress is placed against the perimeter of the crib the resulting gap shall not exceed 2.6 centimeters (1 inch).

## **§ 1509.10 Assembly instructions.**

[↑ top](#)

Unassembled non-full-size baby cribs shall be accompanied by detailed instructions that shall:

- (a) Include an assembly drawing;
- (b) Include a list and description of all parts and tools required for assembly;
- (c) Include a full-size diagram of the required bolts and other fasteners;
- (d) Be so written that an unskilled person can assemble the crib without making errors that would result in improper and unsafe assembly;
- (e) Include cautionary statements concerning the secure tightening and maintaining of bolts and other fasteners;

(f) Contain a cautionary statement that when a child's height reaches 35 inches, the child should be placed in a youth bed; and

(g) Contain a warning relative to mattress size for the non-full-size baby crib that specifies the dimensions of any mattress to be used with the crib as determined under §1509.9.

**§ 1509.11 *Identifying marks, caution statement, and compliance declaration.***

 [top](#)

(a) Non-full-size baby cribs shall be clearly marked to indicate:

(1) The name and place of business (city and state) of the manufacturer, importer, distributor, and/or seller; and

(2) A model number, stock number, catalog number item number, or other symbol expressed numerically, in code or otherwise, such that only cribs of identical construction, composition, and dimensions shall bear identical markings.

(b) The following caution statement shall appear on an inside surface of a non-full-size baby crib in a type size of at least 1/8 inch:

(1) For rectangular cribs:

CAUTION: Any mattress used in this crib must be at least \_\_\_ inches long by \_\_\_ inches wide and not more than \_\_\_ inches thick.

The blanks are to be filled with dimensions complying with §1509.9(a) and (b).

(2) For nonrectangular cribs:

CAUTION: Check proper fit of mattress. Should be not more than \_\_\_ inches thick. The maximum gap between mattress and inside of crib border (or edge) should be no more than 1 inch.

The blank is to be filled in with a dimension complying with §1509.9(a).

(3) The dimensions to be inserted in the blanks in the caution statements in paragraphs (b) (1) and (2) of this section shall be determined by the manufacturer according to the provisions of §1509.9. The markings shall appear in block letters, shall contrast sharply with the background (by color, projection, and/or indentation), and shall be clearly visible and legible.

(c) Except for markings required under paragraphs (d) and (e) of this section, markings on non-full-size baby cribs shall be of a permanent nature such as paint-stenciled, die-stamped, molded, or indelibly stamped directly thereon or permanently affixed, fastened, or attached thereto by means of a tag, token, or other suitable medium. The markings shall not be readily



removable or subject to obliteration during normal use of the article or when the article is subjected to reasonably foreseeable damage or abuse.

(d) The retail cartons of non-full-size baby cribs shall clearly indicate:

(1) The name and place of business (mailing address including ZIP code) of the manufacturer, importer, distributor, and/or seller; and

(2) The model number, stock number, catalog number, item number, or other symbol described in paragraph (a)(2) of this section.

(e) All non-full-size baby cribs and their retail cartons shall bear a conspicuous label stating that the article conforms to applicable regulations promulgated by the Consumer Product Safety Commission. The label need not be permanently attached to the article and carton nor is any particular wording required for the statement. The label on the article must be conspicuous under normal conditions of retail display. All non-full-size baby cribs and their retail cartons introduced into interstate commerce for a period of 2 years after the effective date of this part 1509 must bear such label.

### **§ 1509.12 *Recordkeeping.***

 [top](#)

The manufacturer or importer shall keep and maintain for 3 years after production or importation of each lot or other identifying unit of non-full-size baby cribs, records of sale and distribution. These records shall be made available upon request at reasonable times to any officer, employee, or agent acting on behalf of the Consumer Product Safety Commission. The manufacturer or importer shall permit such officer, employee, or agent to inspect and copy such records, to make such inventories of stock as he or she deems necessary, and to otherwise verify the accuracy of such records.

### **§ 1509.13 *Requirements for cutouts.***

 [top](#)

Non-full-size baby cribs shall comply with the following test requirements:

(a) Place the neck of the headform probe shown in Figure 2 into any cutout (partially-bounded opening) located along the upper edges of an end or side panel. The axis of the neck shall be horizontal and at right angles to the plane of the panel at the point of contact. The head portion of the probe shall be on the outer side of the panel. With the neck resting on the panel at any point within the cutout area (for compliance purposes, the Commission may test at all points that could result in a failure), and the front of the probe pointing downwards, draw the head of the probe towards the panel until surface “A” makes contact with the outer side of the panel (see Figure 3).

(b)(1) Press down on the neck to cause the head to swing upwards through the cutout in the panel. The probe shall not be rotated about the major axis of the neck during this procedure. The arc through which the head is swung shall be in a vertical plane and shall terminate when the major axis of the neck attains an upright position or is prevented from attaining an upright position by an obstruction. During the test, contact shall be maintained between surface “A” (or at least one of edges “AB”), the neck of the headform probe and the panel. If, during the swing to the upright position, an edge or surface other than surface “D” is contacted, sideways motion of the headform shall not be restrained, but the arc through which the headform is swung shall remain vertical

(2) If a cutout is V-shaped (the side boundaries or the tangents to the side boundaries are nowhere parallel), an additional test shall be performed on the cutout. Upon completion of the swing to the upright position, rock the headform sideways parallel to the plane of the panel while maintaining contact between surface “A” or an edge “AB” and the panel. This will result in the probe sliding toward the bottom of the cutout. The maximum angle through which the headform is rocked shall be determined by contact with the panel by a surface or edge other than “A” or “AB” or until one of the surfaces “B” is in a vertical plane.

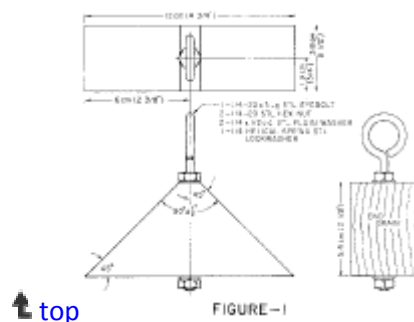
(c) During the test described in paragraph (b) of this section, no portion of the panel shall contact:

(1) Simultaneously, more than one of surfaces “B”, “C” or edges “BC,” “CC,” or “CD,” in any combination if they are on opposing sides of the headform.

(2) Any of surfaces “D”.

Note: Edges are identified by the letter designations for surfaces that lie on either side of the edge.

**Figure 1 to Part 1509**



[View or download PDF](#)

[47 FR 47541, Oct. 27, 1982]

**Figure 2 to Part 1509—Headform Probe**

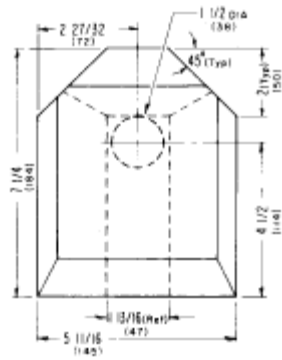
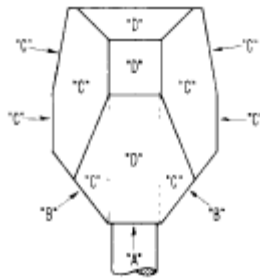
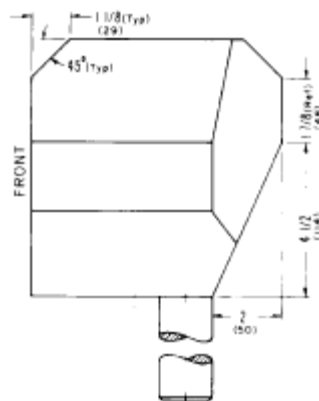
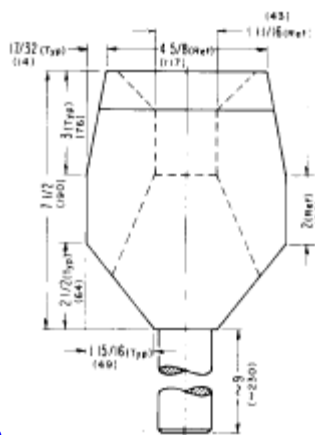


FIG 2-HEADFORM PROBE

DIMENSIONS ARE SHOWN IN INCHES AND WILL BE USED FOR COMPLIANCE PURPOSES. MILLIMETERS, SHOWN IN PARENTHESES, ARE FOR CONVENIENCE ONLY.



REAR VIEW—  
IDENTIFYING SURFACES



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[47 FR 47544, Oct. 27, 1982]

**Figure 3 to Part 1509**

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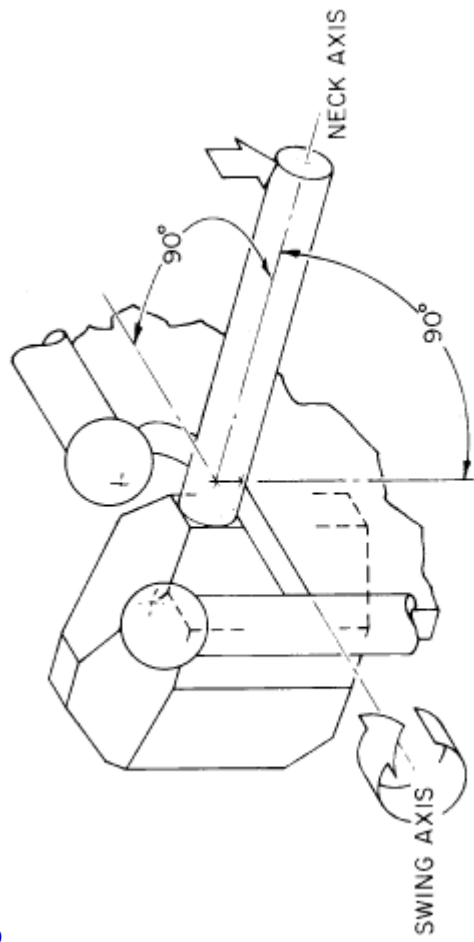


FIG 3

## **Appendix J: CPSC Engineering Test Manual**

FULL-SIZE AND NON-FULL-SIZE BABY CRIBS

TESTING MANUAL APPROVAL RECORD

Manuel G. Karos 6-17-83  
Date M. G. Karos, Test Analyst

A. B. Riley 6-17-83  
Date A. B. Riley, Supervisory Mechanical Engineer

W. S. West 6-17-83  
Date W. S. West, Director, Engineering Laboratory

Revisions:

No.	Date	Description	Approval		
			Test Analyst	Supervisor	Director

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## INTRODUCTION

### A. Background

The Consumer Product Safety Commission (CPSC) promulgated requirements for Full-Size and Non-Full-Size Baby Cribs with effective dates of February 1, 1974 and August 10, 1976, respectively. Also, CPSC promulgated requirements for cutouts with an effective date of June 1983.

The regulations provide performance criteria and test procedures but do not provide specific details of how each test is to be conducted and reported.

In order to provide a uniform system of testing and reporting within CPSC this Engineering Test Manual has been developed. Additional guidelines with regard to potential problems which might be encountered in performing the compliance tests, have also been incorporated into this document.

### B. Scope

This Engineering Test Manual sets forth the detailed test procedures, test equipment, test sequence, report format, and test personnel certification to be utilized within the Commission in the compliance testing of Full-Size and Non-Full-Size Baby Cribs.

### C. Applicable Documents

1. 16 CFR Part 1508 Full-Size Baby Crib, Dated November 15, 1973.
2. 16 CFR Part 1509 Non-Full-Size Baby Crib, dated February 6, 1976.
3. 16 CFR Part 1508 and 1509 Admendments for Full-Size and Non-Full-Size Crib Paragraph 1508.11/ 1509.3 Requirements for cutouts.

## II. GENERAL PROCEDURES

### A. Safety Precautions

The Test Analyst shall be responsible for the safety, competence and training of all testing personnel. All tests shall be conducted in such a manner as to provide the maximum protection to these individuals conducting the tests.

## B. Equipment Calibration and Accuracy

All equipment used in the performance of the tests shall be maintained in conformance with the Headquarters Laboratory Calibration and Maintenance program. For all cases the equipment utilized will provide the accuracy and precision necessary to withstand the scrutiny of possible legal actions.

## C. Equipment

The following list prescribes the equipment to be used in the performance of the test as well as any equipment or apparatus specified in the standard(s).

