This book is dedicated to my grandson, Grayson James Rosselli.

He is a builder at heart and always makes his grandfather proud.
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# Equipment and Facility Design Standards

Thomas H. Sawyer, *Indiana State University*

Tonya L. Gimbert, *Indiana State University*

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As the cost of construction for sports- and health-related facilities skyrockets, it becomes ever more paramount for those who plan, design, construct, and use these facilities to have access to a comprehensive facilities guide. The 13th edition of *Facility Planning and Design for Health, Physical Activity, Recreation, and Sport* is a tool for all professionals involved in facility planning and construction use.

The 21st century is a time of increased interest in health, fitness, recreation, physical activity, and sport. A synopsis of the historical development of this text is important. In 1945, at the board of directors meeting of the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) in Washington, D.C., support was given to a proposal submitted by Caswell M. Miles, AAHPERD vice president for recreation, to prepare a grant to finance a national workshop on facilities. Subsequently, a request for $10,000 was submitted to and approved by Theodore P. Bank, president of the Athletic Institute, to finance the first workshop. The December 1946 workshop at Jackson’s Mill, West Virginia, resulted in the publication of the premiere edition of the *Guide for Planning Facilities for Athletics, Recreation, Physical and Health Education*.

The 1956 edition of the guide was a product of the second facilities workshop, held May 5–12, 1956, at the Kellogg Institute, and was held again January 15–24, 1965, at the Biddle Continuing Education Center, Indiana University in Bloomington. Two years later, April 29–May 8, 1967, another workshop was held at Indiana University. Among those invited were a number of outstanding college and technical personnel engaged in planning and administering programs of athletics, recreation, outdoor education, physical education, and health education. Other planning authorities and specialists receiving invitations included city planners, architects, landscape architects, engineers, and schoolhouse construction consultants.

The 1974 guide was reconstructed in such a way that it would serve as a more practical tool for school administrators, physical education heads, architects, planning consultants, and all others interested in planning new areas and facilities or checking the adequacy of those already in use.

The Athletic Institute and AAHPERD Council on Facilities, Equipment, and Supplies initiated the 1979 revision of the guide. A blue-ribbon steering committee was appointed by the Council. Edward Coates from Ohio State University and Richard B. Flynn from the University of Nebraska at Omaha, were appointed as coeditors and contributing authors.

Professionals well known for their expertise in facility planning, design, and construction were invited to assist in a complete rewrite, which resulted in Planning Facilities for Athletics, Physical Education, and Recreation.

The 1985 edition of *Planning Facilities for Athletics, Physical Education, and Recreation* represented a continuing effort on the part of The Athletic Institute and AAHPERD to keep the text current and relevant. Richard B. Flynn was selected to be editor and contributing author. Many of the contributors to the previous edition updated their chapters, and some new material was added.

The American Alliance for Health, Physical Education, Recreation, and Dance published the 1993 edition, entitled *Facility Planning for Physical Education, Recreation, and Athletics*, and Richard B. Flynn again was asked to serve as editor and contributing author. Again, many of the contributors to the previous edition updated their chapters, and some new material was added.

The AAHPERD Council on Facilities and Equipment selected Thomas H. Sawyer of Indiana State University to serve as chair of the editorial committee and editor-in-chief of the 1999 and 2002 editions of *Facilities Planning for Physical Activity and Sport*. Many new contributors were selected to complete a major revision of the text, which resulted in a great deal of new material and many fresh ideas and concepts. The editorial team for both the 1999 and
2002 editions was Thomas H. Sawyer, Ed.D. (Indiana State University); Michael G. Hypes, DA (Indiana State University); Richard L. LaRue, DPE (University of New England); and Todd Seidler, Ph.D. (University of New Mexico). There were 21 authors involved in writing 29 chapters in the 1999 edition, and 21 authors involved in writing 37 chapters in the 2002 edition.

The revised 2013, 13th edition, with Thomas H. Sawyer again serving as editor-in-chief, fulfills the intent of the Council on Facilities and Equipment to update and revise the text on a regular basis. Regularly revising and updating a text of this magnitude is no easy task. Basically, at the completion of one edition, the planning for a new edition begins—therefore never-ending work for the editor, editorial board, and authors. I would like to commend these selfless individuals. With rapid changes in both technology and construction methods, the regular updating of this text is a necessity. This new edition now adds one new chapter.

It should be noted that much of the material in this text reflects the composite knowledge of many professionals who have contributed to past AAHPERD text editions, as well as of those individuals who were solicited to serve as authors, editors, and reviewers for the current text. The American Alliance for Health, Physical Education, Recreation, and Dance, the American Association for Active Lifestyles and Fitness (AAALF), and the Council on Facilities and Equipment (CFE) have endorsed this book as one of the best on the topic of planning facilities for sport, physical activity, and recreation.

Having had the pleasure to work closely with Thomas H. Sawyer and the editorial board and the Facilities and Equipment Council and having been an author in four editions of the text, I would at this time give my sincere thanks and appreciation to all of those involved in this 13th edition of this text—a job well done! I recommend this edition of *Facility Planning and Design for Health, Physical Activity, Recreation, and Sport* as the most comprehensive source guide for planning, designing, and constructing facilities related to health, physical activity, and sport.

From its inception, this text has been a milestone resource for sports and physical activity facility designers, users and managers. Each edition builds on and adds to the field of knowledge in sport and physical activity facility design, planning, and construction. I give my highest endorsement to this 13th edition of the “bible” for facility designers and planners.

With gratitude,

**Edward (Ed) Turner, PhD**
Professor Emeritus
Department of Health, Leisure and Exercise Science
Appalachian State University

Appreciation is expressed to the editorial committee members of the Council for Facilities and Equipment (CFE) for assuming initial responsibility for outlining the content and chapters for the text and selection of the chapter authors. While some served as authors/editors for specific chapters in the text, all served as reviewers for assigned chapter drafts. The editorial committee members for the 13th edition consisted of:

- Dr. Thomas H. Sawyer, NAS Fellow, Chair and Editor-in-Chief, Contributor, 1999-2014 (9th, 10th, 11th, 12th, and 13th editions), Indiana State University, Chair CFE, 1995-97
- Dr. Julia Ann Hypes, Morehead State University, Chair CFE, 2007-08
- Dr. Michael G Hypes, Morehead State University, Chair CFE, 2008-2009
- Dr. Jeffrey C. Peterson, Baylor University, Chair CFE, 2005-07

We are indebted to a number of authoritative sources for permission to reproduce material used in this text:
- The National Collegiate Athletic Association (NCAA) for permission to reproduce drawings from selected 1997 NCAA rulebooks. It should be noted that these specifications, like others, are subject to annual review and change.
- Athletic Business for permission to reprint selected drawings.
- Selected architectural firms for supplying photographs, line drawings, artists renderings, and other materials.

