Project Proposal:

Field Design for Swarthmore College Softball

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Introduction

The objective of this project is to design a practice and game facility for the Swarthmore College Softball Team. The present softball field (Site A, Figure 1) is part of the Clothier Field Complex, located near the South entrance to the Swarthmore College campus, south of Field House Lane and West of Chester Road, in Swarthmore, Pennsylvania. This is also the site of a development project proposed by the College and the Swarthmore Borough to construct a 3-story inn with a restaurant and other commercial space [1]. Consequently, the softball field and other athletic practice fields will have to be moved. There are two proposed sites for a new softball facility (Figure 1):

Site B – The field would remain a part of the Clothier Field Complex, but be moved South East of Site A, adjacent to the Palmer Dormitory.

Site C – The field would be moved to the Cunningham Field Complex, located east of Chester Road and the main college campus.

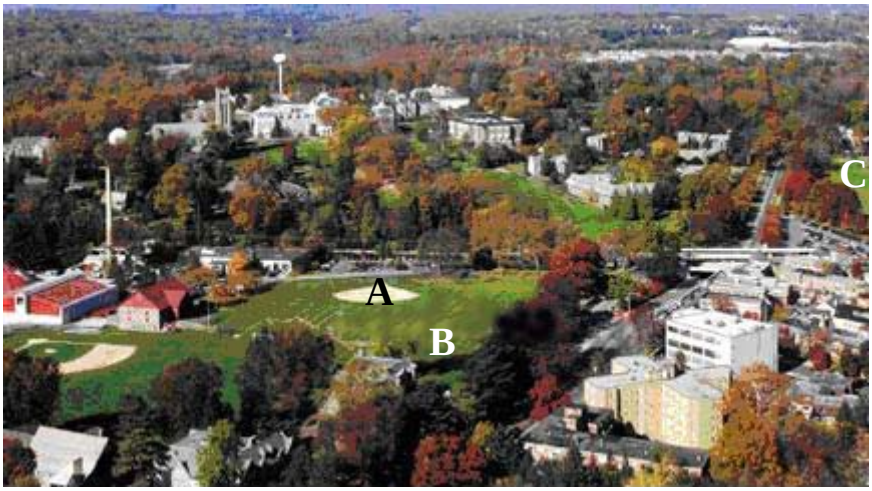

Figure 1. The Clothier Field Complex at Swarthmore College [1].

The design of a new softball facility must meet the needs of the athletic department and softball team while staying within the budget and regulations established by the College Facilities Department. In addition, the final design should fit into the College's architectural style and green-friendly philosophy.

Technical Discussion

Essential design considerations for an outdoor sports facility include safety, playability, maintenance requirements, and costs [2, 3].

Safety of athletes and coaches, spectators, and the surrounding area should be the primary design parameter for this project. Athlete and coach safety is relevant when selecting playing surfaces and fencing, designing warm-up and seating areas, and considering the orientation of the field with respect to the sun. Spectator safety should be considered when designing fencing and seating as well. Softball and baseball present a unique safety hazard to surrounding people and property, as balls are frequently hit or thrown outside the playing facility. Consequently, the fencing, orientation, and location of the playing field are essential design decisions for ensuring safety.

Playability ensures that the facility will meet the standards required for high quality athletic competition at the collegiate level. This involves respecting all regulations established by the National Collegiate Athletic Association (NCAA), developing versatility to optimize usage by the entire College community, and designing proper playing surfaces to ensure that the facility is suitable for collegiate softball competition and practice.

All NCAA sanctioned fields must conform to certain dimensions and requirements [4]. Figure 2 depicts the required field dimensions. The most important dimensions for field design include the range of acceptable distances from home plate to left, center, and right fields, the relative geometry of the infield and outfield playing surfaces, the required spacing between home plate and the backstop, and the required spacing between the out-of-bounds fencing and the foul lines. The distances from home plate to left and right fields must be between 190 and 225 feet; the distance from home plate to center field must be between 200 and 225 feet; the infield playing surface must occupy the 60 by 60 foot square base path region; the outfield playing surface must start beyond a radius of 60 feet from the pitcher's mound; the backstop must be 25 to 30 feet behind home plate; the out-of-bounds fencing must be 25 to 30 feet away from the foul lines. Appendix A defines other dimensional requirements and illustrates details about field requirements [4].