### 1. General Equipment

- a. Spring force gauge, 25 lb. full scale,  $\pm$  .25 lb., or equivalent.
- b. Measuring steel tape.
- c. Level.
- d. Vernier or dial caliper.
- e. 20 lb. weight.

### 2. Specified Equipment

- a. Block A: A rectangular block, 2 3/8" Wide by 4" High by 4" Long (see Figure 1).
- b. Block B: A rectangular block, 2 1/2" Wide by 3 1/4" High by 3 1/4" Long (see Figure 2).
- c. Loading wedge: Refer to Figure 3 of this manual.
- d. Head form probe: Refer to Figures 5 & 6.

#### D. Sample Identification

A "sample" includes all items received under one sample number and may consist of several subsamples. If the sample has not been marked by the field, each subsample shall be permanently marked so that the identification will remain throughout the tests. Such markings shall not affect the results of the tests.

#### E. Test Sequence

The tests shall be performed in the order they appear in this manual.

#### F. Data Acquisition and Report Format

The CPSC Test Report for Full-Size and Non-Full-Size Baby Cribs (see Appendix) shall be used for reporting of all results. A copy of all field screening test reports and any data acquisition forms shall be sent to the Headquarters Engineering Laboratory.

#### G. Laboratory Environment

All tests shall be conducted in ambient laboratory conditions (60° to 80°F).

#### H. Personnel and Test Report Certification

All reports shall be prepared on the form specified herein and shall be certified as to the accuracy and conformance to all the requirements of this Test Manual by the Test Analyst. The Test Analyst shall be a suitably trained expert and certified by the Director of the CPSC Headquarters Engineering Laboratory. Prior to tests, the Test Analyst shall insure that all test operators are familiar with the procedures of this manual.

### III. TEST CRITERIA AND PROCEDURES

#### A. Crib Assembly

Prior to test, the cribs shall be properly assembled as per assembly instructions accompanying the crib. If the instructions are not supplied by manufacturer, the crib shall be assembled appropriately by the test analyst.

B. Interior Dimensions for Full-Sized and Non-Full  
Sized Baby Cribs

Prior to test determine whether the crib is Full-Size or Non-Full-Size by definition:

1. Full-Size Crib has the following interior dimensions:

Length: 49 3/4" to 55"  
Width: 25 3/8" to 30 5/8"

2. Full-Size Cribs - Requirements

Note that cribs that fall within full-size dimensions must have interior dimensions between 27 3/8" to 28 5/8" in width and between 51 3/4" to 53" in length in order to comply with two requirements for full-sized cribs. The reason for this is so that a standard size crib mattress will fit the interior dimensions of the crib so that no hazardous gaps are present between the mattress and the sides or ends of the crib. There are no types of full-size cribs that are excluded from these requirements.

3. Non-Full-Size Crib has the following dimensions:

Length: Larger than 55" or smaller than 49 3/4"  
or  
Width: Larger than 30 5/8" or smaller than 25 3/8"  
or both

4. Non-Full Size Cribs:

Below are the exclusions for the non-full size cribs;

- a. Mesh/net/screen cribs and other nonrigidly constructed baby cribs.
- b. Cradles (both rocker and pendulum types).
- c. Car beds.
- d. Baby baskets and bassinets (also known as junior cribs).

FULL & NON-FULL SIZE CRIBS

In order to determine the interior width measure between the innermost surfaces of the crib side rails. In order to determine the interior length measure between the innermost surfaces of the crib end panels, slats, rods, or spindles.

Both measurements are made at the level of the mattress support spring in each of its adjustable positions and no more than two inches horizontally from the crib corner posts or from the first spindle to the corresponding point of the first spindle at the other end of the crib. If a crib has contoured or decorative spindles, in either or both sides or ends, the measurement shall be determined from the largest diameter of the first turned spindle within a range of four inches above the mattress support spring in each of its adjustable positions, to a corresponding point in the first spindle or innermost surface of the opposite side of the crib.

C. Crib Side Rail and End Panel Height Dimensions

1. Measure the crib side rail and end panel heights from the top of the side rail and end panel in their lowest position to the top of the mattress support in its highest position. Record these measurements in the Test Report Form.

2. Measure the crib side rail and end panel heights from the top of the side rail and end panel in its highest position to the top of the mattress support in its lowest position. Record these measurements in the Test Report Form.

D. Spacing of Crib Components

1a. Measure the spacing between adjacent uniformly spaced components such as slats, spindles, and/or corner posts with a ruler. The distance shall not exceed  $2 \frac{3}{8}$  inches.

1b. For non-uniformly spaced components such as contoured or irregular slats or spindles use a ( $2 \frac{3}{8}$ " X 4" X 4") "A" block for this test. The minimum dimension of the block shall not pass through the space between the components.

2a. Place the crib on its side in a horizontal position supported at its ends as depicted in Figure 4. Make sure that the crib is level. Place the loading wedge depicted in Figure 3 between two crib components midway between the top and bottom horizontal rails as shown in Figure 4. Gradually apply a 20 pound weight to the wedge. Measure the spacing between adjacent uniformly spaced components such as slats, spindles, and/or corner posts at a point immediately above and below the loading wedge. The distance between any adjacent components should not exceed  $2 \frac{1}{2}$  inches.

2b. For non-uniformly spaced components\* such as contoured or irregular slats or spindles use a (2 1/2" X 3 1/4" X 3 1/4") "B" block for this test. The minimum dimension of the block shall not pass through the space between the components on either side of the loading wedge.

Return the crib to its normal in-use position.

3. The crib component spacing requirement is also applied to spindles, slats, and other fully bounded openings near the top of the crib end panels (refer to Figure A below).

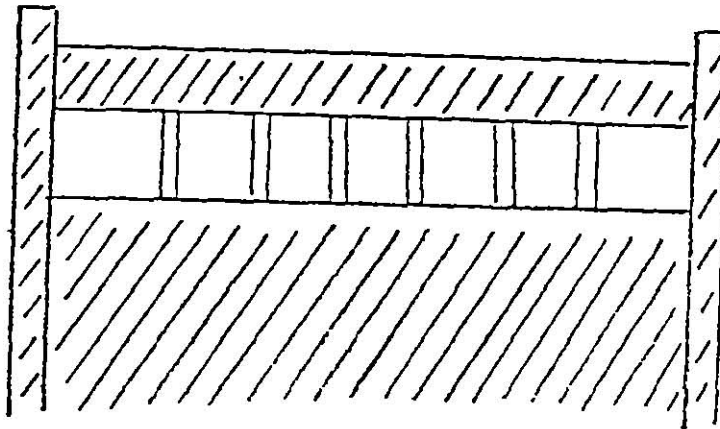


FIGURE A CRIB END PANEL WITH FULLY BOUNDED OPENINGS

Fully bounded openings near the top of the end panel do not present the same hazard pattern as do slats that are at mattress level. At mattress level the hazard presented by slats that are too widely spaced is that of an infant's body sliding between the slats. A fully bounded opening 20 inches above the mattress support would not present such a hazard, but if it were large enough to admit a child's head, it could present a head entrapment hazard.

Therefore, the Commission decided that the component spacing requirement of 2 3/8" would apply to fully bounded spaces above mattress level. This issue is discussed in the preamble of the final requirements for full-size baby cribs.

1. The fully bounded openings we have seen have contoured spindles. Spacing of such openings should be tested with the block which measures 2 3/8" X 4" X 4". Apply the end of the block which measures 2 3/8" X 4" to the openings with the 2 3/8" both horizontal and then vertical. The block should not fit through openings in either orientation.

\*Non-uniformly spaced components refers to irregularly shaped crib slats whether parallel to each other or not.

2. If you encounter any cribs with fully bounded openings with straight slats or spindles, measure the distances between components with a ruler. No distances should exceed 2 3/8". Also, conduct the tests as described in Section 2a and 2b on the crib endboards with fully bounded openings.

#### E. Hardware

1. Inspect crib hardware for mechanical hazards\* that could pinch, bruise, lacerate, crush, break, amputate, or that could otherwise, injure portions of the human body when the crib is subjected to reasonable foreseeable damage or abuse. Photograph any observed potential hazards.

2. Ascertain that the release mechanism of sides and/or end panels locking or latching devices is not activated when a force of less than 10 pounds is applied or that the mechanism requires two distinct actions for release. Apply force along the line of action of the latch mechanism, using the force gauge. If a force of less than 10 pounds releases the latching or locking device, record the force in the Test Report Form.

3. Check that no wood screw is used in the assembly of any stationary sides, drop rails, folding rails or stabilizing bars to crib ends or components that must be removed by the consumer in the normal disassembly of a crib.

#### F. Construction and Finishing

1. Inspect all wood surfaces for splinters and take a photograph. Record the results in the Test Report Form.

2. Inspect all wood parts for splits, cracks, or other defects which might lead to structural failure and photograph. Record the results in the Test Report Form.

3. In the case of Full-Size Baby Cribs ascertain that end panels and sides or any attachments have no horizontal bar, ledge, projection, or other surface accessible to a child inside the crib capable of being used as a toehold (>3/8") located less than 20 inches above the mattress support in its lowest position, when the side rail is in its highest position.

Also, toeholds > 3/8" in depth on fully bounded openings as depicted in Figure A on page 6 on crib endboards should be at least 20" above the mattress support in its lowest position in order to preclude toeholds accessible to the child.

\* Refer to page 7A for test procedures.

E.1. Hardware (Continued)

a. Small Parts Tests C.F.R. Part 1501-"Method For Identifying Toys And Other Articles Intended For Use By Children Under 3 Years Of Age Which Present Choking, Aspiration, Or Ingestion Hazards Because Of Small Parts," shall be used to determine any small part hazards. The results shall be noted in the comments section of the Test Report.

b. Use and Abuse Tests The Test Analyst and the Test supervisor shall evaluate each crib and determine the appropriate Use and Abuse Tests. The results of such tests shall be noted in the comment section of the Test Report.

c. Sharp Points and Sharp Edges Eventhough CFR 1500.48(b)(2) (sharp points) and CFR 1500.49(b)(2) Exempts these tests for Non-Full-Size and Full-Size Cribs, these test methods may be used at the discretion of the Test Analyst and the Test Supervisor to measure the extent of possible laceration or puncture hazards. The results of these tests shall be noted in the Test Report.



An exception to this requirement is the lower horizontal bar of the crib rail which may have a vertical dimension that extends no higher than 3 inches above the mattress support when in its lowest position.

In no case will any gap vertical between the top surface of the mattress support and the bottom of the lower horizontal rail of both the sides and the end panels be permitted. For purposes of this paragraph, any ledge or projection with a depth dimension greater than  $\frac{3}{8}$  inch shall constitute a toehold. Indicate compliance or indicate the violative dimensions in the Test Report Form.

4. In the case of a Non-Full-Size Baby Crib, measure and ascertain that the end panels and sides have no horizontal bar, ledge, projection or other surface accessible to the child inside the crib that could be used as a toehold (any ledge or projection with a depth or dimension greater than  $\frac{3}{8}$ ", located less than 16 inches above the mattress support when in the lowest adjustable position and when the crib side is in its highest adjustable position). Indicate compliance or indicate the violative dimensions of crib panel or side rail height above the mattress support in the Test Report Form and photograph the location of the violation. Also, toeholds  $> \frac{3}{8}$ " on fully bounded openings as depicted in Figure A on page 6 on crib endboards should be at least 16" above the mattress support in its lowest adjustable position in order to preclude toeholds accessible to the child.

#### G. Mattresses for Non-Full-Size Cribs Only

1. Place the crib side in its highest adjustable position and the mattress support in its lowest adjustable position to make this measurement. Measure and make sure that the mattress supplied with a nonfull-size crib has, in a noncompressed state, a thickness that will provide a minimum effective crib side height dimension of at least 20 inches, as measured from the upper surface of the mattress to the upper surface of the crib side and/or end panel.

After determining by measurement the minimum effective side height dimension, record this measurement in the Test Report Form.

Measure and make sure that the mattress supplied with a nonfull-size crib has, in a noncompressed state, a thickness that will provide a minimum effective crib side height dimension of at least 3 inches as measured from the upper surface of the mattress to the upper surface of the crib side and/or end panel. Place the crib side in its lowest adjustable position and the mattress support in its highest adjustable position to make the measurement.

After determining by measurement the minimum side height dimension, record this measurement in the Test Report Form.

