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**NCAA Division I, II, and III Track and Field Hammer  
Throw Facilities: Compliant with International  
Safety Standards?**

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## Abstract

The highly competitive nature of intercollegiate athletics has created an “arms race” with schools committing major resources to new and upgraded facilities. However, these facility resources are seldom equally spread amongst all sport programs. The hammer throw, a throwing event within track and field, often has competition and practice venues that are overlooked or neglected. Significant injuries and deaths in this event warrant an examination of the hammer throw facilities from both a policy and risk management perspective. This study examined the level of compliance for National Collegiate Athletic Association (NCAA) hammer throw facilities with NCAA and International Association of Athletics Federations (IAAF) recommendations for facilities across all three NCAA divisions via a 35-item online survey. Respondents indicated 69.6% of hammer facilities were in compliance with NCAA guidelines while only 35.8% complied with the more stringent IAAF standards. One-way ANOVA analyses of overall facility safety demonstrated significant differences for 13 facility factors, and regression analysis determined four facility factors that were significant predictors of overall facility safety: a dedicated hammer facility, cage age, cage gates, and meeting IAAF specifications. In light of these findings, the NCAA should consider closer alignment of its hammer facility guidelines with the IAAF standards.

## NCAA Division I, II, and III Track and Field Hammer Throw Facilities: Compliant with International Safety Standards?

The enormous financial rewards for a successful athletic program have fueled an arms race among National Collegiate Athletic Association (NCAA) member institutions to build larger, more lavish venues that can increase revenues from luxury suites and sponsors and also serve to attract prospective athletes. Over the past five years, schools in the NCAA's top six sport conferences raised more than \$3.9 billion for new sport facilities, according to the *Chronicle of Higher Education* (Wolverton, 2007). Schools engage in this arms race by building and upgrading stadiums, training facilities, offices, and meeting rooms. Athletic facilities are often showcased and viewed as a symbolic commitment to excellence by the entire university. The race to build the best and biggest facilities, however, is not an equal-opportunity competition for all sports. High-revenue generating sports such as football and men's basketball typically receive the majority of funding while other sport programs, often referred to as “Olympic” sports, have much smaller budgets (Dudley & Rutherglen, 2002).

Some Olympic sport facilities at NCAA institutions are world class venues while others may be less than desirable. Olympic sport venues like track and field ovals and throwing areas have been affected in two ways by this trend of facility expansion: first, track facilities are most often not included in the expansion trend and money is often allocated to other sports leaving many track facilities out-of-date; second, tracks are being

removed from their original location inside football stadiums (Hunter, 2000; King, 2009) and are often not rebuilt to the standards of the facilities for the revenue-producing sports. The trend of removing track facilities from the primary university stadium is often traced to the 1979 renovation of Martin Stadium at Washington State University when the track was removed to add seating for football (King, 2009). Other schools have since followed Washington State's example.

In some cases, a poorly designed/poorly funded venue can increase a university's potential liability from an accident. Some NCAA institutions have found themselves involved in litigation because of track and field and, specifically, throwing event accidents (Connolly, 2006). For example, **Rucker v. Regents of the University of California** was an example of a case from 1993 in which the University of California was forced to pay a settlement of \$2.25 million because of a hammer throw accident (Lewellyn, 2008). An errant throw resulted in Mr. Rucker, a triple jumper on the team, being struck in the head and sustaining permanent brain damage during a team practice. In the 1980s, a sportswriter was killed by a hammer thrown during the Bakersfield - Cal State Los Angeles dual meet at Cal State Los Angeles. During the 1999 United States of America Track and Field (USATF) National Championships, American record holder Dawn Ellerbe was struck just above her eye with a hammer handle from an errant throw that rico-

ched off of the cage (D. Ellerbe, personal communication, March 25, 2009). More recently, in 2005, Noah Bryant, a thrower at the University of Southern California, was seriously injured when the hammer bounced off the cage and struck him in the face (N. Bryant, personal communication, May 21, 2009). During that same year, Rachel Longfors, a thrower from the University of Florida, was struck in the shoulder by a hammer while warning another athlete of impending danger during a competition (R. Longfors, personal communication, March 22, 2009). Tragic accidents of this nature provide anecdotal evidence that the safety of track and field facilities requires further study. Could these tragic accidents have been prevented by safer venues? Would venues mandated to meet current industry safety standards established by the International Association of Athletics Federation (IAAF) impact venue safety?

### **Hammer Throw Facility Requirements**

At the original inception of the modern hammer throw in Ireland, Scotland and England in 1866, there was no safety cage used (Dunn & McGill, 1991). As the event evolved, a “C” shaped cage was designed (Connolly, 2006). The hammer cage was originally designed to prevent the hammer from exiting the thrower’s hands in unprotected directions, such as out of the back, sides, and in dangerous angles from the circle. Equipment changes such as more precisely manufactured hammers, the invention of the concrete throwing ring and smooth-soled shoes that permitted faster spinning, and superior training methods increased throwing distances considerably (Connolly, 2006). The more-sophisticated equipment and resulting increased distances enhanced the dangers associated with the hammer throw.