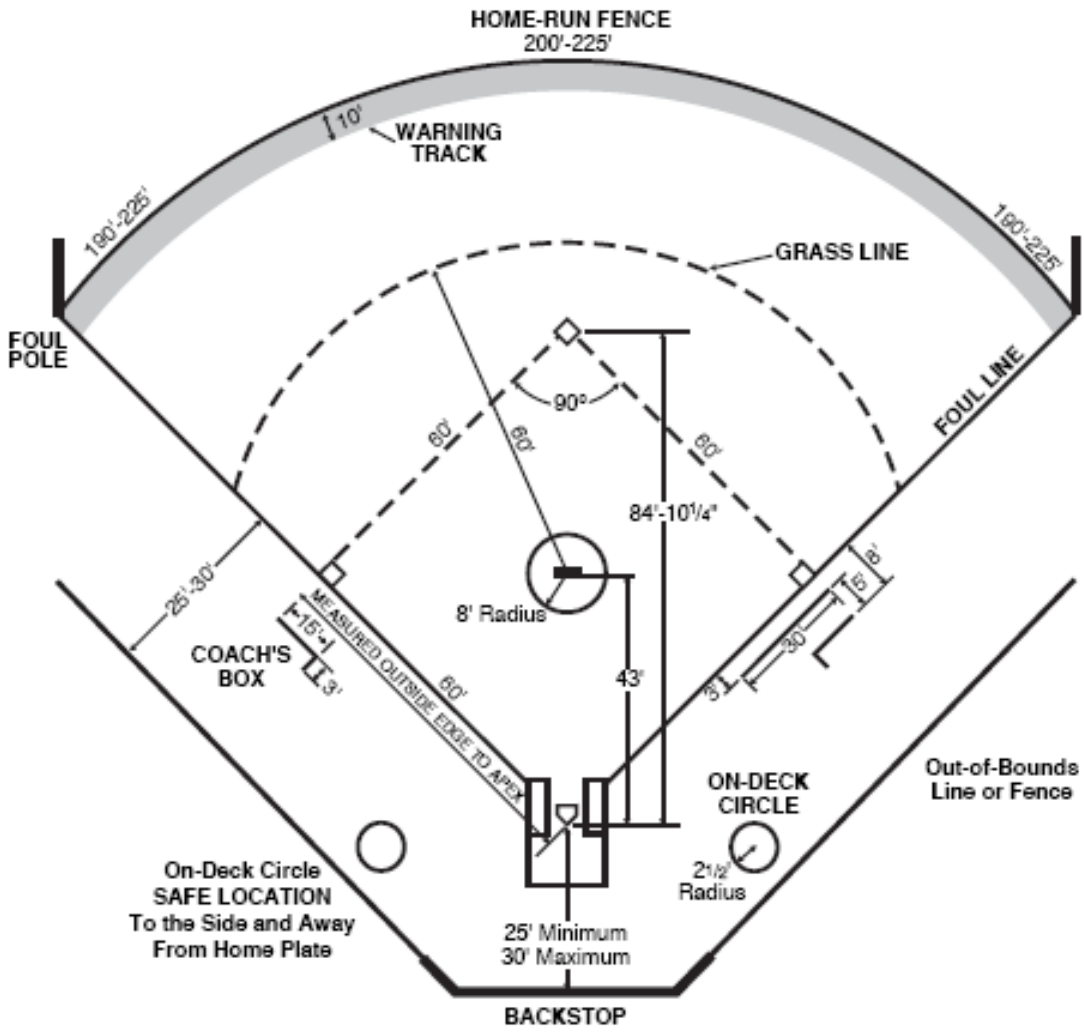

Figure 2. Required Dimensions for NCAA Softball Fields [4].