2. Measure and make sure that the dimensions of the mattress supplied with a non-full-size baby crib when placed in the center of the crib, in a non-compressed state at any of the adjustable positions of the mattress support, does not leave a gap of more than 1/2 inch at any point between the perimeter of the mattress and the inside perimeter of the crib. When the mattress is placed against the inside perimeter of the crib the resulting gap must not exceed one inch.

After determining by measurement the maximum gap dimensions, record these measurements in the Test Report Form.

#### H. Assembly Instructions Criteria

If the crib is shipped other than completely assembled, inspect that the following instructions are given in the instruction manual:

1. An assembly drawing.
2. A list and description of all parts and tools required for assembly.
3. A full-size diagram of the required bolts and other fasteners.
4. Be so written that an unskilled person can correctly assemble the crib without making errors that would result in improper and unsafe assembly.
5. Include cautionary statement concerning the secure tightening and maintaining of bolts and other fasteners.
6. Contain a cautionary statement that when a child's height reaches 35 inches, the child should be placed in a youth bed.
7. Contain the warning relative to mattress size for full-size cribs described in section 1.3.
8. Contain a warning relative to mattress size for the non-full-size baby crib that specifies the dimensions of any mattress to be used with the crib as determined under Section 1.4.

Also, attach a copy of the assembly instructions in the Crib Test Report.

1. Identifying Marks and Warnings

Ascertain if the cribs and their retail cartons are clearly marked as follows:

1. The name and the place of business (city and state), of the manufacturer, importer, distributor, and/or seller; and

2. A model number, stock number, catalog number, item number, or other symbol expressed numerically, in code or otherwise, such that only articles of identical construction, composition, and dimensions shall bear identical markings.

Describe any non-compliance in the comments section of the report.

3. In the case of full-size cribs, ascertain if the following warning appears on the retail carton and on the inside of the head end panel or on the top surface of the mattress support in a type size of at least one-fourth inch:

"CAUTION: Any mattress used in this crib must be at least 27 1/4 inches by 51 5/8 inches with a thickness not exceeding 6 inches", or:

"CAUTION: Any mattress used in this crib must be at least 60 centimeters by 131 centimeters with a thickness not exceeding 15 centimeters."

The marking shall appear in block letters, shall contrast sharply with the background (by color, projection, and/or indentation), and be clearly visible and legible. The dimensions of the mattress shall be taken from seam to seam or edge to edge where appropriate.

Describe any non-compliance in the comments section of the report.

4. In the case of a non-full-size crib, ascertain if the following caution statement appears on an inside surface of a non-full-size baby crib in a type size of at least 1/8 inch:

a. For rectangular cribs:

"CAUTION: Any mattress used in this crib must be at least \_\_\_\_\_ inches long by \_\_\_\_\_ inches wide and not more than \_\_\_\_\_ inches thick."

The blanks are to be filled with dimensions complying with Sections G1 and G2.

b. For nonrectangular cribs:

"CAUTION: Check proper fit of mattress. Should be not more than \_\_\_\_\_ inches thick. The maximum gap between mattress and inside of crib border (or edge) should be no more than 1 inch."

The blank is to be filled in with a dimension complying with Section G1.

c. The dimensions to be inserted in the blanks in the caution statements in Section 4 (a) and (b) shall be determined by the manufacturer according to the provisions of section 5. The markings shall appear in block letter, shall contrast sharply with the background (by color, projection, and/or indentation), and shall be clearly visible and legible.

Describe any non-compliance in the comments section of the report.

5. Ascertain that markings on the cribs are of a permanent nature, such as paint-stenciled, die-stamped, molded, or indelibly stamped directly thereon or permanently affixed, fastened, or attached by means of a tag, token, or other suitable medium.

The markings shall not be readily removable or subject to obliteration during normal use of the article or when the article is subjected to reasonably foreseeable damage or abuse.

Describe any non-compliance in the comments section of the report.

6. Inspect that the retail cartons of cribs clearly indicate:

a. The name and place of business (mailing address, including zip code) of the manufacturer, importer, distributor, and/or seller; and

b. The model number, stock number, catalog number, item number, or other symbol described in Section 1.2 of this document.

Describe any non-compliance in the comments section of the report.

7. Inspect that all non-full-size and full-size cribs and their retail cartons bear a conspicuous label stating that the article conforms to applicable regulations promulgated by the Consumer Product Safety Commission. The label need not be permanently attached to the article and carton nor is any particular wording required for the statement. The label on the article must be conspicuous under normal conditions of retail display.

All non-full-size baby cribs and their retail cartons introduced into interstate commerce for a period of 2 years after August 10, 1976, must bear such a label.

All full-size cribs and their retail cartons introduced into interstate commerce on or after February 1, 1974 through January 31, 1976 must bear this label.

Describe any non-compliance in the comments section of the report.

J. Requirements for Cutouts Along the Upper Edges  
of an End or Side Panel

1. Place the neck of the headform probe shown  
in Photo #1A and #1B below into any cutout located along  
the upper edges of an end or side panel of the crib. A  
cutout is a partially-bound opening (refer to Figure #5).

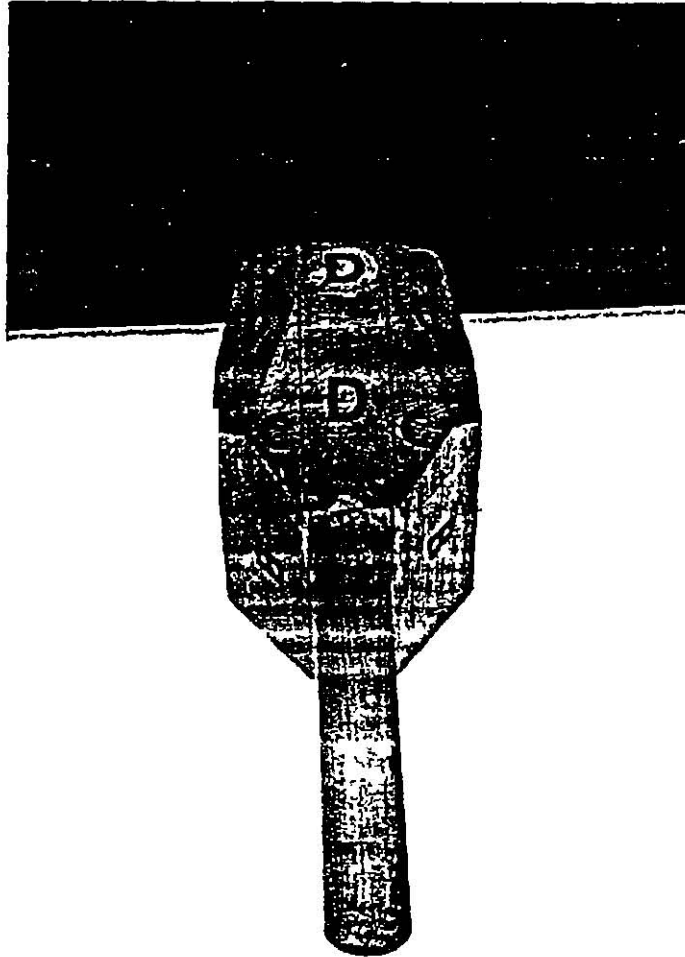


PHOTO #1A

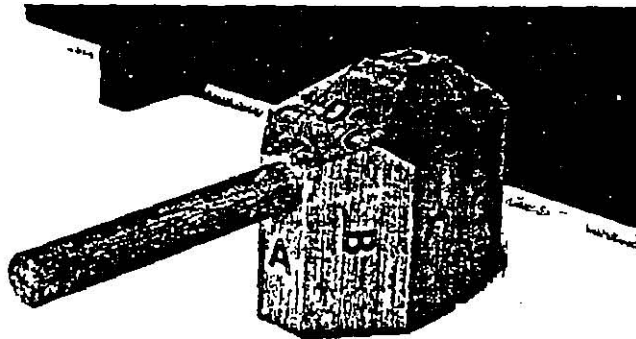


PHOTO #1B

## I. Cont'd:

The axis of the neck shall be horizontal and at right angles to the plane of the panel at the point of contact. The head portion of the probe shall be on the outer side of the panel (see PHOTO #2 below).

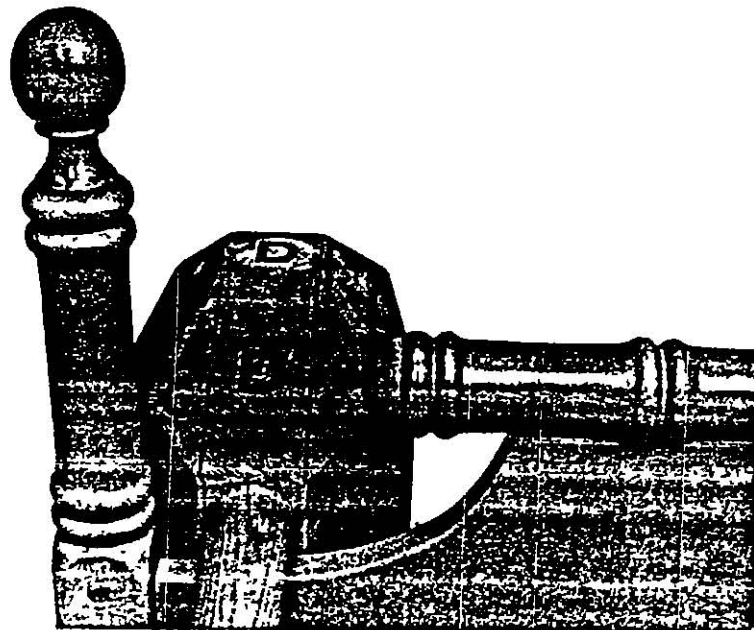


PHOTO #2

2. With the neck resting on the panel at any point\* within the cutout area and with the front of the probe pointing downwards, draw the head of the probe toward the panel until surface "A" makes contact with the outer side of the panel (see Figure #5 below and Photo #2).

\* For compliance purposes the Commission may test at all points that could result in a failure.

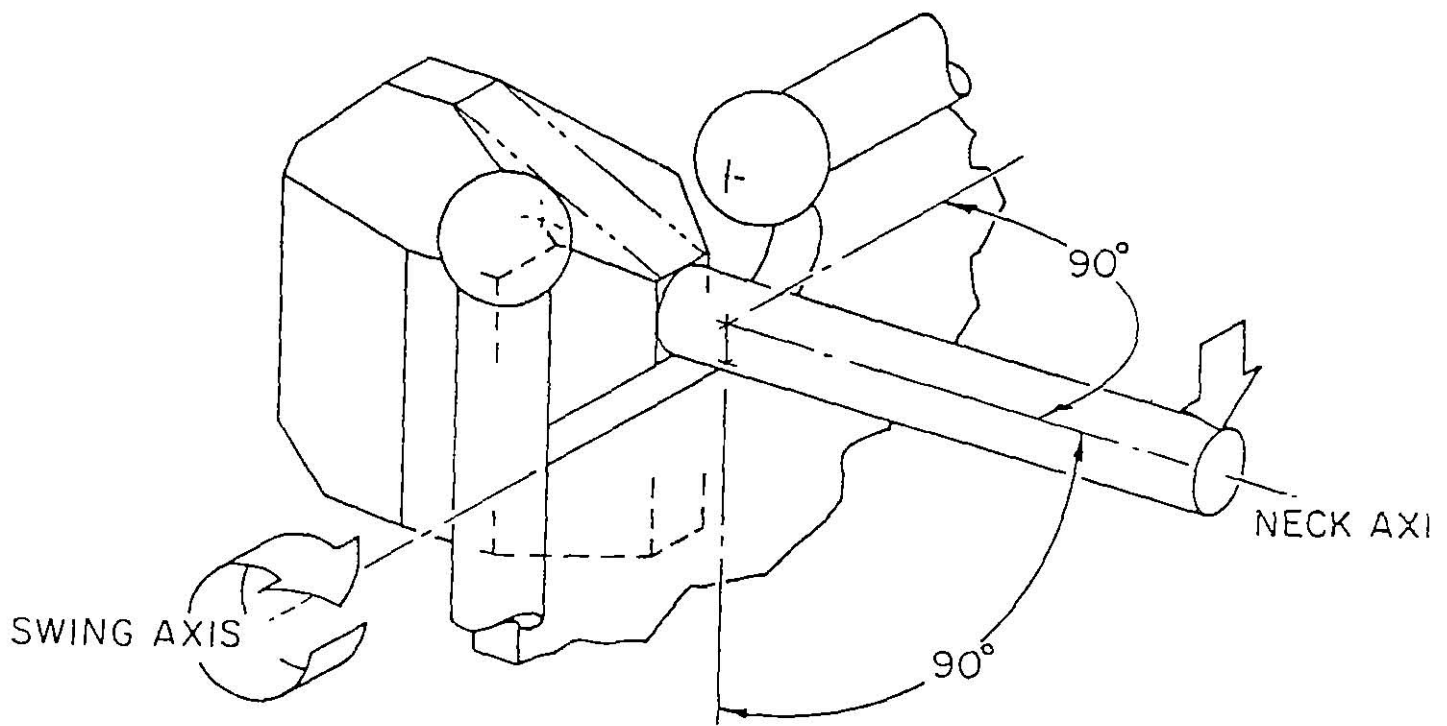


FIG 5



3. Push down on the neck to make the head of the probe swing upwards through the cutout in the panel (see PHOTO #3 below). The probe shall not be rotated about the major axis of the neck (refer to Figure #5 which depicts the neck axis). The arc through which the head is swung shall be in a vertical plane and shall stop when the major axis of the neck attains an upright position or is prevented from obtaining an upright position by an obstruction (refer to PHOTO #3 below). During this test contact shall be maintained between surface "A" (or at least one of the edges "AB") and the neck of the headform probe and the panel.