As the sport developed and increased in popularity, the landing sector marked on the field for valid throws in the hammer throw (i.e., similar to a baseball field’s foul lines) has shrunk from 90 degrees to the 60 degrees of the 1960’s to 40 degrees in the 1970’s to the present sector angle of 34.92 degrees (Connolly, 2006). Prior to 2004, the last significant change to hammer cage design was in 1994-1995 when the height of the cage netting and more particularly the hammer cage gates were significantly increased in height (Laurel *et al.*, 2004). At this time, it was suggested (but not required) that an effective hammer cage have movable panels (gates) that were 2.00 meters wide and 6.15 meters in height. These dimensions were increased to 8.00 meters in height and 2.90 meters in width in 2004.

Even with the changes in safety standards of the cage

and the reduced throwing sector, the inclusion and growth of the hammer throw event has met considerable resistance from state high school associations as the hammer throw is currently only contested in one state. At the collegiate level, some athletic administrators are reluctant to stage the event on campus due to perceived risks. For example, the Ohio Valley Conference does not offer the hammer event as part of the outdoor conference championships (Ohio Valley Conference, 2009).

Rule 1, Section 9 of the NCAA Track and Field rulebook states that the purpose of the hammer cage is to contain, but not interfere with, the flight path of the implement (NCAA, 2008). The recommended minimum height for the NCAA hammer cage is 6.15 meters, and the rule book states that the height should be increased to 8 meters whenever possible. The gates are stated to be panels of suitable material between 2.74 and 2.90 meters in width with a fixed cage opening of between 8 and 9 meters. It is also stated in the rules that cage configurations that are more restrictive than the minimums set forth in this rule may only be used with the consent of each participating institution (NCAA, 2008). The problem, as noted by some coaches and participants, with current NCAA hammer cage recommendations and design is that implements can still land on the track’s front and back straight away even when the cage gates are operated correctly. The NCAA standards are far below the IAAF standards of a smaller 7 meter opening and gates that are 10 meters in height and 3.2 meters in length (Laurel *et al.*, 2004).

After three hammer-throw-related deaths in European venues in 2000, the 2001 IAAF Congress’ decided to reduce the landing sector angle to 34.92 degrees as a measure to improve safety (Laurel, Wilson & Young, 2004). Additionally, in August 2003, IAAF approved rule changes affecting hammer throw safety cages. These two measures taken by the IAAF Technical Committee were enacted rather than to change the event by altering the implement weight, length, or number of turns allowed (Laurel *et al.*). The IAAF considered the need for new cage designs as prior specifications did not provide enough safety (see diagram of cage specifications in Appendix 1). The new design modifications were made to augment safety by increasing the length and height of the gates as well as decreasing the opening between the front posts to accommodate the new throwing sector of 34.92 degrees. Studies of the trajectory of the hammer necessitated that the minimum height of the additional two side panels and the gates be increased to 10 meters (Gutiérrez, Soto, &

Rojas, 2002). The new IAAF rule standards came into force January 1, 2004 (IAAF, 2008). According to Laurel et al, (2004), the mathematical calculation method of the release velocity gives an 83 degree danger zone for the pre-2004 cage design. The pre-2004 IAAF cage design is the same as the current NCAA recommendations across all divisions. The danger zone for the new IAAF cage is approximately 53 degrees, thus reducing the danger zone by thirty degrees. The new design (see photo in Appendix 2) considerably reduces the danger of a hammer thrown by a right handed thrower from landing on the main straight away if the cage is located near the 1500 meter starting line (Laurel et al., 2004).

The new IAAF hammer cage design has worked well in terms of reducing the risk of hammers landing on the track (Laurel *et al.*, 2004). However, the new IAAF specifications have not been adopted by the NCAA rules committee. At the 2006 outdoor championships of USA Track and Field, Sam Seemes, CEO of the U.S. Track and Cross Country Coaches Association, polled a select group of NCAA throws coaches regarding adopting the IAAF hammer cage specifications. According to Mike Corn, assistant director of the U.S. Track and Cross Country Coaches Association, these coaches recommended not adopting the IAAF standards due to concerns related to the narrower opening impacting collegiate throwers and skepticism that IAAF standards would address safety concerns (M. Corn, personal communication, March 17, 2010). Although the NCAA has detailed facility site specifications for member institutions in numerous other sports, these detailed venue and facility specifications are not applied across the board for hammer throw facilities (NCAA, 2008). Given the dangerous nature of the hammer throw, the NCAA's standards not adhering to the IAAF standards, and the impending concerns from the NCAA's lack of enforcement of its standards, this study examined current NCAA Division I, II, and III hammer throw facilities.

## Research Questions

The following research questions guided this study of hammer throw facilities at NCAA institutions throughout the United States:

1. What are the basic characteristics of NCAA hammer throw facilities across all three divisions?
2. To what degree do NCAA college hammer throw facilities meet NCAA and IAAF standards?