In order to optimize the facility's usage, it should be designed for versatility. Using removable fencing would make available larger grass practice areas to be used by other athletic teams and clubs. In addition, implementing a playing surface that can be easily maintained is essential for providing a satisfactory facility for all users.

Similarly, the playing surface must be suitable for playing collegiate softball especially during the months of March through May in the southeast Pennsylvania climate. The infield surface must be skinned; that is, the soil must be exposed. It is critical that this area of the playing field have excellent drainage qualities and be compactable to a true, smooth grade. Ideally, water drainage occurs via surface runoff rather than subsurface percolation. Fields are typically designed with a 0.05 to 1 % grade

from the pitchers mound to foul territory to facilitate proper water drainage. Infield mixes contain sand, silt, clay and water. They are typically classified according to the clay content. Professional-grade infield mixes usually have about 25% clay. "Clay furnishes strength and holds moisture" [5]. Higher clay contents result in a lower percentage of coarse grains and, therefore, smoother surface finishes. However, infield mixes high in clay content are prone to clumping and may not allow for adequate water percolation. Thus, they require more field maintenance after rain events and during games. Underground drainage systems can by installed to facilitate adequate water drainage as well. The outfield playing surface should be grass or a synthetic grass material. While drainage in the outfield is not as important as in the infield, considerations for proper water runoff should be made. Most importantly, the surface should be flat and uniformly graded.

Field **upkeep and maintenance** should be considered in the design process as well. The maintenance requirements should be compared to available maintenance resources when selecting playing surface materials. In addition, the field must be accessible for maintenance equipment.

The **costs** associated with construction are limiting factors in designing an athletic field. Fiscal and environmental costs should both be considered. It is important to select economical materials that will be durable under the local climate conditions. In addition, the environmental impact of construction is important.

Project Plan

The tasks associated with this project can be divided into seven major divisions (Table 1). Each division has associated actions (Table 2) that are described and accounted for in the Gantt chart (Table 3) and critical path analysis (Figure 4 and 5).

Table 1. Seven Major Divisions of Tasks Required to Complete Project

	Project Division	**Associated Actions**
1	Background and Research	Literature review; Site visits, research, interviews; Learn CAD; Learn surveying techniques; Purchase surveying equipment
2	Rough Design	Survey potential sites; Research Synthesis; Select site; Basic field design
3	Optimal Design of Playing Surfaces and Enclosures	Ideal infield design; Ideal outfield design
4	Stadium Design	Ideal backstop and dugout design; Ideal press box and seating design
5*	Optimal Design of Optional Enhancers to Field Complex	Ideal practice, warm-up, and storage facilities design
6	Design Synthesis, Prepare Deliverables	Design optimization; Final CAD design; Prepare construction manual
7	Project Presentation	Create model; Write report; Prepare for presentation

Division One is the process of information gathering. It will be particularly important to become familiar with the Swarthmore College's methods of resource distribution and project planning. It will be necessary to communicate with individuals in the athletic department, facilities department, and college administration. In addition, I will become proficient in AutoCAD Lite and learn basic surveying techniques. After becoming familiar with surveying, I will hope to purchase a suitable digital surveying system for use in surveying the proposed sites in this project and for future use in the Swarthmore College Engineering Department.

Division Two will require a synthesis of the research and background information in order to lay the groundwork for the rest of the project. Complete boundary and elevation surveys of both Site B and C must be completed. In addition, any geotechnical information that is not already available in the College Facilities database must be collected. After compiling survey and geotechnical information, initial design decisions about site, location, field orientation, and field dimensions will be made.