Special recognition is due to those professionals who served as chapter authors or assistant editors, including Kimberly Bodey, Mark Cryan, Steven Dalcher, Tonya Gimbert, Bernie Goldfine, Susan Hudson, Julia Ann Hypes, Michael G. Hypes (Contributor and Assistant Editor), Lawrence W. Judge, Richard LaRue, David LaRue, John Miller, Jeffrey Peterson, Donald Rogers, Gary Rushing, Todd Seidler, Donna Thompson, LeLand Yarger, Hal Walker, Todd Weaver, and Jason Winkle. These individuals worked diligently to present chapter material in an informative and useful manner.

Without great assistance from a number of very special and important folks, this book would not have been possible: Julia Ann Hypes, who was responsible for the glossary and author information; Meghan “Muffin” Sawyer Rosselli for her graphic and photography expertise; and Susan Davis and Amy Dagit of Sagamore Publishing for invaluable advice, counsel, patience, and encouragement during the final edit and design of the manuscript.
Prologue

Todd Seidler, University of New Mexico
Bernie Goldfine, Kennesaw State University

Have you ever seen a facility with so many design problems that it left you shaking your head in disbelief? Each facility presents its own unique design challenges; if these challenges are not addressed and overcome, the result is a facility with design problems. Typically, the larger a building project, the greater the likelihood that mistakes will be made in the planning and design process. Often, details are overlooked, and sometimes even major mistakes are made in the planning process and not discovered until after the facility is built and opened for use. For example, most of us have seen buildings with poor lighting, ventilation, or access control that could have been prevented with appropriate planning. In particular, one of the most common design flaws in recreational, physical education, and sports facilities is a lack of proper storage space. Surely, we have all visited buildings where hallways, classrooms, and even activity spaces were used for temporary or permanent storage of equipment.

Inadequate planning has resulted in countless design flaws in sports and recreation facilities. Can you imagine a high school football team playing on an 80-yard football field? What about a recreation center with access to the locker rooms available only by crossing the gym floor? Do you believe a facility designer would locate a locker room toilet one foot lower than the septic field it was supposed to drain into? How about a gymnasium with large picture windows directly behind the basketball backboards? And how safe is an indoor track constructed as part of a pool deck that has water puddles present in every running lane? Impossible? Unfortunately, it is not.

These “building bloopers” are real and not as uncommon as we would like to believe. Such mistakes can be embarrassing, expensive, amazing, and sometimes humorous (if it is not your facility). These and many other design errors can usually be traced to insufficient planning. An example of an outrageous building blooper is Olympic Stadium in Montreal. Constructed as the track and field site for the 1976 Montreal Olympics, it has yet to be completed satisfactorily. Originally estimated to cost about $60 million, the price thus far is in excess of $1 billion.

Building bloopers are often caused by devoting insufficient time, effort, and/or expertise to the planning process. The earlier in the process that mistakes are discovered and corrected, the less they will cost to rectify. It is inexpensive to change some words on a paper, somewhat more expensive to change lines on a blueprint, and outrageously expensive or even impossible to make changes once the concrete has been poured. Furthermore, the impact of a poorly designed building is staggering when compared with other management problems. Problematic staff can be relieved of their responsibilities. Funds can be raised for underfinanced programs. However, the consequences of a poorly designed building will have to be endured for decades. Therefore, it is essential to devote all available resources early in the planning process.

All too often, facilities are planned without in-depth consideration of the programs that they will support. Basically, a facility is a tool. The better it is planned, designed, and constructed, the better it will support the objectives of the programs it will house. Strange as it may seem, sport facilities often are designed without a great deal of consideration given to programming and user desires. Aesthetics, the interests of one popular sport or program at the time, or the personal desires of decision-makers may, in fact, dictate the design of the facility. Implementing a new program in an existing or poorly planned facility often requires designing the programs based on the limitations of the facility. Poorly designed venues may limit or even prevent some activities from taking place. Conversely, a well-designed facility will support and enhance the desired programs. Planning and building a new facility is a great opportunity to ensure that it will optimally support these programs. Furthermore, well-planned venues allow for flexibility when the popularity of activities and user demand fluctuate. Planned with an eye toward future trends, these facilities are designed to be easily altered so that new activities can be added as needs change.
This book is intended to provide a basic understanding of the planning and design process as well as the unique features of many different areas and types of facilities. Although there is no such thing as a perfect building, with significant time, effort, and expertise devoted to the planning and design process, future building bloopers can be kept to a minimum. It is hoped that those of you involved with the planning of sports facilities will find this book to be a significant resource.
Section I

Common Facility Components
Anyone who has been involved in facility planning and development understands that errors are common during the planning and development process. The challenge is to complete a facility project with the fewest number of errors. Before becoming too deeply involved in the planning and development process, it is important to review some of the common errors that have been made in the past (Conklin, 1999). Conklin (1999), Farmer, Mulrooney, and Ammon (1996), Frost, Lockhart, and Marshall (1988), and Horine and Stotlar (2002) suggested these errors include, but are not limited to (see photos on p. 5), (1) failure to provide adequate and appropriate accommodations for

### 25 Years of Indoor Innovations

According to Dennis Read (2013), it is extremely hard not to be amazed by all the new features facilities offer spectators and players. This is a list of the top 25 innovations in indoor facilities since 1989:

1. Video scoreboards
2. Unbreakable basketball goals
3. Bleacher seats with full backs, comfortable cushions, armrests, cup holders, and seats that fold
4. Portable basketball goals
5. Wood lockers
6. Synthetic gymnasium floors
7. Green floor finishes
8. Enhanced sound systems
9. Volleyball posts
10. Game clocks that stop and start on the official’s whistle and shot clocks
11. Automated delivery of pool chemicals
12. Scoring tables with high-definition messages through LED lighting
13. Wall mats
14. Energy efficient lights
15. Practice structures
16. Gymnasium dividers
17. Customized sideline chairs
18. Indoor track surfaces
19. Antimicrobial locker rooms
20. Bleacher safety
21. Antimicrobial indoor surfaces
22. Wireless scoreboard controls
23. Floor and wall graphics
24. Faster pools with larger gutter systems and improved lane lines to reduce turbulence
25. Floor cover storage

persons with disabilities throughout the facility; (2) failure to provide adequate storage spaces; (3) failure to provide adequate janitorial spaces; (4) failure to observe desirable current professional standards; (5) failure to build the facility large enough to accommodate future uses; (6) failure to provide adequate locker and dressing areas for both male and female users; (7) failure to construct shower, toilet, and dressing rooms with sufficient floor slope and properly located drains; (8) failure to provide doorways, hallways, or ramps so that equipment may be moved easily; (9) failure to provide for multiple uses of facilities; (10) failure to plan for adequate parking for the facility; (11) failure to plan for adequate space for concessions and merchandising; (12) failure to provide for adequate lobby space for spectators; (13) failure to provide for an adequate space for the media to observe activities as well as to interview performers; (14) failure to provide for adequate ticket sales areas; (15) failure to provide adequate space for a loading dock and parking for tractor trailers and buses; (16) failure to provide adequate numbers of restroom facilities for female spectators; (17) failure to provide adequate security and access control into the facility and within the facility; (18) failure to provide adequate separation between activities (buffer or safety zones) in a multipurpose space; (19) failure to provide padding on walls close to activity area, as well as padding and/or covers for short fences, on goal posts, and around trees; (20) failure to plan for the next 50 years; (21) failure to plan for maintenance of the facility; (22) failure to plan for adequate supervision of the various activity spaces within the facility; and (23) failure to plan to plan.