3. How do hammer throw facility characteristics relate to facility safety?

## Methods

A 35-item survey instrument was developed to collect data regarding the hammer throw facilities at NCAA Division I (n=320), Division II (n=175) and Division III (n=275) colleges and universities throughout the United States that compete in track and field. This survey was developed by the researchers and reviewed by experts in the area of facility design and management and was approved via the researchers' Institutional Review Board. The inQsight system was utilized to allow for online survey administration. An email detailing the study was sent to all 770 head track and field coaches in the United States. The email included a statement of informed consent and a hyperlink to the online survey. The head coaches were instructed to complete the survey themselves or to forward it directly to their throws coach. In order to improve the response rate, a reminder to complete the survey was emailed two weeks following the initial contact.

A total of 139 valid responses were obtained representing an approximate response rate of 18.1% of NCAA member institutions with programs in track and field for either men and/or women. The distribution of responses by division included: 53.2% from Division I, 15.1% from Division II, and 31.3% from Division III. This distribution across the three NCAA divisions closely resembles the actual distribution of NCAA member schools with track and field programs with Division I at 320 for 41.6%, Division II at 175 for 22.7%, and Division III at 275 for 35.7% (NCAA, 2009). Once the raw data was obtained, SPSS version 17.0 was used to analyze the data via chi square, ANOVA, and regression analyses with an alpha level of .05 established for significance.

## Results

The experience of the coaches responding to the survey adds strength to the study's results. Those coaches completing the survey were experienced with the hammer throw event with a mean value of coaching experience of 9.6 years (SD = 7.6) with one participant documenting 39 years of throws coaching experience. Additionally, 52.6% of these coaches had prior experience competing in the hammer, and all study participants were coaching in track and field programs that fully included the hammer event.

The basic hammer throw facility characteristics were

obtained regarding the type and location of facility available at each school including the provisions for a dedicated hammer-only facility, location on the campus grounds, location inside the track oval, and hammer cage including gates. The distribution of these four characteristics across the three divisions was analyzed via a Pearson chi-square technique. The only variable with a significant difference in distribution across the divisions was the hammer facility located inside the track oval,  $\chi^2 (2, N = 137) = 10.056, p = .007$ . The hammer cage was located inside the track in 16.8% of all the facilities, but Division I was significantly greater with 26.4% inside the track compared to only 4.8% of Division II cages, and 6.8% of Division III cages inside the track. The basic characteristics of the hammer facilities at these universities are detailed for all divisions combined and for each of the three separate divisions in Table 1.

In addition to the basic facility characteristics, both knowledge of and compliance with NCAA and IAAF standards were assessed. A total of 69.6% of facilities were reported to be in compliance with NCAA guidelines for the hammer with 23.9% not in compliance and 6.5% unsure of their level of facility compliance. The NCAA has established hammer throw facility specifications, but only 54% of the coaches surveyed were aware that the NCAA does not actually require compliance with their own specifications. However, 78.4% of the coaches expressed that the NCAA should require all member institutions to comply with the established specification found in Rule 1, Section 9 of the NCAA Track and Field rulebook (NCAA, 2008). For the IAAF standards, 35.8% of the facilities were compliant with

the new standards put into effect in 2004. There were 62.8% of coaches aware of the IAAF standards. As a whole, 54% of the coaches who responded to the survey favored the NCAA adopting the more stringent IAAF facility standards for the hammer throw cage and sector.

In regards to safety for the hammer facility, a series of survey questions provided insight into the cost, construction, age, maintenance, and accident history for the hammer throw facilities. The reported hammer cage costs in US dollars included: 12.6% under \$10,000, 33.3% in the \$10,001-\$20,000 range, 15.6% in the \$20,001-\$30,000 range, 6.7% in the above \$30,001 range, with 31.9% unaware of cage costs. The reported age of the hammer throw cages were highest at the newer end with 25.4% 1-3 years old, 20.1% 4-5 years old, 17.9% 6-8 years old, 6.7% 9-10 years old, 20.1% 11-15 years old, with an additional 9.7% unsure of the cage age. Investigation on the manufacturer of the hammer cages via a Pearson chi-square analysis revealed a significant difference in distribution from the expected amongst the three division levels,  $\chi^2 (4, N = 134) = 9.776, p = .044$ . The most notable differences included Division II utilizing more local companies, and Division I utilizing fewer local companies in favor of commercial manufacturers and professional track contractors. Full data regarding the hammer cage manufacturer is summarized in Table 2.

The hammer cage installer had no significant differences in distribution across the three divisions according to a chi-square analysis and the combined division results were highest for commercial manufacturer/pro-

**Table 1: Basic Hammer Throw Facility Characteristics**

	All Divisions % Agreement	Division I % Agreement	Division II % Agreement	Division III % Agreement
Dedicated Hammer-Only Facility	45.3%	50.0%	42.8%	38.6%
Hammer Facility Located Inside the Track Oval *	16.8%	26.4%	4.8%	6.8%
Hammer Facility Located on the Campus Grounds	86.2%	85.1%	90.5%	86.0%
Hammer Cage Including Gates	80.1%	87.5%	66.7%	74.4%
Cage Meets NCAA Guidelines	69.6%	78.1%	52.4%	63.6%
Cage Meets IAAF Standards	35.8%	38.0%	30.0%	34.9%

\* significant chi square between divisions  $p = .007$

**Table 2: Hammer Cage Manufacturer Summary**

Cage Manufacturer	All Divisions	Division I	Division II	Division III
University Personnel	11.2%	12.7%	14.3%	7.1%
Local Company	20.1%	11.3%	38.1%	26.2%
Commercial Manufacturer/ Professional Track Contractor	68.7%	76.1%	47.6%	66.7%

*\*significant chi square between divisions, p = .044*

professional track contractor at 39.7%, university personnel at 38.2% and local companies at 22.1%. A full summary of the cage installer data by division is included in Table 3. The maintenance staff was reported to regularly respond to requests for repairs to the net or cage for 74.3% of the facilities, with the speed of maintenance staff response to repair requests ranging from: 15.5% immediate, 11.6% within a day, 18.6% in 2-3 days, 24.8% in 4-7 days, and 29.5% in more than a week.