If, during the swing to the upright position, an edge or surface other than surface "D" is contacted, sideways motion of the headform shall not be restrained. However, the arc through which the headform is swung shall remain vertical (refer to Figure 7).

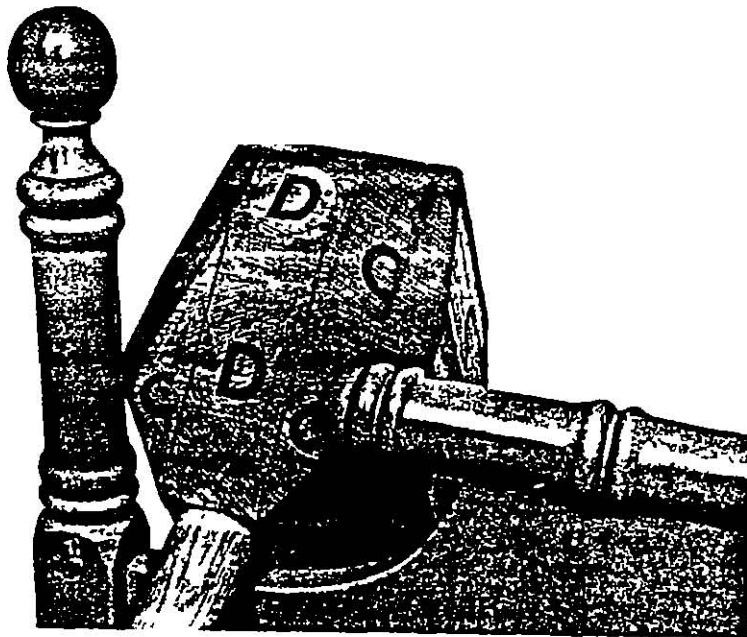


PHOTO #3 - Note that edge "B C" on the left side and surface "C" contact the panel which causes the crib panel to fail the test.

4. During the tests described in Sections 1, 2, and 3, no portion of the panel shall contact:

a. Simultaneously more than one of surfaces "B", "C" or edges\* "B C", "C C", or "C D", in any combination if they are on opposing sides of the head form.

b. Any surfaces "D".

\*Edges are identified by the letter designations for the surfaces that lie on either side of the edge.

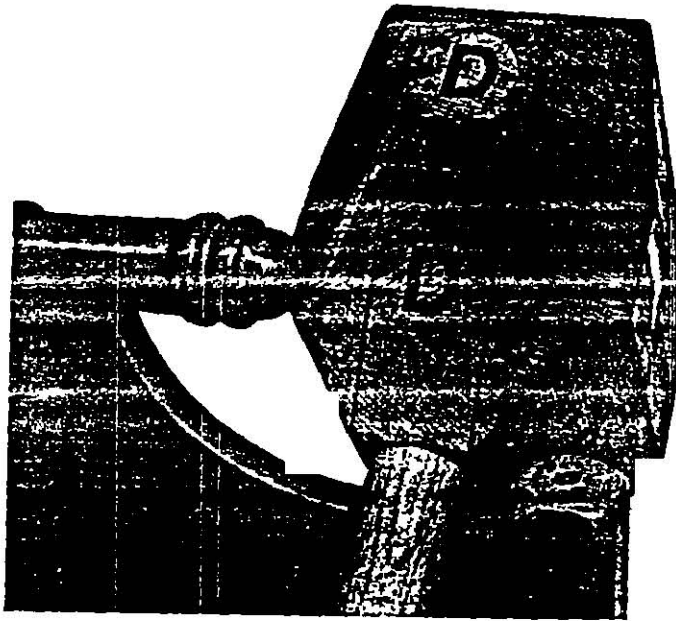


PHOTO #4 - Note that surface "C" on the left side of the head form probe and surface "B" on the right side contact the crib panel which causes the crib panel to fail the test for cutouts.

5. The following test is only for V-shaped cutouts located along the upper edges or side panel.

A cutout is considered V-shaped when the side boundaries or the tangents to the side boundaries are not parallel (see Photo #5 below).

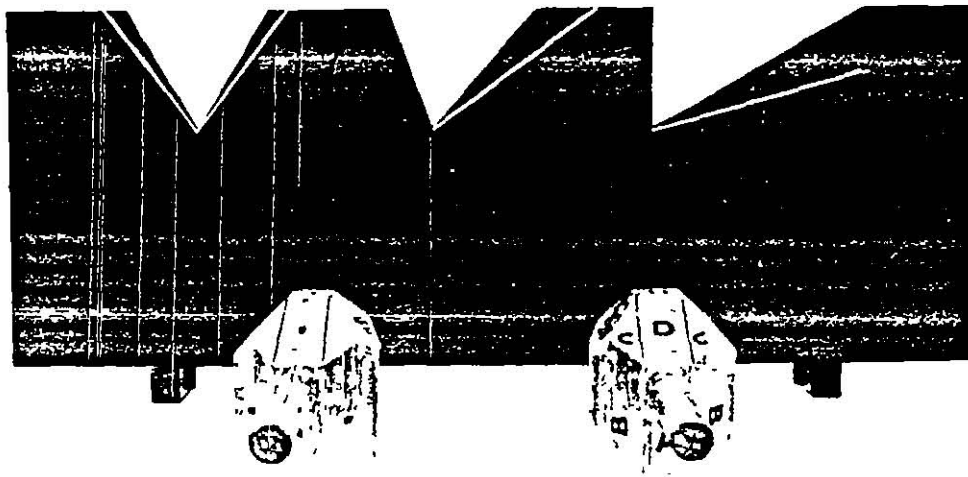


Photo #5 - Showing three V-shaped cutouts on a simulated crib panel.

Place the neck of the head form probe into the V-shaped cutout. The axis of the neck shall be horizontal and at right angles to the plane of the panel at the point of contact. The head portion of the probe shall be on the outer side of the panel. With the neck resting on the panel at any point with the cutout area and the front of the probe pointing downwards, draw the head probe toward the panel until surface "A" makes contact with the outer side of the panel (see Photo #6 below).

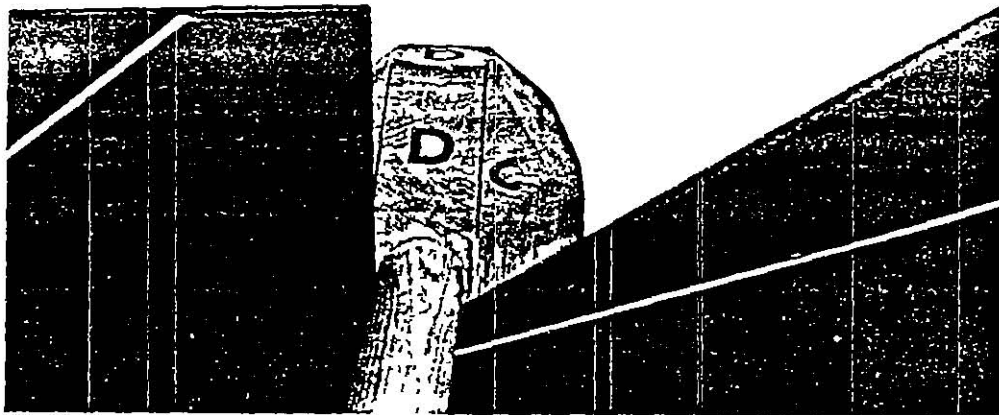


PHOTO #6

Upon completion of the swing to the upright position as described in III.J.1, 2, & 3 rock the head form probe sideways parallel to the plane of the panel while maintaining contact between surface "A" or an edge "A B" and the panel. Rotate the neck toward the most nearly vertical leg of the V and the head away from this leg of the V. This will result in the probe sliding toward the bottom of the cutout. The maximum angle through which the head form is rocked shall be determined by contact with the panel by a surface or edge other than "A" or "A B" or until one of the surfaces "B" is in a vertical plane (refer to Photos #7 and #7a).

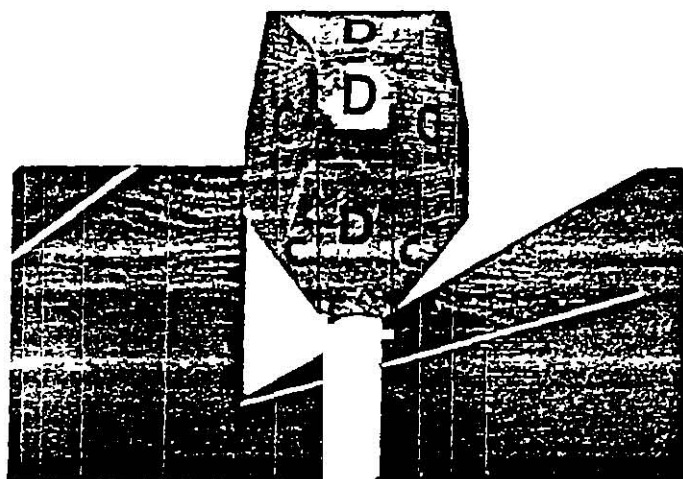


PHOTO #7

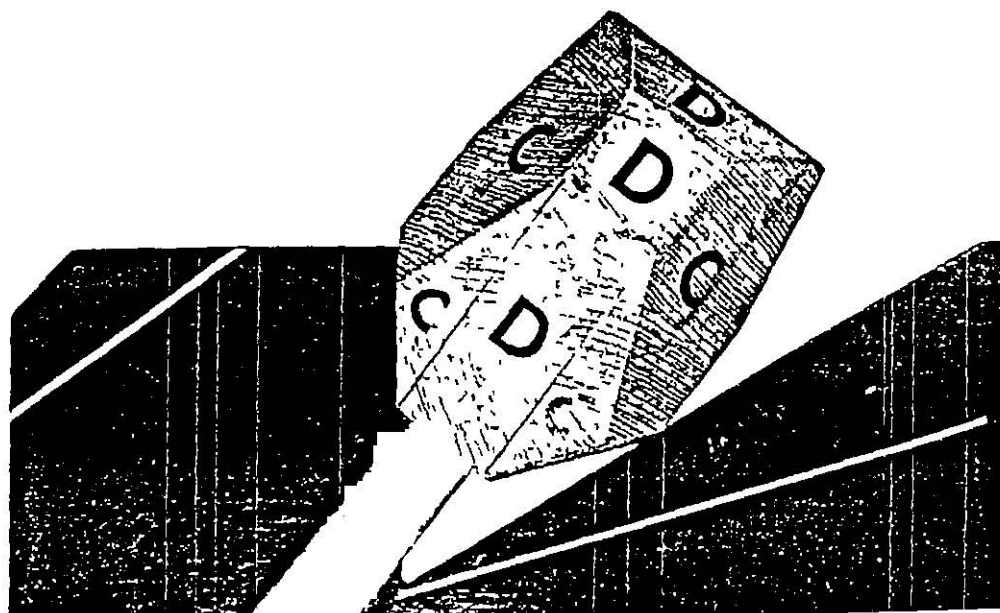


PHOTO #7A

6. During the test described above both before and during the rocking test, no portion of the panel shall contact:

a. Simultaneously more than one of surfaces "B", "C" or edges "B C", "C C" or "C D" in any combination if they are on opposing sides of the head form.