Division Three involves the design of the infield and outfield playing surfaces and the field enclosures. Soil grading plans and recommendations for a proper drainage system will be produces in this part of the project. In addition, the materials to be used for the playing surfaces will be selected. Permeability tests will be performed on the current infield top soil mix and several commercial mixes in order to guide the design

decision for the infield playing surface. Fencing or some sort of temporary barrier will be selected to enclose the field.

Division Four requires a structural design for the dugouts, backstop, and grandstand area. A design decision will be made for the dugouts regarding whether they should be sunken or aboveground structures. Design of the backstop requires considerations for spectator safety and visibility. A structural design of the grandstand seating area and press box will be the focus of this project. It will entail basic concrete and steel design as well as the integration of pre-manufactured parts. Figure 3 illustrates two examples of collegiate dugout-backstop-grandstand structures.

Figure 3. The baseball (top) and softball (bottom) fields at Montclair University in Montclair, NJ.

Division Five is the design of optional enhancements to the field including practice and warm-up facilities, storage space, landscaping, and a scoreboard. These aspects are not essential in the initial construction of a field. However, rough designs of ideal "dream" items will be included in this project so as to give design options to the

athletic department and the college that fall within a range of construction prices. This project division is optional and will be completed as time permits.

Division Six is a complete design synthesis and optimization from Project Divisions Three, Four, and Five. This Division represents the "deliverables" of the project and will include a final CAD design of the entire field and a construction manual with a projected construction budget, materials list, and general project recommendations.

Division Seven is the process of presenting the project in a professional and informative way. This will include the written report and preparations for the final oral presentation. An optional task within this division will be to create a physical or computer model of the field design.

Project Costs

Items required to complete this project include surveying equipment, geotechnical laboratory equipment, commercial infield mixes, and access to a plotting machine to produce CAD designs. All of these materials are already available through the Swarthmore College Department of Engineering, Athletics Department, and Facilities Department. However, the surveying equipment currently owned by the Engineering Department is outdated and not ideal for this job. Purchase of digital surveying equipment both for this project and future use within the department would be ideal.

Table 2. Description of Project Actions within each Project Division.

		Action	Description
1	A	Literature Review	See Appendix B
	B	Site Visits, Research, and Personal Interviews	Visit notable collegiate softball field construction projects, interview staff from athletics department, facilities, and College budget committee
	C	Purchase surveying equipment	Consult equipment retailers and purchase equipment that can be used throughout the engineering department in the future
	D	Learn surveying techniques	Training at Electrical Systems Consultants (Fort Collins, CO)
	E	Learn CAD Software	Training at Electrical Systems Consultants (Fort Collins, CO)
2	F	Survey Potential Sites	Collect Topographic Information and geotechnical data
	G	Research Synthesis	
	H	Select Preferred Site	See Figure 1 for options
	I	Basic Field Design	Macro-dimensions, orientation, exact location, CAD development
3	J	Ideal Infield Design	Grading, drainage plan, permeability tests, infield soil mix design
	K	Ideal Outfield Design	Grading, turf selection, infield-outfield boundary condition, warning track, outfield and foul line fencing options, foul poles
4	L	Ideal Backstop and Dugout Design	Choose style of dugout, concrete design, CAD development, fencing, backstop options
	M	Ideal Press Box and Seating Design	Concrete design and structural analysis, CAD development
5*	N	Ideal Practice, Warm-Up, and Storage Facilities Design	Batting cages, bull-pens, CAD development, landscaping, scoreboard
6	O	Complete Design Optimization	Optimize design of essential aspects of field with best combination of dugout, press box, seating, and practice facility design that fits within constraints
	P	Final CAD Design	
	Q	Prepare Construction Manual	Compile final CAD design, projected construction budget, materials list, and general project recommendations
7	R	Create Model*	Prepare computer generated or physical model of design
	S	Write Report	
	T	Synthesize Presentation	E90 Presentations begin May 7, 2007