The accident history for the hammer throw was reported in two areas: practice accidents and competition accidents. For practice situations, 9.6% of coaches reported accidents involving the hammer throw at their facilities. Of these practice accidents, the throwers themselves were the victim in 23.1% of the accidents, other throwers in the area were victims in 38.5% of the accidents, the coaches were victims in 23.1% of the accidents, and unaware bystanders were involved in 15.4% of the practice accidents. Competition accidents were reported in 5.1% of the facilities with the thrower themselves hurt in 22.2% of the accidents, other non-competing throwers hurt in 22.2% of the accidents, meet officials hurt in 33.3% of the accidents, coaches hurt in 11.1% of the accidents and bystanders hurt in 11.1% of the accidents.

A final analysis of the coaches overall perception of hammer facility safety was conducted. This included a 5-point Likert-scaled question ranging from very safe

(1) to very unsafe (5). The mean value for the combined divisions was 2.21 (SD = 1.19), and there were no significant differences between the three divisions in mean safety ratings. Additional analyses were conducted for multiple factors to determine if they significantly impacted overall perception of facility safety via univariate ANOVA. Of the 24 facility characteristics examined there were 13 factors that significantly impacted overall cage safety including: whether the cage had gates  $F(1, 134) = 50.45, p < .001$ ; gate positioning during practice  $F(1, 130) = 30.66, p < .001$ ; gate height  $F(4, 124) = 21.34, p < .001$ ; cage maintenance  $F(1, 134) = 114.73, p < .001$ ; cage security in practices or nonevents  $F(1, 99) = 23.61, p < .001$ ; cage age  $F(5, 128) = 9.23, p < .001$ ; landing area security in competition,  $F(1, 130) = 9.16, p = .003$ ; cage manufacturer  $F(2, 131) = 7.24, p = .001$ ; cage installer  $F(2, 128) = 5.22, p = .007$ ; cage cost  $F(4, 130) = 6.08, p < .001$ ; maintenance repair speed,  $F(4, 124) = 6.39, p < .001$ ; meeting NCAA guidelines  $F(1, 135) = 46.98, p < .001$ ; and meeting IAAF standards  $F(1, 132) = 29.85, p < .001$ . Seven of the above statistically significant factors were part of a group of 12 yes-no response items that are that are summarized in Table 4.

Six of the significant factors (gate height, cage age, cage manufacturer, cage installer, cage cost and maintenance repair speed) had multiple response items and required further evaluation via Tukey post hoc analyses. For the five gate heights, the safety ratings increased as

**Table 3: Hammer Cage Installer Summary**

Cage Installer	All Divisions	Division I	Division II	Division III
University Personnel	38.2%	44.3%	47.6%	22.5%
Local Company	22.1%	17.1%	28.6%	27.5%
Commercial Manufacturer/Contractor	39.7%	38.6%	23.8%	50.0%

the gate height increased with the lowest height being significantly less safe than the greatest height as summarized in Table 5. Post hoc testing of the cage maker factor revealed that commercially manufactured cages ( $M = 1.97$ ) had significantly greater impact on overall safety than cages fabricated on-site by university personnel ( $M = 3.07$ ),  $F(2,131) = 7.24$ ,  $p = .001$ . The speed of maintenance response factor post hoc testing demonstrated

that hammer throw facilities that had maintenance repair requests acted upon within one day had mean safety ratings significantly better than facilities where maintenance requests took more than a week for action to be taken. Table 6 displays the general trends and the significant overlap among other maintenance response speed variables in relation to overall facility safety.

Table 4: Hammer Throw Facility Mean Safety Ratings for 2-Item Factors		
Category	Yes Response Mean Value (+/- SD)	No Response Mean Value (+/- SD)
Hammer Only Throwing Facility	2.02 (+/- 1.04)	2.37 (+/- 1.28)
Cage Inside the Track Oval	1.96 (+/- 1.02)	2.24 (+/- 1.19)
Cage On-Campus	2.24 (+/- 1.17)	2.00 (+/- 1.33)
Cage Gates Present *	1.88 (+/- 0.87)	3.41 (+/- 1.42)
Gates Properly Positioned in Practice *	1.81 (+/- 0.91)	2.86 (+/- 1.25)
Cage Maintained Properly *	1.71 (+/- 0.73)	3.49 (+/- 1.12)
Landing Area Security in Practice *	1.96 (+/- 1.06)	3.19 (+/- 1.27)
Landing Area Security in Competition *	1.96 (+/- 1.01)	2.63 (+/- 1.25)
Practice Accident in the Past	2.46 (+/- 0.78)	2.13 (+/- 1.18)
Competition Accident in the Past	2.43 (+/- 1.13)	2.16 (+/- 1.15)
Cage Meets NCAA Specs *	1.75 (+/- 0.80)	3.55 (+/- 1.22)
Cage Meets IAAF Specs *	1.52 (+/- 0.74)	2.55 (+/- 1.17)