Furthermore, the process should include a planning committee, a master plan, a predevelopment review, a facility checklist, and site selection and development phases.

**Development of a Master Plan**

Master planning is a decision-making process that promotes changes that will accommodate new and revised needs and will search for ways to improve existing conditions. The master plan is critical during periods of excess and limited resources. The planning process can and does change attitudes about the needs and utilization of current assets, as well as provides a way for communicating with the stakeholders.

The master planning process requires coordination, organization, and integration of program, financial, and physical planning. Such planning is cyclical in nature and requires the architectural, strategic, and master planning staff to develop and implement procedures and schedules to ensure that the various activities occur in the proper sequence (see Figure 1.1).

Another important characteristic of the master planning process is its ability to respond to changing needs. It must be a flexible and dynamic plan so that it is easy to amend, taking into consideration future projections as reflected by the realities of the present and the absolutes of the past. This means the process will be more important than the eventual product.

Master planning is a process structured to promote cost-effective development decisions that best serve the goals and objectives of the organization. The process operates on the premise that the development of facilities and their ongoing management can best serve specific program needs if the organization’s standards of space planning, facilities programming, design, and construction management are closely linked.

**Typical Phases of a Master Plan**

The master plan can be used to answer three common questions: Where are we? Where do we want to go? How do we get there? This approach is flexible to allow the individual organization to reflect local conditions, priorities, and emphases.

**Establishment of an Ad Hoc Program Committee and a Plan for Planning**

The organization’s ad hoc planning advisory committee (sometimes called the program committee) should be composed of:
- program specialists,
- end users,
- financial consultants,
- maintenance personnel,
- community representatives,
- maintenance personnel,
**Dos**

This is an example of proper use of safety fencing for a baseball or softball shelter. Notice the 4-ft fence has a protective cover.

This is an example of proper use of a protective covering for a short fence that provides a greater measure of safety for the players.

This is a good example of proper design with a warning track, 8-ft fence with protective covering, and a wind screen.

**Don’ts**

This is an example of an unsafe fence without a protective covering for a short fence.

This is an example of a proper 10-ft safety buffer zone, but with an unprotected wall. This wall should be covered with mats under the basket.

This is an example of poor planning with the exit doors located directly behind the basketball backboard.
management representatives,
facility consultants, and
risk management and safety consultants.

The role of the planning advisory committee includes representing all of the organization's constituencies; overseeing and reviewing the ongoing work; communicating with the various stakeholders about the work in progress, findings, and results; validating the process; resolving unsettled issues; and endorsing the results and forwarding the master plan for approval.

The committee should be assisted by the office staff within the organization, who should keep the senior administration advised of the ongoing work, coordinate and schedule the planning efforts, serve as committee recorder, assist in communicating the ongoing work to the stakeholders, and represent the committee at planning work sessions and related meetings.

**Organization Briefings and Initiation of Organization Master Plan Studies**

The committee should organize and schedule information meetings to (a) notify the organization and the community of the organization's planning activity, purpose, method, and schedule; (b) solicit immediate concerns, comments, and suggestions; (c) encourage participation in the planning process and identify organization or community issues; and (d) identify the planning staff who will be available for further discussions of these and related matters.

**Identification and Confirmation of the Organization's Goals and Objectives**

Now detailed planning can begin with three concurrent studies: development of an organization profile, identification of capital improvements, and analysis of existing conditions. The development of the organization's program statement is intended to generally describe the organization's niche (see Figure 1.2). The statement should include, but not be limited to, a brief history of the organization; the organization's mission; the organization's programs, products, and services; the administrative structure; critical issues and strategic responses; goals and objectives for the organization; details about clientele; an outline of short-range planning, mid-range planning, and long-range planning; and other programmatic features that describe the organization as a distinctive operational entity (see Table 1.1). The statement should conclude with a descriptive overview of how the existing situation is expected to change strategically during the period covered by the proposed organization master plan and the implications and consequences such changes may have on the physical development of the organization.

It is important to compile a 10-year listing of projected capital improvements for the organization. Capital improvement items should include buildings, landscape, circulation (i.e., pedestrian and vehicular traffic), infrastructure (i.e., chilled air, electricity, roadways, sewage, sidewalks, steam, telecommunications, water, etc.), land acquisition, and actions that will change and modify the existing physical plant (e.g., new state highway right-of-way).
The objective of the survey of existing conditions is to discover and describe elements that, in combination, typically create, inform, and/or express the organization as a physical place designed and operated for a specific purpose and located in a setting that has tangible physical characteristics. Certain items should be identified and defined in graphic and narrative formats so as to describe location, function, and physical character of elements. Such items include land ownership, land forms and topography; microclimate, soils and related subsurface conditions; recreational, social, and cultural patterns; land use; building use; buildings rated by physical condition; building entrances, exits, and service points; pedestrian and vehicular circulation systems; public transportation; parking; landscapes; ecological and natural settings, views, vistas, and related design features; major utilities by location, type, and condition; site history and heritage; site and building accessibility; and site and building problems.