* Optional Project Division or Activity

Table 3. Project Actions with Associated Duration and Effort

Activity	Action	Needs	Feeds	Duration *(weeks)*	Effort *(hours)*
A	Literature Review		G	12	12
B	Site Visits, Research, and Personal Interviews		G	6	15
C	Purchase Surveying Equipment		F	1	3
D	Learn Surveying Techniques		F	2	8
E	Learn CAD Software		P	4	15
F	Survey Potential Sites	C,D	H	2	8
G	Research Synthesis	A,B	H	0.5	2
H	Select Preferred Site	F,G	I	0.1	1
I	Basic Field Design	H	J,K,L,M,N	0.5	1
J	Ideal Infield Design	I	O,P	2	15
K	Ideal Outfield Design	I	O,P	1	10
L	Ideal Backstop and Dugout Design	I	O,P	6	40
M	Ideal Press Box and Seating Design	I	O,P	8	60
N	Ideal Practice, Warm-Up, and Storage Facilites Design	I	O,P	1.5	8
O	Complete Design Optimization	J,K,L,M,N	Q	1	8
P	Final CAD Design	E,J,K,L,M,	Q,R	3	15
Q	Prepare Construction Manual	O,P	S,T	2	15
R	Create Model	P	T	1	8
S	Write Report	Q	U	1	8
T	Synthesize Presentation	Q,R	U	1	6
U	Finish	S,T			
				TOTAL hrs:	258
		from critical path:		**TOTAL wks:**	28.1

Figure 4. Gantt Chart

Activity	Action	Week		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
A	Literature Review	12	12																													