\*significant difference in means within the factor,  $p > .05$

Table 5: Mean Safety Ratings According to Hammer Cage Gate Height		
Gate Height	n	Means for All Divisions
Less than 10' - 0"	5	4.60*
10'-1" to 15-0"	8	3.50
15'-1" to 20'-0"	32	2.18
20'-1" to 25' - 0"	54	1.96
25'-1" to 30'-0"	30	1.43*

\*significant difference between means  $p < .001$

Table 6: Mean Safety Ratings According to Speed of Maintenance Response—subsets represent significantly distinct groups of means				
Maintenance Response Time	N	subset 1 for $\alpha=.05$	subset 2 for $\alpha=.05$	subset 3 for $\alpha=.05$
Immediate	20	1.5	1.50	
1 day	15	1.4		
2 to 3 days	24	1.96	1.96	1.96
4 to 7 days	32		2.28	2.28
more than 7 days	38			2.60

A regression analysis was conducted in order to predict the overall rating of cage safety that respondents gave their hammer facility. The overall prediction model was significant ( $r^2 = .392$ ,  $p \leq .001$ ) and included the following significant predictors: dedicated hammer facility ( $\beta = .140$ ,  $p = .048$ ), cage age ( $\beta = .269$ ,  $p = .01$ ), cage gates ( $\beta = .325$ ,  $p \leq .001$ ), cage meets IAAF specifications ( $\beta = .244$ ,  $p = .002$ ). Cage age was a significant positive predictor within the regression model, and significantly positively correlated to speed of maintenance response, ( $r = .248$ ,  $p = .040$ ) and cage meets IAAF specifications ( $r = .384$ ,  $p = .001$ ).

## Discussion—Facility Issues

### Hammer Facility Location

Traditionally, all track and field events are contested inside the track and field stadium (Judge & Sawyer, 2009). It makes sense that the running events, jumping events, and throws are all contested in the same venue so the fans can more easily watch all of the events. However, this tradition must be balanced with the nature of the activity and the safety of the participants and spectators. The hammer facility location is another important aspect concerning safety. Locating the hammer cage inside or outside of the track and field oval is therefore an important question.

It was interesting to note that only 16.8% of all hammer venues in all NCAA divisions were located inside the track and field oval. This is a sharp contrast to European venues that typically contest all of the events within the track and field oval (H. Connolly, personal communication, March 24, 2009). The Division I universities did have the highest rate of inside the oval facilities (26.4%) and this may be due to the overall larger budgets at this level that may allow for more track and field exclusive venues. The high number of hammer cages located outside the oval could be attributed to a number of factors. The venue in many instances may be a combination track/soccer stadium and may not accommodate a hammer ring and cage in the infield. The decision to put the hammer facility in a remote area away from the main track may actually be a way to increase safety for onlookers. In fact, 13.8% of the hammer facilities studied were even located at an off-campus area. This remote location may protect others from errant hammers, but it also creates greater logistical problems for supervision and maintenance.

### Facility Construction, Installation and Maintenance

The analysis of the cage manufacturer factor revealed that commercially manufactured cages had significantly greater impacts on the overall perception of safety than cages fabricated on-site by university personnel. Commercial manufacturers are more likely to be aware of, trained in and abide by the industry standards for safety. The speed of maintenance response established that hammer facilities that had maintenance repair requests acted upon within one day had mean safety ratings significantly better than facilities where maintenance requests took more than a week for action to be taken. This demonstrates that, in addition to proper initial construction, cage maintenance significantly contributes to overall hammer facility safety.

To help contain costs, some universities choose university personnel or a local fence contractor to design and install this important venue; often the result is a cage made of chain link fencing. The results of this study indicate almost one-third (31.3%) of universities across all divisions use a locally manufactured chain link cage with the highest percentage coming from Division II (52.4%). This type of cage construction provides necessary protection for onlookers, but it can also put the thrower at risk. The rigid construction of the chain link fences does not “give” when struck by an implement but instead creates the potential for the hammer to bounce back and hit the thrower while still in the circle. Noah Byrant, a thrower at the University of Southern California, was seriously injured when his own hammer bounced off the chain link fence cage and struck him in the face at a competition at Cal State Northridge. Byrant survived the accident but the injury left him with a permanent steel plate in the left side of his face (N. Bryant, personal communication, May 21, 2009). The implements can also break on impact or be severely damaged by the chain linked fence. Damaged hammer handles, wires, and swivels are potentially dangerous and procurement of replacements adds additional costs to the equipment budget.

Another very important issue with non-commercially manufactured hammer cages is the lack of gates at the front of the cage. The gates are the part of the cage that protects the landing area outside of the sector lines. Alarming, nearly 20% of hammer cages across all divisions failed to have any type of gate on the front of the hammer cage. The lack of gates drastically increases the danger zone around the landing sector and puts anyone in the vicinity of the venue at risk. In fact, many of

the new IAAF standards are focused upon the increases in gate length and height for increased protection.