**Synthesis and Evaluation of Findings**

After an ad hoc planning advisory committee is established, briefings are completed and plan studies are initiated, and master plan goals and objectives are identified and confirmed, it is time to synthesize and evaluate those findings. This effort should begin to clarify issues and opportunities that the organization should address and should establish and confirm the direction of the master plan. The issues and opportunities that should surface during the synthesis and evaluation effort relate to:

- the organization’s image;
- a sense of place for the improvements;
- existing and new initiatives that may require new building(s) and infrastructure, improvements and revitalization of existing physical resources, and potential demolition;
- the expansion of present facilities, which should occur only after careful and thorough evaluation of projected needs and capabilities of existing facilities; and
- the following approaches, which are listed in priority order, and which are generally considered the most appropriate way to proceed with the program requirements: (1) higher usage of existing space, (2) renovation of existing structures, (3) infill (i.e., adding ver-

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**Figure 1.2. Program Statement** *(Source: White & Karabetsos, 1999; Sawyer, 2002, 2005, 2009)*
Table 1.1

Sample Building Program Statement Outline

Part I. Objectives of the Programs
   a. Instructional (professional service)
   b. Recreational sports
   c. Adapted activities
   d. Athletics (interscholastic and intercollegiate)
   e. Club sports
   f. Community/school programs
   g. Others

Part II. Basic Assumptions to be Addressed
   a. Facilities will provide for a broad program of instruction, adapted activities, intramural and other sports
   b. Demographics of the population who will use the facility
   c. Existing facilities will be programmed for use
   d. Basic design considerations. What is most important?
   e. Facility expansion possibilities will be provided for in the planning
   f. Outdoor facilities should be located adjacent to indoor facilities
   g. Consideration will be given to administration and staff needs
   h. Existing problems
   i. Others

Part III. Comparable Facility Analysis
   a. Visit comparable facilities that have been recently constructed
   b. Compare cost, design features, etc.

Part IV. Factors Affecting Planning
   a. Federal and state legislation
   b. Club sports movement
   c. The community education or “Lighted School” program
   d. Surge of new noncompetitive activities being added to the curriculum
   e. Expansion of intramural sports and athletic programs
   f. Sharing certain facilities by boys and men and girls and women (athletic training rooms and equipment rooms)
   g. Coeducational programming
   h. Emphasis on individual exercise programs
   i. Physical fitness movement
   j. Systems approach in design and construction
   k. New products
   l. Others

Part V. Explanation of Current and Proposed Programming
   a. Instructional
   b. Intramural sports
   c. Club sports
   d. Adaptive programs
   e. Community/school
   f. Recreational programs
   g. Priority listing of programs
   h. Others

Part VI. Preliminary Data Relative to the Proposed New Facilities


tically or horizontally to existing structures), and (4) expansion of facilities into new areas on the organization’s site.

The master plan, during this phase, needs to consider generally accepted land use guidelines such as (1) the highest and best use should be made of all land, (2) land use conflicts should be avoided (i.e., neighboring residential and commercial areas), (3) areas should complement each other and promote a visual interest and functionally fit the remainder of the organization’s site, (4) facilities should be constructed only on sites that best meet programmatic and environmental objectives of the organization, and (5) the organization should develop a no-build policy relating to the preservation of historic sites or open spaces.

Furthermore, the master plan should contain goals and objectives for circulation and transportation on the organization’s site. These goals and objectives should include, but not be limited to, (1) general access to the organization, (2) vehicular circulation, (3) parking, (4) pedestrian and bicycle circulation, and (5) transit.

Another extremely important aspect of the master plan is the utilities and service elements. A consolidated utility system consistent with the projected needs of the organization should be developed. This system should be designed for simplicity of maintenance and future needs for extension or expansion of the utility network.

The master plan should consider the landscape design. The primary landscape goal for the campus should be to present an image with a high degree of continuity and quality. The landscape design should consider the organization’s buildings and grounds, accessibility issues, fire, security, energy conservation, and desired development beyond the organization’s property line.

The following steps assume an organization planning a new facility from the ground up.

**Regional Analysis**

Sufficient data must be gathered about the off-site surroundings to ensure that the project will be compatible with surrounding environments, both man-made and natural. This part of the design process is referred to as the regional analysis. It should include the following:

- service area of the facility under construction (i.e., major facilities such as parks, large commercial areas facilities, and minor facilities such as children’s playgrounds, senior citizen centers, local library, etc.),
- user demand (i.e., determine the kind of use clients desire, activity interests, demographic makeup of residents, and local leadership and calculate the number of users),
- access routes (i.e., major and secondary routes),
- governmental functions and boundaries (i.e., contact the local planning agency and local government offices),
- existing and proposed land uses (i.e., gather information about abutting land ownership, adjacent land uses, land use along probable access routes, off-site flooding and erosion problems, off-site pollution sources, views [especially of aesthetic and historic interest], and significant local architectural or land use characteristics), and
- regional influences (i.e., check for anything unusual or unique that could either enhance or cause problems to the project).

**Site Analysis**

The planning committee will need to consider various pieces of information prior to selecting the building site. The considerations for site selection (Flynn, 1985; Sawyer, 1999, 2002, 2005, 2009) include:

- access to the site (i.e., ingress and egress, surrounding traffic generators, accessibility via public transportation);
- circulation within the site (e.g., roads—paved and unpaved—bicycle trails, walking and hiking trails);
- parking;
- water supply;
- sewage disposal;
- electrical service;
- telecommunication service;
- other utilities, including oil/natural gas transmission lines or cable TV;
- structures to be constructed or renovated;
- environmental concerns and conditions on and off property (e.g., noise, air, water, and visual pollution);
- easements and other legal issues (e.g., deed restrictions, rights-of-way, and less than fee simple ownership);
- zoning requirements (i.e., changing the zoning is usually time consuming and expensive and frequently not possible);
- historical significance;
- any existing uses (activities) on the site;
- climatic conditions prevalent in the area by season (e.g., temperature; humidity; air movement velocity, duration, and direction; amount of sunshine; precipitation—rain, sleet, snow; sun angles and subsequent shadows; special conditions—ice storms, hurricanes, tornadoes, heavy fog, heavy rainstorm, floods, and persistent cloud cover);
- nuisance potentials (children nearby, noise, etc.);
- natural features (e.g., topography, slope analysis, soil conditions, geology, hydrology, flora and fauna);
- economic impact of a site (e.g., labor costs, growth trends, population shifts, buying power index, available workforce, property taxes, tax incentives, surrounding competition, utility costs, incentives, area of dominant influence, designated market area, and established enterprise zones);
natural barriers and visibility;
- supporting demographics (age, gender, occupation, marital status, number of children, expenditures, education, income, number of earners in the family, ethnic background, etc.) and psychographics (e.g., lifestyle data or lifestyle marketing); and
- security concerns (e.g., proximity of police, fire, emergency medical personnel, hospitals).

The most important aspects of site selection are location, location, and location. If the site is not in the most accessible location with a high profile for people to recognize, the success of the venture will be negatively affected.

The following seven steps apply to both new ventures and established organizations planning major overhauls (Flynn, 1985; Fogg, 1986; Miller, 1997; Sawyer, 1999, 2002, 2005, 2009):

1. Master plan agenda. The master plan agenda is a specific list of issues, opportunities, and projected physical improvements. The plan will include the number and type of structures to be constructed or renovated, the estimated capital costs over a set period of time, approximate locations of new structures, and probable priority to be considered in the preparation of the master plan (see Figure 1.3).