B	Site Visits, Research, and Personal Interviews	6	15																													
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D	Learn Surveying Techniques	2	8																													
E	Learn CAD Software	4	15																													
F	Survey Potential Sites	2	8																													
G	Research Synthesis	0.5	2																													
H	Select Preferred Site	0.1	1																													
I	Basic Field Design	0.5	1																													
J	Ideal Infield Design	2	15																													
K	Ideal Outfield Design	1	10																													
L	Ideal Backstop and Dugout Design	6	40																													
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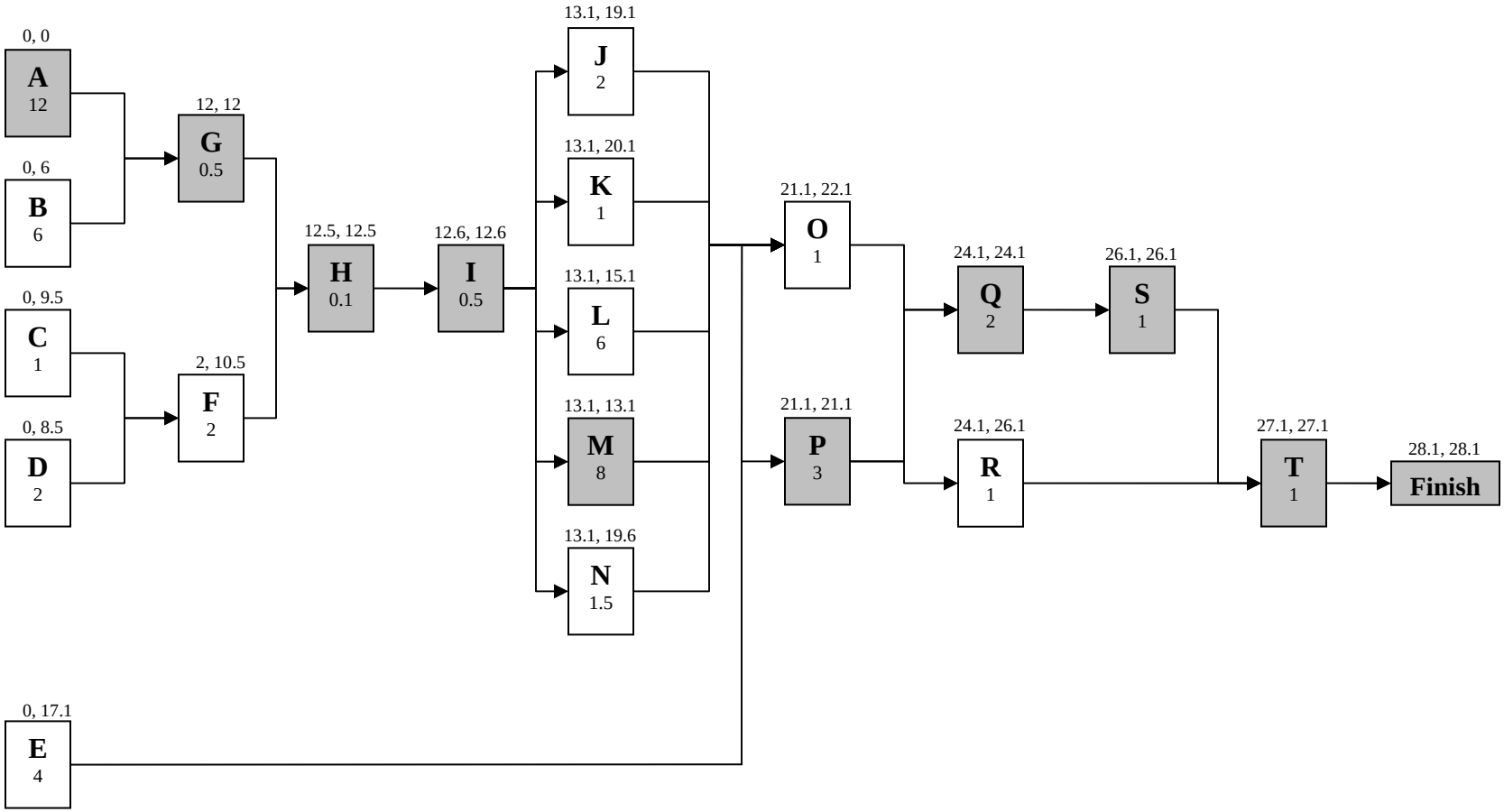
P	Final CAD Design	3	15																													
Q	Prepare Construction Manual	2	15																													
R	Create Model	1	8																													
S	Write Report	1	8																													
T	Synthesize Presentation	1	6																													
U	Finish			october				november				december				january				february				march				april				may