In another cost-cutting measure, universities may purchase a commercially manufactured cage but may choose to have university personnel install the cage. It is interesting to note that of the overall number of cages that are installed by a commercial manufacturer; the highest percentage is in Division III (50.0%), followed by Division I (38.6%), and Division II (23.8%). For commercially manufactured cages, installation of the protective netting is of utmost importance. Participants in the present study indicated that 38.2% of cages across all divisions were installed by university personnel while an additional 22% were installed by a local company. University/local professionals may have limited understanding of the hammer throw event which impacts the installation of the protective netting. Often, netting is not properly installed and is tied back too tightly or looped over which reduces the energy absorbing characteristics for which it was intended. If the netting is too tight, an errant throw can potentially bounce back into the throwing circle and hit the thrower. If the net is not anchored properly, an errant throw can roll under the net and hit an official or onlooker.

## **Procedural Issues**

### **Compliance and Awareness**

The development and improvement of safety standards for the hammer throw has now been initiated on the international level. The IAAF has recently passed new rules for the construction of hammer throw cages that has dramatically improved safety by reducing the danger zone for the hammer throw landing area. However, in the United States, there continues to be reluctance by NCAA colleges and universities to adopt the new IAAF safety standards. Interestingly, there has never been a formal vote on this issue by NCAA track and field coaches but merely discussions of this important issue. In a 2006 meeting of the top throws coaches arranged by Sam Seemes, CEO of the U.S. Track and Cross Country Coaches Association, it was recommended to not adopt the IAAF standards due to concerns related to the narrower opening impacting collegiate throwers and skepticism that IAAF standards would address safety concerns. Results of the current study revealed that 35.8% of the NCAA Division I, II, and III facilities were compliant with the IAAF standards put into effect in 2004. Hammer cages at some NCAA member institutions not only fail to comply with the more stringent IAAF standards, but also, in some cases, fail

to conform to the NCAA recommended standards for safety. A total of 69.6% of participants in the study reported that they were in compliance with the NCAA minimum recommendations. Division I facilities had the highest rate of IAAF compliant cages at 38% with 30% for Division II and 34.9% for Division III. When examining the data by division for schools meeting the NCAA recommendations, there were differences between Division I (78.1%), Division II (52.4%), and Division III (63.6%). Alarming, 47.6% of Division II and 36.4% of Division III facilities do not even meet NCAA minimum recommendations. The remaining 21.9% of the Division I participants reported their facility also did not meet NCAA recommended standards.

Differences in how hammer cage safety is handled exist among divisions. Division I institutions had the most schools compliant with both IAAF standards and the minimum NCAA guidelines. Funding would be an appropriate reason to explain the contrast; Division I schools usually have more funds available and therefore have the ability to update and build the proper hammer facilities that meet the tougher new standards. As noted in a report on NCAA funding, the average athletic department operating expenses for schools with football programs at Division I-A schools was \$27.3 million, Division II was \$2.7 million, and Division III was \$1.6 million (Fulks, 2005). Interestingly, more Division III schools were compliant with the IAAF and NCAA standards than Division II schools. This may also be due to sport funding; although Division II schools may emphasize sports to a greater degree via scholarships, many private Division III institutions may have access to greater external donor funding opportunities.

Almost one third (30.1%) of the participants in the study were not aware of the IAAF facility standards. Most collegiate coaches in the United States are familiar with the NCAA and USATF rulebooks. Since there are very few international track and field competitions in the United States each year, coaches often do not become as familiar with the IAAF rulebook. It was interesting to note that 53.4% of the coaches surveyed supported the adoption of the IAAF facility standards for NCAA hammer throw events. The NCAA colleges and universities are putting themselves at a heightened level of risk by not exercising a standard of care for facility construction that is consistent with IAAF guidelines.

### **Accidents and Close Calls**

The safety of athletes, officials and spectators when the hammer is being thrown is paramount. There have

been several fatal accidents and close calls in the United States involving the hammer throw (Connolly, 2006). Unfortunately, major incidents usually occur because the early warning signs, such as accidents and close calls, are ignored. The results of the present study illustrate that accidents are still occurring in both practice and competition. Participants in the present study reported accidents, classified as nonfatal incidents requiring medical attention, at the rate of 9.6% in practice (and at the rate of 5.1% in competitions). However, it is unknown how many of the reported accidents were directly related to facility issues. Could a facility that meets the current IAAF standards have prevented the fatalities of the past and the accidents reported in the present study? The additional safeguards of the IAAF hammer throw facility reduces the possibility of errant throws exiting the cage and striking unsuspecting bystanders.

Documented incidences previously mentioned demonstrate serious issues with the current collegiate venue that could easily result in a fatality. The Rucker case specifically showed that the safety of the track and field hammer facility in that instance was flawed and the procedures for conducting hammer throw practice while the track facility was in use by other athletes were questionable. In response, the University of California has since changed its practice policy so that other track members are not practicing anywhere in the vicinity of hammer throwers while they are on the field (Lewellyn, 2008). Closing the venue to non-throwers is purely a procedural measure, and does not address the facility issue. This new policy will not protect the athletes participating in the hammer throw. Increased risks will still exist for throwers and observers if the NCAA does not insist upon its schools meeting the higher standards established by the IAAF.