Or

b. Any surfaces "D"

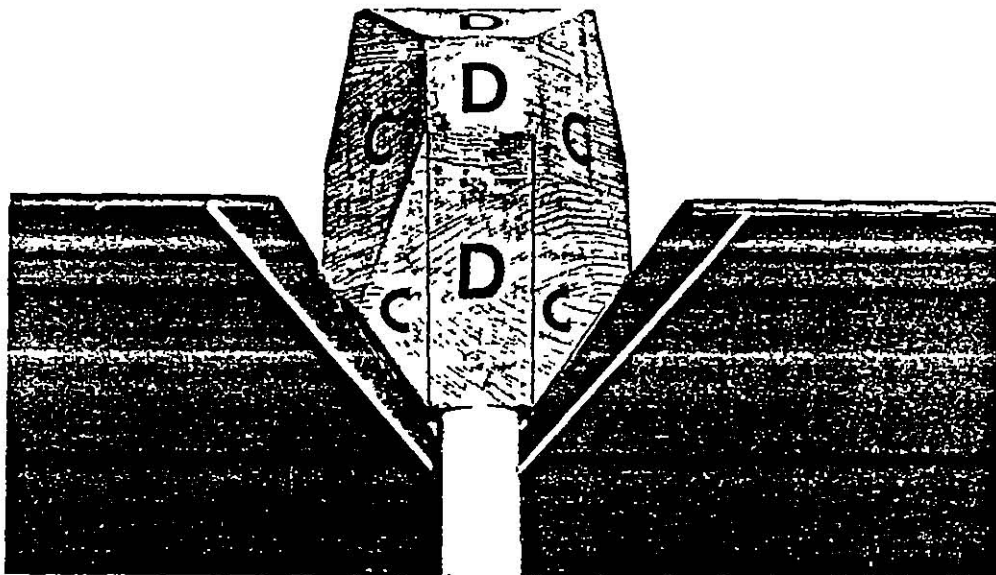
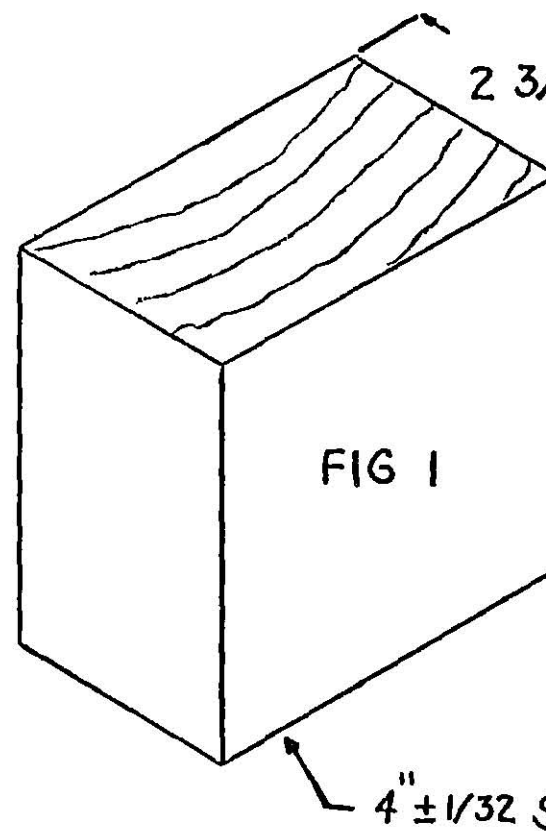
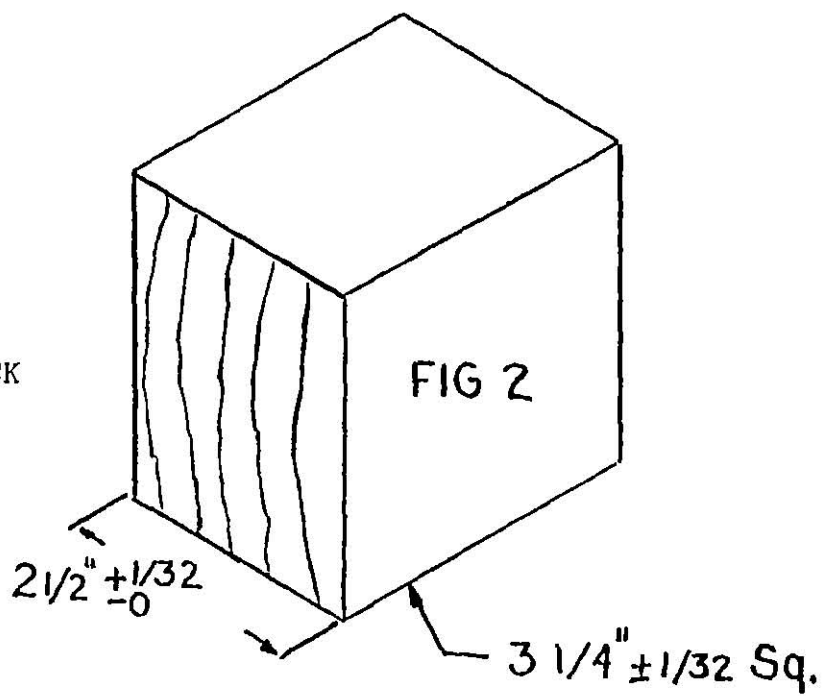


PHOTO #8A

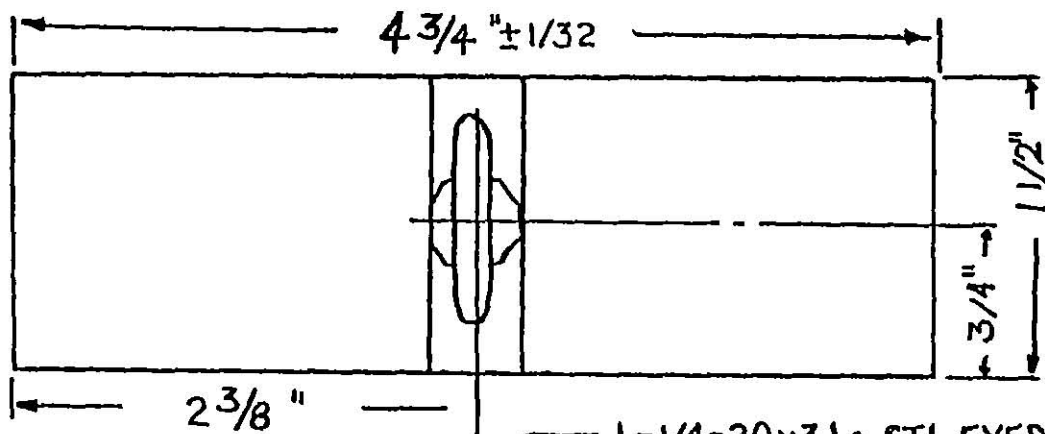
For this V-cutout the rocking test was not required because surface "B" on the left and right side of the probe contacted the panel causing the V-cutouts to fall.

#### IV. FIGURES

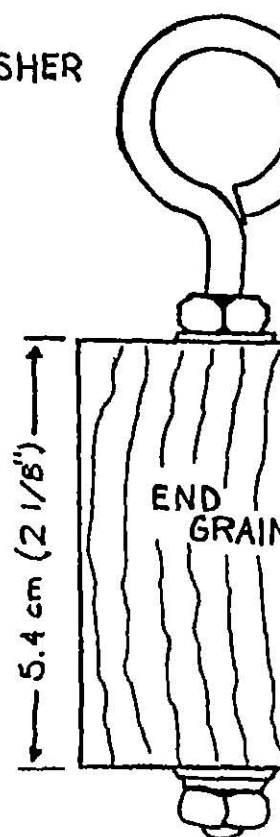
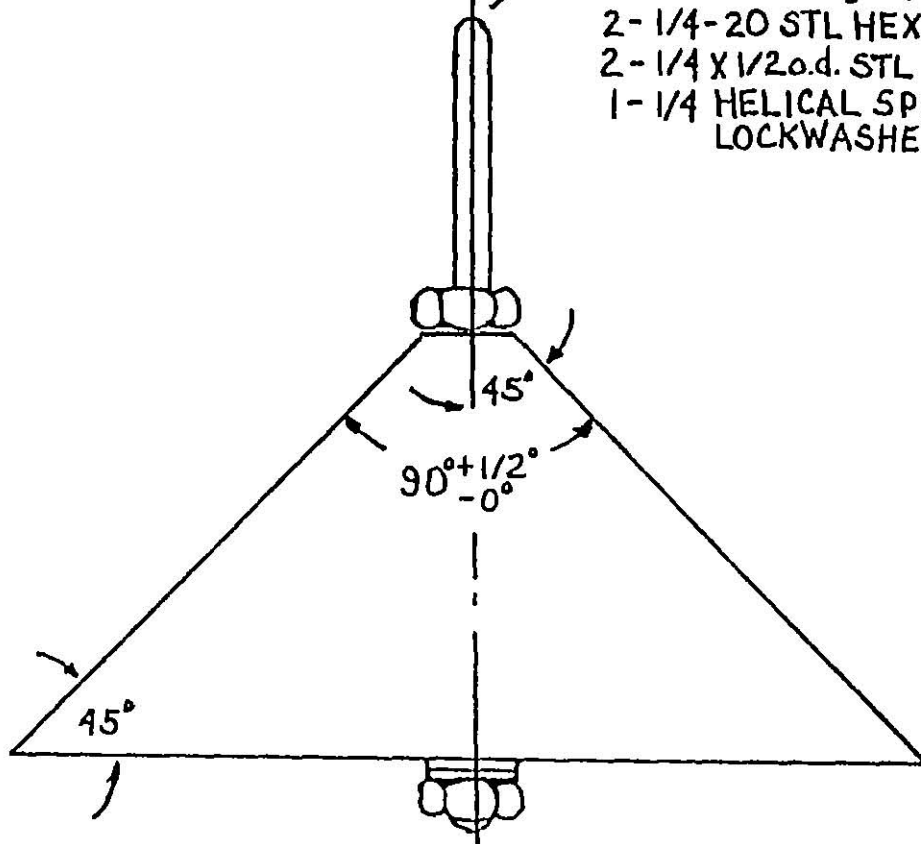
BLOCK  
"B"







- 1-  $\frac{1}{4}$ -20x3 Lg STL EYEBOLT
- 2-  $\frac{1}{4}$ -20 STL HEX NUT
- 2-  $\frac{1}{4}$ x $\frac{1}{2}$  o.d. STL PLAIN WASHER
- 1-  $\frac{1}{4}$  HELICAL SPRING STL LOCKWASHER