2. Review and discussion. This step offers the organization and its stakeholders the opportunity to review and comment on the work completed on the master plan to date. The planning committee should be present at these open forums to answer questions and understand the issues and concerns raised. The presentations for these open forum meetings should include:
   - a description of the process,
   - a summary of the organization's profile,
   - a review of the projected capital improvements,
   - a summary of the surveys and analysis of existing conditions,
   - an accounting of issues and opportunities,
   - a list of items on the master plan agenda, and
   - a description of the next steps in the planning process.

The committee should review and evaluate all reactions and concerns raised at the meeting(s).

Then the committee should determine appropriate modifications to the master plan.

3. Preparation of the draft master plan. The preliminary master plan should be expressed in both general and specific terms. The former is intended to communicate the major features of the campus plan. The latter view enriches the vision by showing in greater detail the character, justification, feasibility, and phasing of selected significant improvements. The following components typically appear in a master plan: (1) new construction; (2) building and site reconstruction, renewal, and demolition; (3) revisions to and extension of the circulation systems; (4) new and improved landscape projects; (5) parking patterns; (6) transportation proposals; (7) infrastructure projects; (8) joint organization and community development; (9) drawings and illustrations; (10) block models; (11) organization design guidelines for buildings and building materials; and (12) landscape guidelines including views, boundary identification, major entrances and exits, service entrances and exits, building sites, vehicular and pedestrian circulation systems, parking, water features, rock formations, gardens, open spaces, and passive or recreational spaces.

4. Review of preliminary plan. The planning committee will present the preliminary plan to the organization's constituencies, administration, board, and community at large. These groups will review the preliminary plan. After careful review, a combined report will be generated with suggested modifications and justifications for the modifications.

5. Revision of the master plan to obtain consensus and approval. After the preliminary plan review has been completed, the master plan should be revised to include recommended changes from the stakeholders. The revised plan should be published and distributed as a draft master plan for use in the plan approval process. The master plan remains a dynamic and flexible document even after approval.

6. Documentation and dissemination of the master plan. The ad hoc planning advisory committee is transformed into a standing planning advisory committee with the following responsibilities: (1) serve as a conduit for the organization's community to present issues and suggestions regarding the master plan; (2) review all capital expenditure projects; (3) confirm conformance to the campus plan; (4) expedite the resolution of nonconformance; (5) review, resolve, and recommend plan amendments; and (6) participate in an annual review of the master plan and cyclical master plan revisions.

7. Master plan amendment process. The master plan will need to be amended periodically to stay current with new trends and developments. The standing planning advisory committee should plan to revise the master plan every 5 years. The process is the same as the original process that established the master plan. The standing planning advisory committee will annually review the master plan. If the administration plans a major new initiative that requires modifying the master plan or a structure or utility fails, the committee can request that the master plan be modified. This recommendation would be forwarded to the administration and board for approval.
Implementation of Plan

After the master plan has been approved as a guideline for the organization's future planning, it is important to remember that the master plan is a guide for the entire organization. It is not a specific plan for a particular structure. Once approval and funding have been gained for a specific structure, then the developmental process begins for that structure. The common components of a development process for a single structure or complex include research; regional analysis; site analysis; program; functional analysis; combined site, function, land use; refinement and site plan/overall design; construction documents; bidding; construction; and review.

Design Team

The design team (see Figure 1.4) is composed of the project planning committee, architect(s), engineers, facility consultant(s), interior designer(s), construction
manager, acoustical consultant(s), and turf management specialist(s). Generally, the architectural firm the organization selects employs engineers (e.g., civil, electrical, mechanical, and structural), interior designers, acoustical consultants, and turf management specialists. The organization often hires a facility consultant to work with the program committee and architect. However, in some cases, the architectural firm as part of the design team may employ the facility consultant.

A facility consultant can provide numerous services. If the consultant is part of the owner’s team rather than the architectural team, this individual should serve as a liaison between the project planning committee and the architect. It is important to understand that the majority of architects an organization employs have little or no experience in designing these types of facilities. It would be preferable to select an architectural firm familiar with these types of facilities. If this is not possible, then the facility consultant becomes very important to the process.

Selecting an Architectural Firm

The selection of an architectural team should be based solely on the reputation and experience of the company and a formal review process. Once a project is approved, an advertisement (a request for qualifications [RFQ]) should be placed in the news media seeking qualifications of interested architectural firms for the specific project. Later, a letter should be sent to specific firms who qualify inviting them to submit proposals.

Tips for Drafting the Request for Proposal

The request for proposal, or RFP, is composed of the following components: (1) Prepare an RFP and communicate to a broad list of applicants to ascertain their qualifications and experience for this particular type of project (Noyes & Skolnicki, 2001; Sawyer, 2009). (2) Draft an evaluation sheet for the selection committee to use to determine who is qualified. (3) Based on responses to the RFQ, select no more than 20 firms to which to send the RFP. (4) Draft a second evaluation sheet to narrow the pool to three to five finalists for the selection committee. (5) Provide the applicants adequate time to prepare a proposal—between 3 and 4 weeks, or longer if holidays are involved. (6) Request the firms include in their proposals the following: a list of recently completed projects (last 10 years), the estimated budgeted costs and actual costs for each project, and in-house professionals available to work on the project. (7) The owner needs to provide the applicants with adequate background for the project. (8) The finalists will participate in an interview process.

Prior to the Interview

Prior to interviewing the finalists, the program committee, facility consultant, and administration representatives should travel to at least two facilities built by each firm and review the final result of their efforts. The travelers need to speak with the facility manager and users and ask about the best features and the worst features of the facility. What would they do differently? After completing the tours, they should draft a number of questions to ask the architect during the interview.

Figure 1.4. Project Planning Committee (Source: White & Karabetsos, 1999; Sawyer, 2002, 2005, 2009)

The Interview

After the field of applicants is narrowed to three to five, the firms should be interviewed. Each firm should demonstrate its competence and philosophy in the following areas (modified from the American Institute of Architects suggestions):

- client’s role in the design process,
- number and type of consultants required,
- design or build versus conventional design versus fast-track process,
- extent of engineering services,
- construction supervision,
- number of sets of plans or specifications to be provided,
- construction cost,
- factors that may influence construction,
- time schedule and target dates for completion,
- architectural fee and payment schedule, and
- development of a budget.

Criteria for Selection

The successful firm should be open and flexible with the program committee and facility consultant experienced with this type of project and able to demonstrate that they have completed facilities within the budget developed (Noyes & Skolnicki, 2001; Sawyer, 2009). The firm should be able to demonstrate awareness, a user-friendly process, past success with other similar projects, and past fees as related to similar projects. Finally, the firm should be willing to provide accessibility to the architects and engineers during the planning and building phases.

Research for Facility Development

In its research, the planning committee should be concerned with (1) knowing and understanding the current and future needs and desires of the people who are involved in and/or affected by the proposed project and (2) knowing everything reasonably possible about the project function and/or activity and the space requirements.