Operational policies and procedures for the hammer throw also must fully consider cage perimeter supervision during a practice and competition. As discussed earlier, a properly installed net has “give” which helps protect the thrower in the ring, but this “give” may endanger spectators standing too close to the netting. A safe zone must be established around the perimeter of the cage. Throwers and officials should always be instructed to stand at least five feet away from the outside of the cage. Even with a properly installed cage, onlookers may be in potential danger when they falsely assume they are safe while standing too close to the cage netting.

## **NCAA Coaches Desire Increased Safety Mandates**

This study’s results showed that coaches supported a change in hammer cage and venue safety. The majority of coaches showed support for compulsory facility requirements of member institution hammer facilities; 82.4% of respondents desired mandated minimal requirements. The analysis of the coaches overall perception of hammer facility safety demonstrated that factors like the height of the gates, the manufacturer of the cage and response time to maintenance issues significantly impacted safety ratings echoing current research (Gutiérrez et al., 2002). The trend for safety ratings as noted in Table 4 improves as gate height increases which is consistent with the IAAF recommendations of increasing gate height to 10 meters.

It is not surprising that coaches supported mandated facility requirements to protect themselves and keep everyone around them safe. Over half of the coaches (56.2%) had prior experience competing in the hammer throw which gives them a greater understanding of the event and venue specifications. The participants in the present study were also highly experienced hammer throw coaches in the sport of track and field with a mean coaching experience of 10.24 years. Experience not only participating but also coaching the event lends to even greater knowledge of event demands; coaches are expected to not only coach athletes, but manage event sites, safety, and athletes during competition. Experienced coaches understand a properly designed venue keeps the focus on coaching and training. Unfortunately, these highly experienced professionals are not typically involved with policy making decisions. Because of departmental priorities and budgetary constraints, athletic departments may be hesitant to adopt facility recommendations that are not mandated by the NCAA.

## **Conclusion**

Gathering data from practicing professionals familiar with the everyday hammer facility operations provided insight into methods to make the hammer facilities safer. Coaches highlighted professionally manufactured cages with proper maintenance and upkeep as key factors to address overall safety. Proper training and competitive venues are important in the prevention of accidents and sports injuries for athletes of all ages. The results of this study reveal a need for increased hammer facility safety; the practicing professionals most involved with the event demonstrated concern for substandard hammer cages. Heightened NCAA standards

would require member institutions to upgrade their hammer facilities; however, it might also lead to the discontinuation of the hammer throw at some schools if the athletic department could not incur the additional cost.

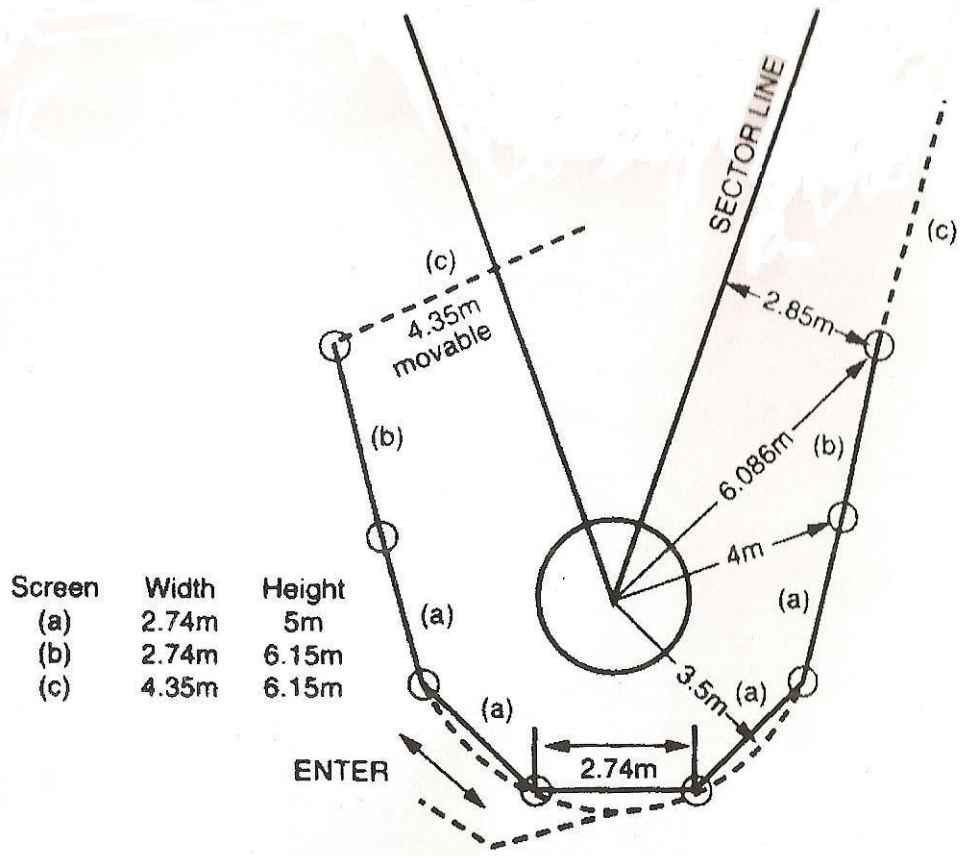
Results of this study raise some interesting conclusions and suggestions for future research. A consideration of the administrative perspective of this issue should be addressed via a study of athletic administrators. With limited resources typically allocated for Olympic sports and their facilities at the collegiate level, a consideration of the cost factors of hammer throw facility improvements should also be addressed from an administrative perspective. This could be addressed from the perspective of the athletic admin-