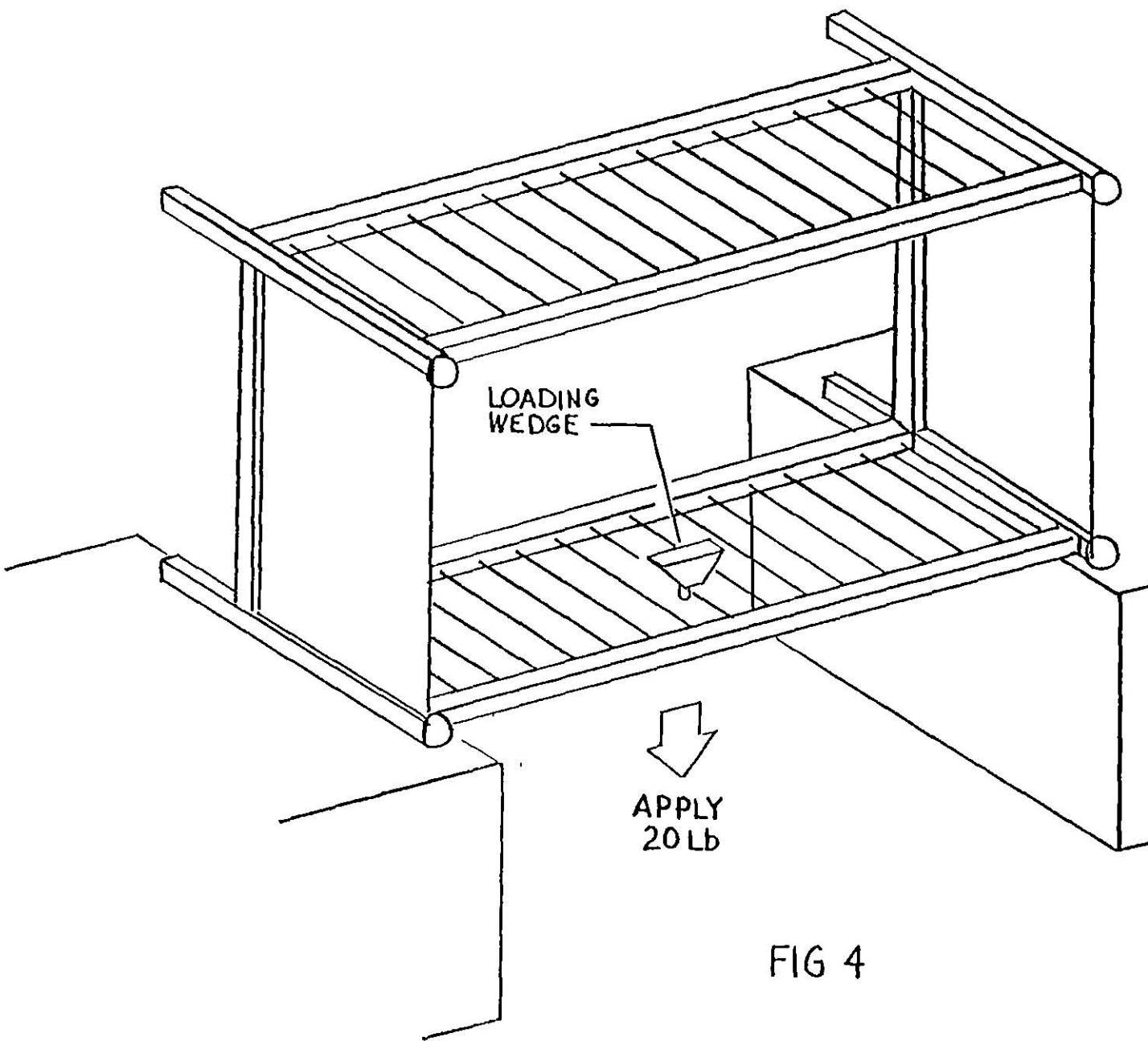


FIG 4

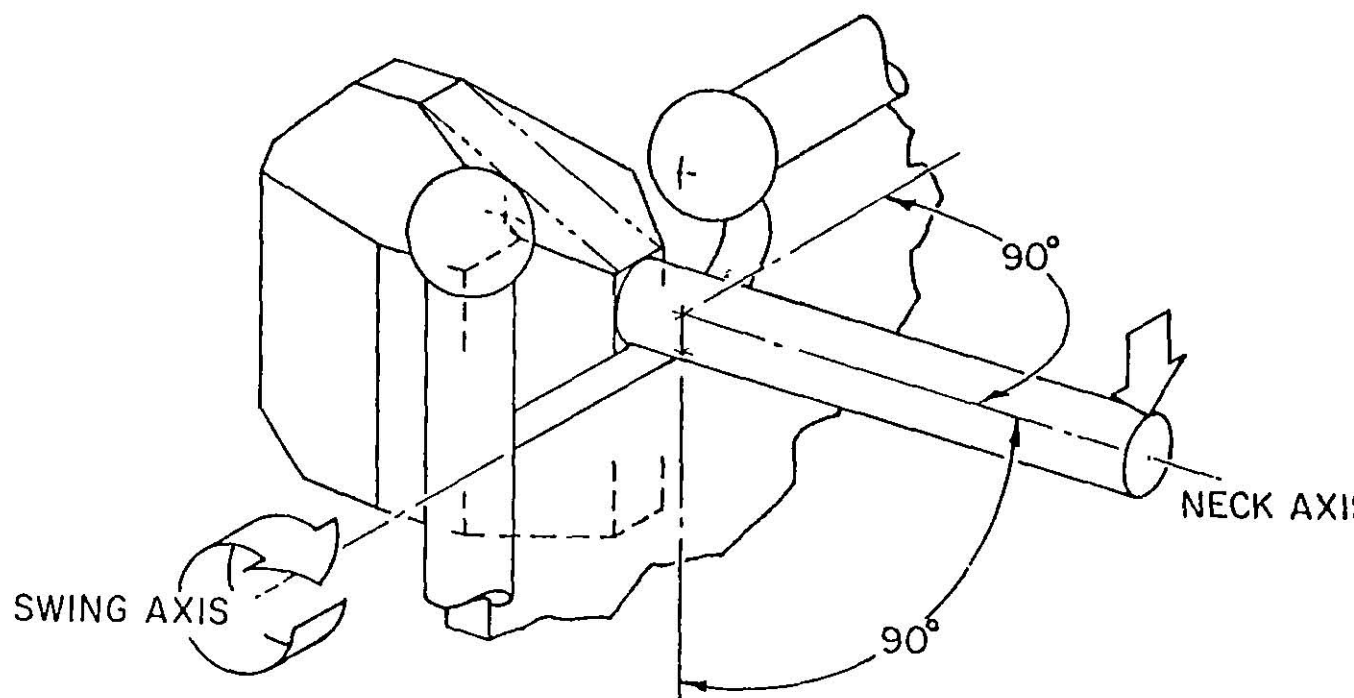


FIG 5

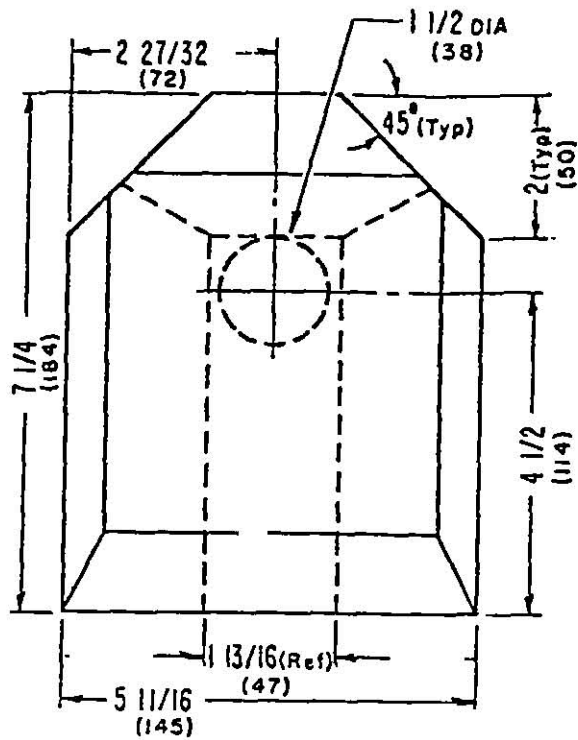
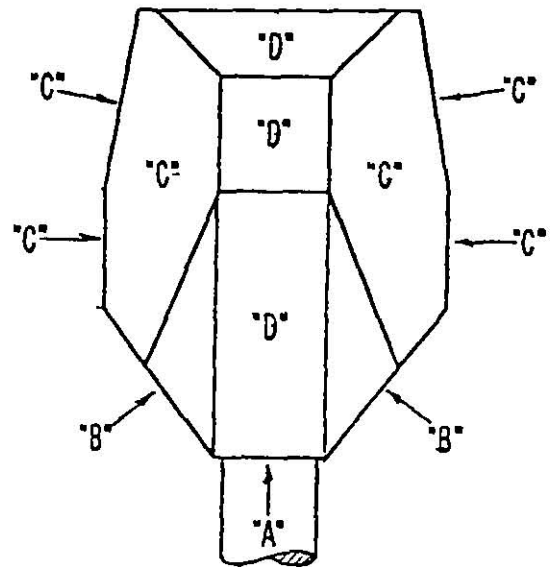
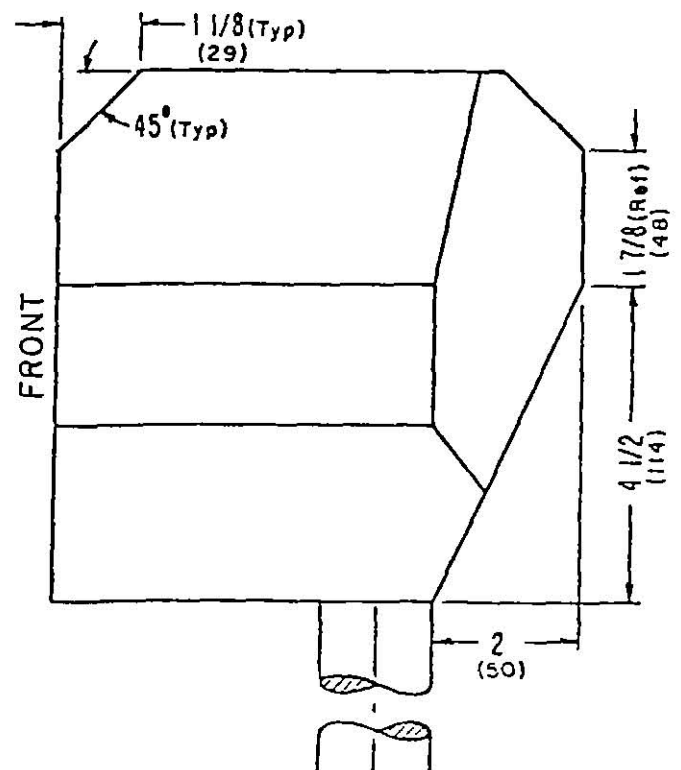
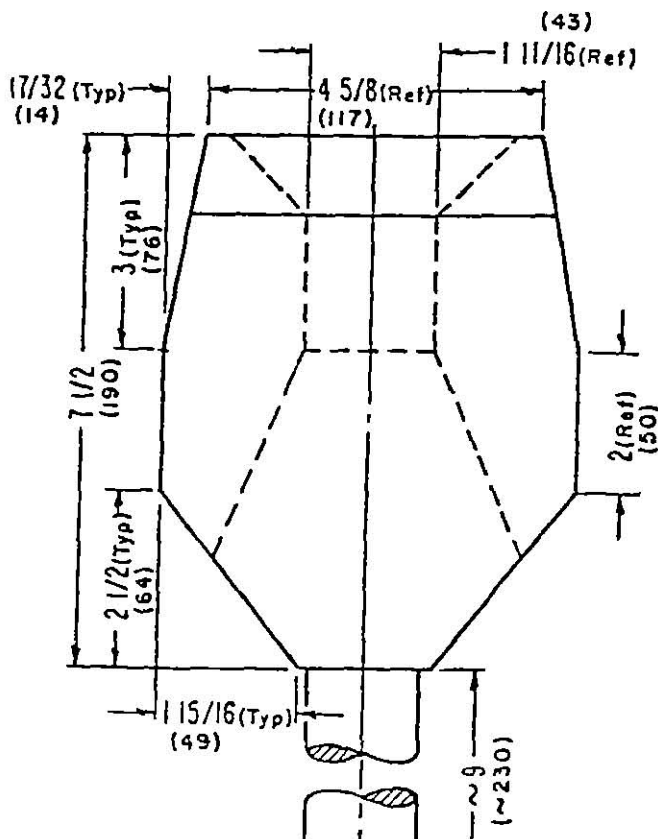


FIG 6-HEADFORM PROBE

DIMENSIONS ARE SHOWN IN INCHES AND WILL BE USED FOR COMPLIANCE PURPOSES. MILLIMETERS, SHOWN IN PARENTHESIS, ARE FOR CONVENIENCE ONLY.