Designers Design for People

At least four groups of people may need to be involved in the research and eventually be satisfied, including clients (e.g., board of directors), users, affected neighbors and/or public, managers and operators, and possibly others. Each of the relevant groups must be identified and its needs, concerns, and desires understood. Conflicts will almost certainly exist between the various groups. Understanding these problems in advance may make resolving them during the design phase possible.

Maintenance and Operations

Maintenance and operational needs, small but significant, must be clearly understood. They can make a project successful or doom it to future failure. The following are specific items to consider:

1. Maintenance
- Will maintenance be conducted by in-house labor or by contract?
- Is special equipment used or needed (e.g., riding lawn mowers)?
- Does maintenance staff require or prefer certain standard equipment (e.g., motors, lights, showerheads, pumps, etc.)?
- How capable is staff to maintain sophisticated equipment?
- What are maintenance space requirements, such as equipment clearance around motors and pumps, so routine maintenance can be performed?
- Are there any special fire protection requirements?
- What special storage requirements are needed for flammables and chemicals?

2. Operations
- Security—Is it needed? If so, what type (patrol, electronic, entrance only, dogs, by whom)? If patrolled, how—by foot, car, motorcycle, horse, bike, or boat?
- Hours of operation—Is night lighting required?
- Trash pickup—In-house? Contract? Kind of equipment used?
- Deliveries—Food, supplies, etc. When are separate entrances and exits needed?
- Communications system—Speakers, phone, radio, bell system, public address system?
- Peak use—How is it handled? Restrict use or provide overflow capacity?

3. Special Programs
- Will there be any? If so, what kind (e.g., concerts at noon, employee training, visitor information and/or education, arts and crafts shows, special exhibits)?
- Any special space requirements for programs? Lighting? Service areas? Other utilities?

Facilities and Their Requirements

Most facilities have specific site requirements. Technical data must be gathered on all the proposed facilities. At a minimum, the following must be known:

- size (actual dimensions plus any buffer spaces or required accessory space);
• grade requirements (i.e., maximum and minimum heights);
• special construction requirements (e.g., aquatic centers, tennis courts, or ice hockey rinks); and
• utility needs (i.e., type and amount).

Predevelopment Review

Along with the master planning process, a thorough review of facility needs should be completed for a proposed new or renovated facility. This review should be completed before an architect or consultant is brought on board. This can save time and money, as well as ensures that the structure will fit the proposed program. It is important to develop a checklist at the beginning, not the end, of the planning process. This will help focus and guide the dream and planning process. See Appendices A through D for examples of specific checklists to guide you in developing your own checklist for the proposed project.

Program

Program, as used here, is the organization of the information needed for planning a project to provide an appropriate facility to meet the needs of the affected people (client, users, neighbors, and staff). Program needs should include a list of activities, facility needs for each activity listed, number of participants in each activity during peak periods, size of each facility ranging from minimum to ideal, and a description of the relationship between activities and facilities (i.e., Can certain activities coexist with other activities at the same time in one facility?).

Functional Analysis

Functional analysis is the process of analyzing and organizing the information provided in programming and relationships by translating that analysis into graphic symbols. It establishes the preferred or ideal physical relationships of all the components of a project. The process commonly consists of four parts: space diagrams, relationship charts and/or diagrams, bubble diagrams, and land use concepts. All of the elements contained in the activity/program must be considered and their desired functional and physical relationships accommodated.

Combined Site, Function, and Land Use

Two issues are key to land use: people's needs and site constraints. At this point, the various constraints and opportunities the site presents must become integrated with people's needs. It is also the time when the reality of the site constraints may require changes in the program. This step combines the site analysis with the functional analysis. If changes are made in the program, the changes must be incorporated throughout the functional analysis phase. This step in the site design process is where analysis of the site data is most completely utilized.

If the site selected is too small, the following options should be considered:

• Physical modification of the site. This may be the least desirable option because it is almost always undesirable from an environmental standpoint. It frequently is not aesthetically pleasing, and it is usually expensive.
• Expand the site if adjacent land is available. This is frequently not possible and can be expensive.
• Change to another site. This can be expensive, and alternate sites may not be available.
• Cancel the project. This is not usually desirable or possible.
• Creatively look at ways of solving the problem.

The location is the most difficult choice. It is always difficult to abandon the proven acceptable way of designing and operating facilities. When successful, however, it often leads to outstanding, innovative solutions.

Refinement and Site Plan/Overall Design

After the land use step has been completed, the planning committee needs to refine the focus of the building project before it moves to the site plan/overall design step. After the refinement is complete, then, and only then, should the planners consider site planning and overall design. A site plan shows the entire existing and proposed site features superimposed on a topographic base map at an appropriate scale. It functions as the coordinating plan that ensures that all the project parts fit together. This is the point in the site design process where imagination and creativity are really important. In addition, this plan is almost always the feature part of any presentation to the client and other interested parties. Finally, accompanying the site plan will be a number of drawings, including utilities (e.g., water sources, sewer lines, and electricity/communication lines), grading and drainage, circulation, scale drawings, relationships, and three-dimensional aspects.

Construction Documents

Construction documents control the actual constructed results and consist of two separate parts: working drawings and specifications, the written companion to the working drawings. Upon completion of the working drawings and specifications, the project is bid and, if the bids are satisfactory, the contract is awarded.
Working Drawings

All working drawings must be clear, concise, and understandable to the people who are going to construct the building. Only as much detail as is necessary to build the project should be included. More detail might give the client more control but will definitely cost more money for design and will result in higher bids. All pieces must be clearly presented in a manner that will allow accurate building.

All construction drawings must be accurate, clearly labeled, and dimensioned. If in doubt as to the need for a label or a dimension, include it! Normally, written numbers on the plan take precedence over field-scaled distances.

A useful tool in outlining the numbers and kinds of construction drawings is a plan control list. Each drawing expected to be needed is listed by description. This enables the designer(s) to coordinate work and ensures that all aspects of the project are included.

With the completed list of plans, an estimate of time required to complete the working drawing and the necessary scheduling of work assignments can be carried out. This plan control document will probably be revised during the preparation of drawings. In its final form, it will become the drawing index listing for Sheet 2 of the working drawings package.

The more detailed and elaborate the working drawings are, the higher the cost of preparing them and, very frequently, the higher the cost of building the project. A rule of thumb: The smaller the job, the fewer the construction documents. Small contractors do not like excessive control and paperwork. They frequently will not bid on projects with elaborate specifications, and if they do, they bid high. Frequently, too much control will cause bids to be higher but does not result in an increase in quality.