istrators at each university as well as the perspective of athletic administrators from sport governing bodies such as the NCAA, the National Association of Intercollegiate Athletics (NAIA), National Junior College Athletic Association (NJCAA), or USATF.

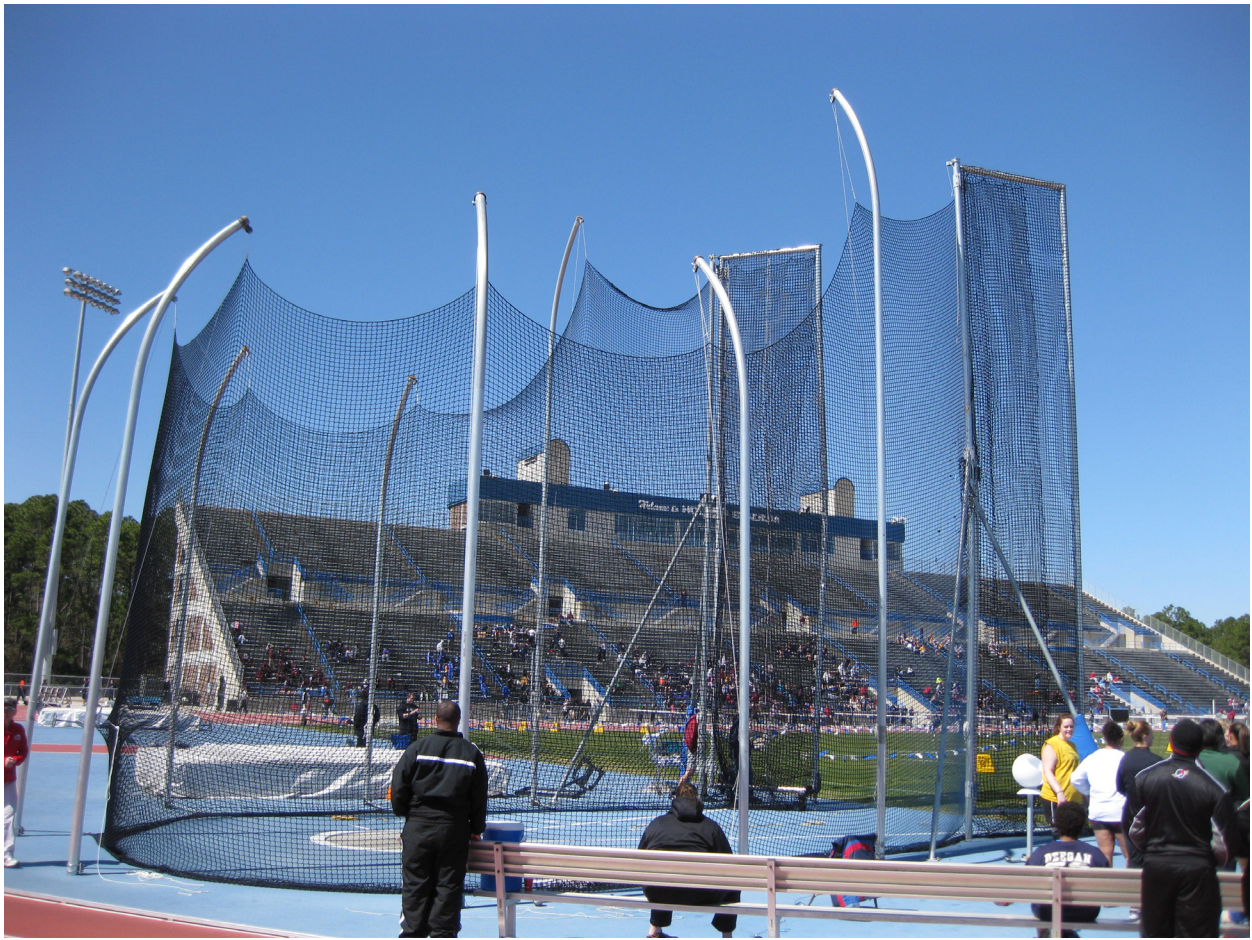
This paper represents only a starting point for a further study of hammer facility design at colleges and universities in the United States. Overall, NCAA member institutions have realized the importance and benefits of improved sport facilities, but this has not yet transcended through all sport venues. It remains unclear why the NCAA has not yet enacted safer, internationally approved, hammer facility guidelines.

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Appendix 1: Diagram of pre-2004 hammer cage specifications.



**Appendix 2: Photo of the IAAF compliant hammer cage at the University of North Florida.**