REAR VIEW—  
IDENTIFYING SURFACES



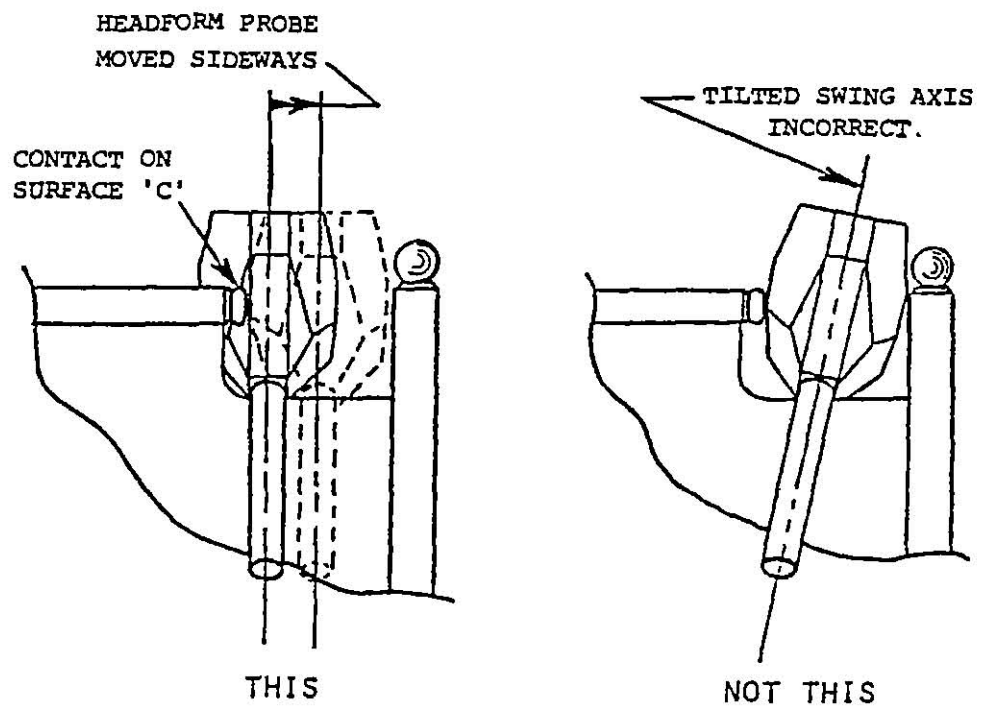


FIGURE 7

V. REPORTING REQUIREMENTS FOR FULL-SIZE  
AND NON-FULL-SIZE BABY CRIBS

The Full-Size and Non-Full-Size Baby Cribs report form used to report the results shall be per Appendix A and B. The names of the test personnel involved shall be inserted and final approval and responsibility shall rest with a certified test analyst. All test conductors or analysts shall be approved by the certified test analyst.

VI. APPENDIX

- A. CPSC Test Report for Full-Size Baby Cribs
- B. CPSC Test Report for Non-Full-Size Baby Cribs
- C. 16 CFR Part 1508 Requirements for Full-Size Baby Cribs.
- D. 16 CFR Part 1509 Requirements for Non-Full-Size Baby Cribs
- E. 16 CFR Part 1508.11 and CFR Part 1509.13

CPSC TEST REPORT FOR FULL-SIZE  
BABY CRIBS

DATE: \_\_\_\_\_

MANUFACTURER: \_\_\_\_\_

SAMPLE NO. \_\_\_\_\_

SUB ITEM NO. \_\_\_\_\_

MODEL OR STYLE: \_\_\_\_\_

## APPROVAL RECORD

\_\_\_\_\_  
Engineering Technician Date\_\_\_\_\_  
Test Analyst Date\_\_\_\_\_  
Supervisor Date



## CPSC TEST REPORT FOR FULL-SIZE BABY CRIBS

REFERENCE PARAGRAPH		REQUIREMENT	MEASUREMENT			
TEST MANUAL	REGULATION		MEETS CRITERIA (YES/NO)			
			SUB 1	Adjust Posit.	Length inches	width inch
III. A. B.	1508.1 (a)	<u>Interior dimension:</u> Length 51 3/4 to 53" Width 27 3/8 to 28 5/8"		#1-low		
	1508.3 (a)			#2		
				#3		
				#4		
				#5		
III. C1	(b)	<u>Crib Side Rail Height (H)</u> 1.Support highest, rail lowest H $\geq$ 9 in. 2.Support lowest, rail highest H $\geq$ 26 in.		Side R.	Left	Right
				#1		
				#2		
				#1		
				#2		
C2	(b)	<u>Crib End Panel Height (H)</u> 1.Support highest, rail lowest H $\geq$ 9 in. 2.Support lowest, rail highest H $\geq$ 26 in.		End Panel-head	foot	
				#1		
				#2		
				#1		
				#2		
III. D1 D2	1508.4	<u>Component Spacing</u> Spacing $\leq$ 2 3/8"		End Panel	Side Rail	
III. E1 E2 E3	1508.6	<u>Hardware</u> Elimination of pinching, bruising, laceration, crushing breaking, amputation, etc. Locking or latching device Activating Force $\geq$ 10 lb. force or two distinct actions No wood screws in assembly of stationary slides, drop side rails, folding rails, or stabilizing bars to crib ends or other components that must be removed by the consumer during normal disassembly				
				Side Rail	Force(lbs)	
				#1		
				#2		

Comments:

## CPSC TEST REPORT FOR FULL-SIZE BABY CRIBS

REFERENCE PARAGRAPH		REQUIREMENT	MEASUREMENT			
TEST MANUAL	REGULATION		MEETS CRITERIA (YES/NO)			
			SUB 1	COMMENTS		
III. F.	1508.7	<u>Construction &amp; Finishing</u>				
1.	(a)	No splinters on wood surfaces				
2.	(b)	No splits or cracks in wood parts or other defects which might lead to structural failure.				
	(c)	No toehold $>3/8"$ i.e. horizontal bar, ledge projection or other surfaces inside crib $<20"$ above mattress in lowest position & side rail highest (except lower horizontal bar of crib rail may have vertical dimension $\leq 3"$ above mattress support in low position. No gap between top surface of mattress support & bottom of lower horizontal rail.				
III. H	1508.8	<u>Assembly Instructions</u>				
		Other than completely assembled				
1.	(a)	Assembly drawing.				
2.	(b)	Parts list, description of parts and tools.				
3.	(c)	Full size diagram of fasteners				
		<u>Instructions</u>				
4.		1. for unskilled.				
5.		2. tighten bolts.				
6.		3. caution for child 35" & over in height.				
7.		4. warning for mattress size.				
III. I.	1508.9	<u>Identification Marks &amp; Warnings</u>				
1.	(b)	1. Name & place of business (crib & carton)				
2.		2. Model number (crib & carton)				
3.	(c)	Cautionary statement in letter size $\geq 1/4"$ (carton, & crib, or mattress support)				
4.	(d)	Permanent crib markings				
		1. Name & place of business (carton)				
5.	(e)	2. Model number (carton)				
III. J.	1508.11	<u>Requirements for Cut-outs</u>				
	(c)	During the test described in Paragraph (b) of this section, no portion of the panel shall contact;				
	1.	Simultaneously, more than one of surfaces "B", "C", or edges "BC", "CC", or "CD", in any combination if they are on opposing sides of headform.				
	2.	Any of surfaces "D".				

CPSC TEST REPORT FOR  
NON-FULL-SIZE BABY CRIBS

DATE: \_\_\_\_\_

MANUFACTURER: \_\_\_\_\_

SAMPLE NO. \_\_\_\_\_

SUB ITEM NO. \_\_\_\_\_

MODEL OR STYLE: \_\_\_\_\_

## APPROVAL RECORD

\_\_\_\_\_  
Engineering Technician Date\_\_\_\_\_  
Test Analyst Date\_\_\_\_\_  
Supervisor Date

## CPSC TEST REPORT FOR NON-FULL-SIZE BABY CRIBS

REFERENCE PARAGRAPH		REQUIREMENT	MEASUREMENT			
TEST MANUAL	REGULATION		MEETS CRITERIA (YES/NO)			
			SUB 1	ADJUST POSIT.	LENGTH Inches	WIDTH INCHES
III. B.	1509.2 (b)	1. Interior dimension:		#1-low		
		Length larger than 55" or		#2		
		smaller than 49 3/4"		#3		
		Width larger than 30 5/8" or		#4		
		smaller than 25 3/8"		#5		
III. C1	1509.3	Crib Side Rail Height (H)		Side R. left		right
	(a)	1. Support highest, rail lowest		#1		
		H ≥ 5 in.		#2		
	(b)	2. Support lowest, rail highest		#1		
		H ≥ 22 in.		#2		
C2		Crib End Panel Height (H)		End panel-Head		Foot
	(a)	1. Support highest, rail lowest		#1		
		H ≥ 5 in.		#2		
		2. Support lowest, rail highest		#1		
	(b)	H ≥ 22 in.		#2		
III. D	1509.4	Component Spacing		End Panel		Side Rail
1a, 2a	(a)	Spacing ≤ 2 3/8", spacing				
		≤ 2 1/2" above and below wedge				
		when a 20 lb. weight is applied				
1b, 2b	(b)	Non-uniformly spaced components				
III. E	1509.7	Hardware				
1	(a)	Elimination of pinching, bruising, laceration, crushing				
		breaking, amputation, etc.				
2	(b)	Locking or latching device		Side Rail		Force (lb)
		Activating Force ≥ 10 lb.				
		force or				
3	(c)	Two distinct actions				
		No wood screws used in the				
		assembly of stationary sides,				
		drop side rails, folding rails,				
		or stabilizing bars to crib				
		ends or other components that				
		must be removed by the consumer				
		during the normal disassembly.				

## CPSC TEST REPORT FOR NON-FULL-SIZE BABY CRIBS

REFERENCE PARAGRAPH		REQUIREMENT	MEASUREMENT MEETS CRITERIA (YES/NO)			
TEST MANUAL	REGULATION		SUB	COMMENTS		
III. F. 1 2  4	1509.8	(a) <u>Construction &amp; finishing</u> No splinters on wood surfaces				
		(b) No splits or cracks in wood parts or other defects which might lead to structural failure.				
		(c) No toehold > 3/8" i.e. horizontal bar, ledge, projections or other surfaces inside of crib < 16" above mattress support in its lowest position with crib side in highest position.				
		<u>Mattresses</u>				
III. G.             2	1509.9	(a) <u>Crib-side height</u>		Side R.	Left	Right
		1. side highest, mattress support lowest. Effective crib side height $\geq 20"$ .		#1		
				#2		
		(b) 2. side lowest, mattress support highest. Effective crib side height $\geq 3"$ .		#1		
				#2		
		<u>Crib-end panel height</u>		End Panel	Head	Foot
		1. side highest, mattress support lowest. Effective crib end panel height $\geq 20"$		#1		
				#2		
		2. side lowest, mattress support highest. Effective crib end panel height $\geq 3"$ .				
		(b) <u>Mattress dimension</u>		Maximum Gap (inches)		
		Maximum gap* with mattress centered $\leq 1/2"$ .				
		Maximum gap* with mattress against side $\leq 1"$ .				

## Comments:

\*Between the perimeter of the mattress and the inside perimeter of the crib

## CPSC TEST REPORT FOR NON-FULL-SIZE BABY CRIBS

REFERENCE PARAGRAPH		REQUIREMENT	MEASUREMENT MEETS CRITERIA (YES/NO)			
TEST MANUAL	REGULATION		SUB 1	COMMENTS		
III. H.	1509.10	<u>Assembly Instructions</u>				
1	(a)	Include assembly drawings				
2	(b)	Include list and description of parts; tools for assembly				
3	(c)	Include full-size diagram of required bolts, fasteners				
4	(d)	Are written to preclude unsafe assembly by unskilled				
5	(e)	Include cautionary statements concerning fastener tight- ening; maintenance				
6	(f)	Contain cautionary statements of non-use by child $\geq$ 35" tall				
8	(g)	Contain warnings specifying dimensions of substitute mattress which would comply with 1509.9				
III. I.	1509.11	<u>Identification Marks &amp; Warnings</u>				
1	(a)	1.Manufacturer's name & location.				
2		2.Model stock number.				
4	(b)	Caution statements $\geq$ 1/8" type				
		*1.Mattress size; correctly stated (rectangular cribs)		Length	Width	Thick
		*2.Mattress gap (non-rectangular cribs)		Thickness		Gap
		3.Legibility of caution state- ments				
5	(c)	Marking method; permanent nature.				
6	(d)	Retail carton indicates: 1.Name and place of business (address and zip) 2.Model or stock number as per 1509.11 (a) (2)				
7	(e)	Crib or carton conspicuous label with CPSC regulation				

\*Refer to paragraph 1509.9(a.)&amp;(b.)

\*\*Refer to paragraph 1509.9(a.)