The construction drawings must be reviewed by the maintenance staff to (1) ensure compatibility of parts with existing facilities, (2) see whether the project can be effectively maintained at reasonable cost, and (3) determine whether alternative materials or design modifications would reduce the costs and/or simplify maintenance. A detailed cost estimate is almost always necessary at this point in the design process. If costs estimated for the time of construction are too high, then the project may have to be reduced in scope and/or redesigned. Be certain that lifetime operations and maintenance costs are also considered in the estimate.

The construction drawings should include the following: demolition and site preparation, utilities, landscape and site improvements, structural, architectural, mechanical/HVAC, mechanical/plumbing, mechanical/fire protection, and electrical/telecommunications.

Specifications

The written portion of the construction documents comes in three parts: bidding and contract requirements (including the bid documents)—Division 0; general requirements—Division 1; and construction specifications—Divisions 2–16.

This part of the design process is often most disliked by designers because of the massive detail required. It is, however, of the utmost importance in ensuring that the design is actually built according to the way it was envisioned.

Specifications should be organized in the 16-division format developed by the Construction Specifications Institute as follows (AIA, 2009):

| Division 0: | Bidding requirements, contract forms, and conditions of the contract |
| Division 1: | General requirements/special conditions |
| Division 2: | Site work |
| Division 3: | Concrete |
| Division 4: | Masonry |
| Division 5: | Metals |
| Division 6: | Wood and plastic |
| Division 7: | Thermal and moisture protection |
| Division 8: | Doors and windows |
| Division 9: | Finishes |
| Division 10: | Specialties |
| Division 11: | Equipment |
| Division 12: | Furnishings |
| Division 13: | Special construction |
| Division 14: | Conveying systems |
| Division 15A: | Mechanical (HVAC) |
| Division 15B: | Mechanical (plumbing) |
| Division 16: | Electrical |

General Notes

- Include everything in the specifications that you want to see in the final constructed product.
- Make sure that Division 1 includes the contractor providing “as-built” drawings, catalogue cuts, and, where appropriate, an operation manual and training of operating and maintenance staff.
- Include only information necessary to the specific project—especially if it is a small one. As with plans, small contractors do not like and frequently do not understand long, involved specifications; therefore, they will not bid or may increase their bids accordingly. The heavier, thicker, and more complicated the specifications are, the higher the bid.
- Conversely, the less detail you have in the specifications, the greater the opportunity for misunderstandings between the owner and the contractor.
- All phases of specifications are readily adaptable to computerization and/or word processing. Much time
can be saved if “canned” specifications are used, thus speeding up this tedious but crucial task. Computerization will probably lead to standardization of details and format.

**Schematic Design Phase**

In the schematic design phase, the architect prepares schematic design documents that consist of drawings and other documents illustrating the scale and relationship of project components. These are based on the mutually agreed-upon program with the owner, the schedule, and the construction budget requirements, and they are submitted to the owner for approval.

The products from this first phase of the project consist of the following: renderings (architect’s conception of the building) and models, floor plans and elevations, narrative (a description of the project with sufficient detail to allow an initial review by the organization), outline specifications (e.g., exterior materials, interior finishes, mechanical and electrical systems, identification of significant discrepancies between the project requirements and the budget), and cost estimates.

The project management issues for this phase consist of cost and budget, program expansion, schedule slip page, design review, quality assurance, use of design and estimating contingencies, code compliance, and building committee(s).

**Design Development Phase**

Based on schematic design documents and any adjustments the owner authorizes in the program, schedule, or construction budget, the architect prepares further design development documents for approval by the owner. These consist of drawings and other documents to fix and describe the size and character of the project as to architectural, structural, mechanical, and electrical systems, materials, and other appropriate elements.

The products for this phase include drawings (site and landscape, utilities, structural, architectural, mechanical, electrical, and special equipment), narrative, specifications, and cost estimates.

The project management issues for this phase consist of cost and budget, scope creep (common elements previously eliminated from the project that reappear in design development), design review, technical review (specific reviews initiated by the owner to ensure the organization’s guidelines for design and construction are being complied with), and use of design contingencies.

**Construction Approaches**

**Lump-Sum Contract**

The traditional approach is commonly known as the lump-sum contract. In this method, a general contractor is selected based on the lowest bid. The general contractor is responsible for selecting all subcontractors and all construction materials. It is not advisable to enter into this type of contractual relationship because the general contractor has too much control of the profit and loss for a job.

**Pros.** This is a simple, traditional approach with a defined project scope, suitable for small or straightforward projects, and fiduciary architect/engineer (A/E) and non-fiduciary general contractor roles are clear.

**Cons.** The builder has no input in design; the price is uncertain until bids are received; it is the slowest project delivery; there is no control over subcontractor selection; an adversarial relationship could exist among the A/E, owner, and contractor. It is prone to cost growth through changes and claims; there is a high incidence of litigation.

**Construction Manager**

Many public projects employ a construction manager to oversee the progress of the construction through all phases. This method allows for multiple bids, such as one for mechanical, another for electrical, and another for general construction of the structure.

**Pros.** There is builder selection flexibility, pre-construction services, a faster delivery schedule, early budget input and control, and change flexibility. Money is saved with controlled purchasing, optimal trade contractor selection through competitive bidding, and effective minority- and women-owned business enterprises procurement.

**Cons.** The owner assumes contractual cost and schedule risk, and there is no single point of contract accountability. The owner must manage more contracts, and the price is not guaranteed. Potential additional design costs and potential claims exist.

**Design and Build**

The next approach is design and build. This method places the responsibility for completing the project on the architect and builder who work for the same company. This option sets a fixed price, encourages interaction, and eliminates additional costs arising from design changes. A variation of design and build is called fast tracking. It is used in large projects in which contracts are let incrementally or sequentially so that the construction time may be reduced. This variation may be not be allowed in public projects due to federal or state mandates.

**Pros.** There is a single point of responsibility for design and construction; it offers the fastest schedule for delivery and allows for early identification of guaranteed costs.

**Cons.** There can be loss of owner control, quality, or both and loss of checks and balances. Contractors’ profits may be excessive, and competitive bid design and build selection with guaranteed maximum price is problematic.
Design/Build/Finance/Leaseback

Another approach is design/build/finance/leaseback. This approach encompasses all the design associated with the construction project as well as obtaining funding and securing a location for the project. Furthermore, this approach also includes operations and maintenance support after the building is occupied for a specific time frame. The financially challenged owner will find this approach more acceptable. The owner will lease the facility for a specific number of years and will own the facility at the end of the term.

Pros. This approach offers a lease commitment versus a capital expense and an early lease cost determination. There is single-source management of the entire program and risk assumption, lease, financing, and ownership flexibility, and it avoids long-term capital ownership commitment.

Cons. Potential interest rates are a risk. There is diminished owner control and potential for higher operating costs. Future facility control is limited, and residual value is reduced or eliminated.