Action lies on the critical path

Figure 5. Critical Path Analysis



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- CAD Technician for Swarthmore College, Woodford Fraizer
- Head Softball Coach, Renee Clarke
- Swarthmore College Athletic Director, Adam Hertz
- CAD Technician for Electrical Systems Consultants, Elaine Sipes
- Surveying Technician for Electrical Systems Consultants, Don Thomas

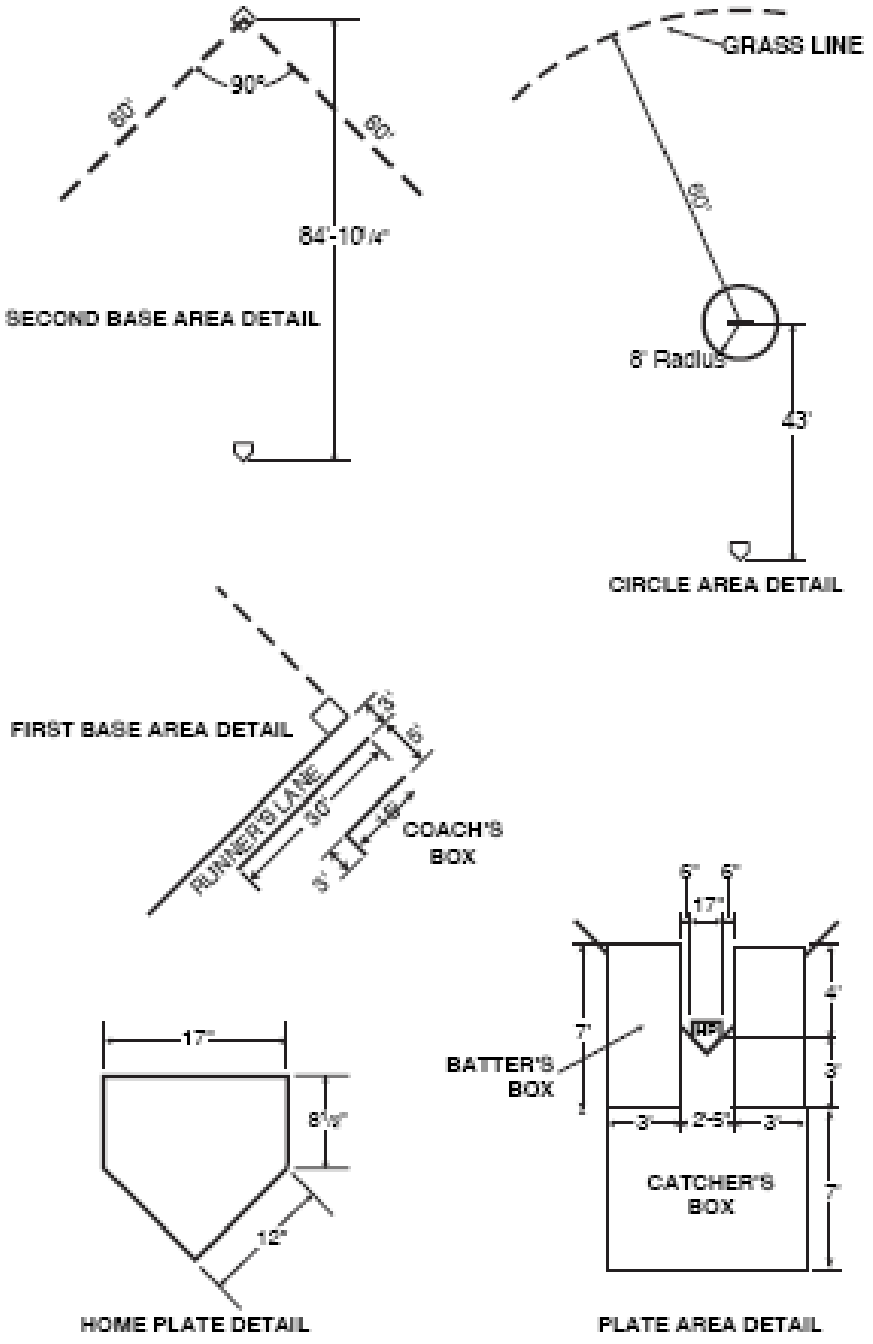
References

[1] http://www.swarthmore.edu/bulletin/currentissue/collection.html
[2] Baseball and Softball Fields: Design, Construction, Renovation, and Maintenance
Jim Puhalla, Jeff Krans, Mike Goatley
[3] Sports Fields: A Manual for Design Construction and Maintenance (Hardcover)
Jim Puhalla, Jeff Krans, Mike Goatley
[4] NCAA Rule Book - http://www.ncaa.org/library/rules/2006/2006_softball_rules.pdf
[5] http://geology.about.com/od/sediment_soil/a/aa_ballfield.htm

Appendices

A) Field Detail Requirements [4].
B) Literature Review.

Appendix A. Field Detail Requirements [4].



Field-marking lines must be drawn.

Appendix B. Literature Review.

Architecture for Sport by Peter Stürzebecher, Sigrid Ulrich

Sports Turf by V.I. Stewart

Stadia, Arenas and Grandstands by P. Thompson

Stadia, A Design and Development Guide by Geraint John, Rod Sheard

Facility Planning for Physical Education, Recreation, and Athletics by AAALF Staff

Recreation and Sport Planning and Design by James W. Daly

Sports Architecture by Rod Sheard

Sports Fields: A Manual for Design Construction and Maintenance by Jim Puhalla

Spectator: Selected Works by Dan Weis by Sara Hart

Baseball and Softball Fields: Design, Construction, Renovation, &Maintenance – by Jim Puhalla