Comments:

## CPSC TEST REPORT FOR NON-FULL-SIZE BABY CRIBS

REFERENCE PARAGRAPH		REQUIREMENT	MEASUREMENT MEETS CRITERIA (YES/NO)			
TEST MANUAL	REGULATION		SUB 1	COMMENTS		
III. J.	1509.13 (c)	<u>Requirements for Cut-outs</u> During the test described in section J. of this manual, no portion of the panel shall contact: 1. Simultaneously more than one of surfaces "B", "C" or edges "BC", "CC" or "CD" in any combination if they are on opposing sides of the headform. 2. Any of surfaces of "D"  (NOTE: If the panel does not meet the criteria for cut-outs list the edges or surface which contact the headform probe and photograph the headform probe contacting these surfaces.)				

Comments:

## Appendix K: Crib Company's Manufacturing Country with Number of Incidents per Company

Crib Company	Countries Manufactured	Number of incidents	Source
IKEA	Poland Romania Ukraine	5	Krister Hardafsegerstad (representative of company)
GRACO CHILDREN'S PRODUCTS CO.	Could not find	7	
DREAM ON ME	Could not find	2	
SIMPLICITY FOR CHILDREN	China	114	<a href="http://www.cpsc.gov/cpscpub/prerel/prhtml09/09260.html">http://www.cpsc.gov/cpscpub/prerel/prhtml09/09260.html</a>
STORKCRAFT INTERNATIONAL	Canada China Indonesia	33	<a href="http://www.cpsc.gov/cpscpub/prerel/prhtml10/10046.html">http://www.cpsc.gov/cpscpub/prerel/prhtml10/10046.html</a>
DELTA ENTERPRISE CORPORATION	Indonesia	56	<a href="http://www.cpsc.gov/cpscpub/prerel/prhtml06/06036.html">http://www.cpsc.gov/cpscpub/prerel/prhtml06/06036.html</a>
JARDINE ENTERPRISES	Taipei, Taiwan	18	<a href="http://www.jardinecribrecall.com/press_release.php">http://www.jardinecribrecall.com/press_release.php</a>
CHILD CRAFT, IND. INC.	Honduras	3	<a href="http://www.cpsc.gov/cpscpub/prerel/prhtml06/06504.html">http://www.cpsc.gov/cpscpub/prerel/prhtml06/06504.html</a>
AFG INTERNATIONAL	Could not find	2	
MILLION DOLLAR BABY (davinci)	Could not find	10	
BABI ITALIA/ LAJOBI INDUSTRIES INC.	Vietnam	3	<a href="http://www.cpsc.gov/cpscpub/prerel/prhtml09/09238.html">http://www.cpsc.gov/cpscpub/prerel/prhtml09/09238.html</a>
BASSETT FURNITURE INDUSTRIES	China	6	<a href="http://www.cpsc.gov/cpscpub/prerel/prhtml08/08581.html">http://www.cpsc.gov/cpscpub/prerel/prhtml08/08581.html</a>
NURSERY MAID	Could not find	1	
BABY CACHE	Could not find	5	
BABY'S DREAM FURNITURE, INC.	Could not find	3	
SORELLE- DIVISION C & T INTERNATIONAL, INC	Could not find	15	
WESTWOOD DESIGN	Could not find	1	
LAND OF NOD	Could not find	1	
ARGINGTON	Could not find	1	
NATART JUVENILE	Could not find	1	
POTTERY BARN KIDS	Could not find	6	
STANLEY FURNITURE (YOUNG AMERICA)	United States	2	Craig Carlton (representative of company)
BONAVITA A DIVISION OF LAJOBI INDUSTRIES	Italy United States	4	
DUCDUC INC.	Could not find	1	
NURSERYWORKS	Could not find	1	



# Appendix L: IDI Investigator Job Description

POSITION DESCRIPTION (Please Read Instructions on the Back)									
2. Reason for Submission <input type="checkbox"/> Reassignment <input type="checkbox"/> Promotion <input type="checkbox"/> New <input checked="" type="checkbox"/> Other		3. Service <input type="checkbox"/> Inactive <input checked="" type="checkbox"/> Field		4. Employing Office Location Bethesda, Maryland		5. Duty Station Various Field Locations		1. Agency Function No. 0196	
7. Fair Labor Standards Act N/Exempt <input type="checkbox"/> Nonexempt		8. Position Status <input checked="" type="checkbox"/> Competitive <input type="checkbox"/> Noncompetitive <input type="checkbox"/> Other		9. Financial Statements Required <input type="checkbox"/> Executive Personnel <input type="checkbox"/> Employment <input type="checkbox"/> Financial Interests		10. Position Title Product Safety Investigator		11. Agency Use BUS CODE: 7777	
12. Classification Grade GS		13. Position Code 1801		14. Grade 07		15. Agency Use SPD 09/30/05		16. Agency Use	
17. Department, Agency or Establishment U.S. Consumer Product Safety Commission		18. Division Division of Field Investigations		19. Branch Field Investigations Branch		20. Section Investigations Team		21. Position Title Product Safety Investigator	
22. Supervisory Certification I certify that I am an employee of the U.S. Government and that the position is necessary to carry out Government functions for which I am responsible. This certification is made with the knowledge that this information is to be used for employment purposes relating to appointment and payment of public funds, and that false or misleading statements may constitute violations of such statutes or their implementing regulations.		23. Signature Carol J. Cave		24. Date 9/30/05		25. Signature Shawn B. Blain		26. Date 9/30/05	
27. Classification Job Grading Certification I certify that this position has been successfully graded as required by the U.S. Code in accordance with standards published by the U.S. Office of Personnel Management, and that the position is necessary to carry out Government functions for which I am responsible. This certification is made with the knowledge that this information is to be used for employment purposes relating to appointment and payment of public funds, and that false or misleading statements may constitute violations of such statutes or their implementing regulations.		28. Signature Shawn B. Blain		29. Date 9/30/05		30. Signature Carol J. Cave		31. Date 9/30/05	
32. Position Review a. Employee b. Supervisor c. Chief of d. Reviewer		33. Position Review a. Employee b. Supervisor c. Chief of d. Reviewer		34. Position Review a. Employee b. Supervisor c. Chief of d. Reviewer		35. Position Review a. Employee b. Supervisor c. Chief of d. Reviewer		36. Position Review a. Employee b. Supervisor c. Chief of d. Reviewer	

#### STATEMENT OF DIFFERENCES

The duties of this position are identical to those delineated in o.d. # 87-0195 . However, assignments are of less complexity and difficulty and are executed under greater supervisory control. Supervisory controls are gradually decreased and the complexity and difficulty of assignments increased until such time as the incumbent has acquired the knowledges, skills and abilities required for full performance.

#### INTRODUCTION

The Consumer Product Safety Commission (CPSC) is an independent regulatory agency of the Federal Government. The Commission administers five statutes related to the safety of consumer products. These are the Consumer Product Safety, Federal Hazardous Substances, Flammable Fabrics, Poison Prevention Packaging and the Refrigerator Safety Acts. The Commission has broad authority to establish and enforce safety standards and product bans, and to seek remedial action to alleviate risk to consumers from hazardous products in the marketplace.

This position is located in a CPSC Regional Center which is responsible for receiving and investigating consumer, industry, and trade complaints, surveillance of industries subject to Commission jurisdiction, evaluation of consumer products, coordination with other Government agencies and implementation of information and education programs. The incumbent serves as a Product Safety Investigator perform inspection and investigative functions to protect consumers from unreasonable risk of injury, illness or death due to dangerous products. Accordingly, the incumbent is responsible for the following:

#### DUTIES AND RESPONSIBILITIES-

- Determines compliance with CPSC regulations, laws, and product standards and identifies potential, substantial and imminent hazards. Collects legal evidence sufficient to determine noncompliance with applicable Federal law and serves as a primary fact witness for the Government in litigation and administrative hearings;
- Conducts non-complex establishment inspections of manufacturers, distributors, wholesalers, and retailers who produce, assemble, distribute and sell consumer products. Inspections are made for several purposes such as to determine a firm's compliance with Commission product standards or regulations, evaluate products for potential hazards, etc. Issues Notices of Inspection to affected firms, detentions responsible members of management, products involved and raw materials used, review formulas and tests conducted and evaluates the firm's quality control from a non-safety standpoint;
- Performs field testing of products to determine compliance with standards. Collects samples and conducts further research of firm's records to determine extent of interstate commerce and specific distribution;
- Conducts inspections to identify possible imminent and substantial product hazards where precedents or Commission guidelines exist; seeking guidance and assistance as necessary otherwise;
- Conducts interviews of responsible management personnel, obtaining affidavits and documents, examines production methods, product specifications, firm testing and quality control procedures, product certification and labeling;
- Inspects plant assembly processes, records and copies of consumer complaints and advises firm of its responsibility under Commission regulations and laws;

- Provides assistance to firms in preparing a Corrective Action Plan to address specific circumstances involved. Monitor effectiveness of such voluntary and mandatory correction plans, through review of records and spot-checks routine;
- Conducts investigations of product related accidents and potential accident situations. Collects information and data necessary to perform evaluations, to include review of official reports (police, medical, fire, etc.). Interviews with victims, witnesses and other knowledgeable parties, etc. Conducts on-site screening of products by utilizing appropriate test equipment such as electrical current leakage tester, etc.;
- Prepares concise, factual reports reflecting significant observations and describing evidence collected;
- Gathers pertinent information through application of effective investigative interviewing and fact-finding techniques. This requires the inherent to exercise mature judgement and poise when dealing with uncooperative or hostile parties;
- Provides technical safety related information to representatives of industry, Government and consumer groups or individuals. Provides assistance to a wide variety of groups and individuals seeking information and advice regarding the Commission's goals, policies, activities, etc. Actively participates in the dissemination of information materials in conjunction with the Commission's Information and Public Affairs Program;
- Assists project officers with compliance contracts with State and local government agencies and/or assists in the coordination of field monitoring of industry product recalls and other corrective actions;
- Travels to on-site locations such as production plants, company offices, distribution facilities, etc. through operation of motor vehicle or other means of transportation;
- Performs other duties as assigned.

#### KNOWLEDGE REQUIRED-

- Knowledge of investigative and fact-finding techniques, practices and methods to elicit information, data and evidence.
- Knowledge of Commission rules, regulations, and policies regarding product safety requirements and standards. Knowledge of Federal law and regulations administered by the Commission such as the CPSA, FPPA, FRSA, FPA, RSA, etc. Basic knowledge of the goals, functions and policies of the Commission's Information and Public Affairs Program and an understanding of its interrelationship with other Commission functions.
- Understanding of the technology associated with product safety processes, standards and requirements.



Skill in oral and written communications sufficient to conduct oral presentations and to prepare concise written reports of findings and other written materials.

Skill in establishing and maintaining effective work relationships in meeting and dealing with others at all levels through the Commission, Federal, State and local agencies and private industry.

Possession of a valid Federal or State motor vehicle operators license.

#### SUPERVISORY CONTROLS-

This position is under the technical and administrative supervision of the Supervisory Investigator who assigns the work by establishing objectives and deadlines and approaches. The incumbent is responsible for independently planning, scheduling and executing assignments, and seeking assistance in resolving technical and administrative problems as necessary. The Supervisor provides additional policy guidance or assistance as needed. Work is reviewed upon completion for objectives attainment, timeliness and policy conformance.

#### GUIDELINES-

Available guidelines include laws, rules and regulations regarding product safety standards, requirements and procedures. The incumbent must exercise sound judgement in selecting, interpreting and applying these guides, seeking assistance as necessary from a higher grade Investigator or Supervisor.

#### COMPLETIVE-

This position involves technical and investigative work in the conduct of fact-finding activities. Incumbent is responsible for planning and conducting data and information collection, review, analysis and evaluation regarding product safety inspections, investigations and reviews. This requires the incumbent to apply a knowledge of investigative and fact-finding methods, techniques and practices; knowledge of Federal laws, rules of evidence, rules and regulations regarding product safety and fact, poise and diplomacy in dealing with others to elicit information. The work also involves preparing and presenting concise findings of fact, and providing materials and assistance to others through the Commission's Information and Public Affairs Program.

#### SCOPE AND EFFECT-

This position involves the performance of investigative work associated with consumer product safety throughout a given geographical area (e.g., Region). Incumbent is responsible for performing fact-finding and investigative activities such as on-site reviews of records and files, interviews, reviews and analyses of products, accident sites, production information and data, quality control procedures, consumer claims, etc. Work performed impacts upon the safety of consumers and the Commission's capability to accomplish main-line mission goals throughout the Region.