Building Project Budget Components

It is important to understand what a building project will cost. The following are the common cost components suggested by the AIA (2009, see http://www.aia.org):

- land acquisition costs;
- land development costs;
- permitting procurement costs;
- utility tie-in, connection, or impact fees;
- attorney’s fees for zoning and permitting;
- regulatory costs;
- consultant fees;
- costs of relocation, staff, and new building simulation drills;
- costs of building commissioning and activation;
- furniture, fixtures, and equipment costs;
- data, security, and telephone infrastructure costs;
- costs of testing and inspection services;
- costs of A/E;
- costs of a construction manager; and
- construction costs.

Construction Document Phase

Based on the approved design development documents and further adjustments in the scope or quality of the project or in the construction budget authorized by the owner, the architect prepares construction documents for the owner’s approval. These consist of drawings and specifications that set forth in detail the requirements for the construction of the project.

Construction documents (developed by the AIA and the Associated General Contractors of America) consist of the following: invitation to bid, instructions to bidders, information available to bidders, bid forms and attachments, bid security forms, construction agreement, performance bond, payment bond, certificates, contract conditions (i.e., general conditions and supplementary conditions), specifications (Divisions 1–16), drawings, addendum(s), and contract modifications.

The program management issues for the phase consist of code compliance, scope creep, schedule slippage, design review, technical review, quality assurance, use of design and estimating contingencies, design contract interpretation and enforcement, bidding and construction strategy (i.e., a lump-sum bid for all components or multiple bids for general contractor, mechanical, electrical, and add-ons or reductions), cost overruns or underruns, design-bid-build (i.e., project designed by an architectural firm and bid out to construction firms to build), design and build, and a variation of design and build called fast tracking.

All designers must keep current on the latest product information available in their field of expertise. When the plans and specifications are completed, the project is ready for bid.

Bidding

Bids are opened in front of witnesses, usually the contractors or their representative(s), and an attorney (normally required by a government agency). The bidding process includes (a) bidding and advertising, (b) opening and reviewing bids, and (c) awarding the contract. The bid documents include invitation to bid, instructions to bidders, the bid form, other sample bidding and contract forms, and the proposed documents (e.g., drawings and specifications).

Bidding and Advertising

Bidding is the process of receiving competitive prices for the construction of the project. A bid form should be provided to ensure that all bids are prepared in the same manner for easy comparison. The bids can be received in many ways. The most common are

- lump sum (one overall price),
- lump sum with alternatives (either add-ons or deletions), and
- unit prices.

All bids on large projects should be accompanied by some type of performance bond, ensuring that the contractor will perform the work as designed at the price bid in the time specified. This ensures that bidders are sincere in their prices.

The time and place of the receipt of the sealed bids must be clearly shown on all bid packages. No late bids can be received without compromising the entire bidding process.
Small Projects (Up to $25,000)
A bid of this size can normally be handled informally. The process of calling a selected list of local contractors will usually be sufficient and will probably result in obtaining the best price.

Larger Projects (Over $25,000)
A formal bid process is usually necessary to ensure fairness, accuracy, and a competitive result. The process starts with advertising for bids. Advertising frequently is initiated prior to completing the plans with an effective date for picking up the completed plans and specifications. The larger, more complex the project is, the wider the range of advertising necessary. Governmental agencies usually have minimum advertising standards. They advertise in the legal advertisement section of the local paper and papers in larger nearby cities and in professional construction journal(s). In addition, designers or clients frequently have a list of contractors who have successfully built past projects and/or who have indicated an interest in bidding on future projects.

As a minimum, the advertisement should consist of:
- a description of the project and kind of work required,
- the date and place plans can be picked up,
- the cost of plans and specifications (usually only sufficient to cover printing costs),
- the bid date and time, and
- client identification.

The approximate value of the project is sometimes included; however, some designers and clients do not wish to give out this information. With complex projects, it is desirable to schedule a pre-bid conference to explain the design and bidding process to prospective bidders. During the bidding period, one or more prospective bidders frequently raise questions. If the questions require design modifications or clarifications, they must be answered in writing in the form of an addendum to all holders of plans.

Opening and Reviewing of Bids
The designers or their representatives are usually present at the bid opening. After the bids are opened and read, it is necessary to analyze them and decide to whom the contract is to be awarded. The technical analysis is usually by the designers who consider whether the bid is complete, the prices are reasonable, and the contractor is able to do the work. A recommendation is then made. The legal analysis by the attorney is conducted concurrently with examining whether bonds are attached, all necessary signatures are included, and all required information is provided.

Award of Contract
Assuming favorable analysis by all involved and that the bids are acceptable to the client, the contract will be awarded. Most contracts are awarded to the lowest qualified bidder. Sometimes, however, the low bidder is not large enough or does not have the expertise to do the work required. Occasionally some bids are improperly prepared. In these situations, they may be rejected and the next lowest qualified bidder will be awarded the contract, or the project is rebid. This can lead to problems with the disqualified bids or bidders and is why an attorney should be present.

Payments
Drawdown. Who pays what and when? The key to a successful construction project is timely payments. Normally there is an agreed-upon payment schedule based on the submission of proper invoices for work completed and materials used from the contractor to the owner. This is generally done on a weekly basis.

Progress payments. The owner agrees to make progress payments to the contractor percentage of work completed. The payment requests are submitted based upon the amount of work completed on a line item from a pre-approved schedule of values.

Retainage. This is the portion of the construction contract amount that the owner typically holds back until all elements of the work are satisfactorily completed. This amount is established in the beginning of a project and is normally specified in the contract as a percentage.

Construction Phases
The architect should visit the site at least twice monthly at appropriate intervals during the construction stage and make the owner generally familiar with the progress and quality of the work in writing. The architect has other responsibilities, including certifying the payments presented to the owner.

The construction step of a project goes through several phases. The number of phases depends upon the scope of the project and the contracting agency. Two general guidelines govern the construction step: (1) the larger the project, the more steps required and (2) governmental projects usually have more contractual controls. At least some, and perhaps all, of the following steps will be required during construction.

Pre-Construction Conference
A meeting should be held between the contracting agency and the contractor(s) prior to the commencement of construction to review the contract items and make sure there is an understanding of how the job is to be undertaken.

Construction
The actual construction begins this phase, which could take as long as 5 years, depending on the scope of the proj-
ect. However, construction can generally be completed in 18 to 24 months on an average project.

Change Orders
Change orders are defined as official documents requested by either the contractor or the contracting agency that change the approved contract documents. These changes usually include an adjustment of the bid price and a benefit to the contractor. It is better to avoid all change orders. Where this is not possible, be prepared to pay a premium price and to accept delays in contract completion.

The owner (or construction manager) needs to do the following to manage change orders:
- evaluate the proposed change for impact on the construction budget and schedule,
- determine whether the proposed change is cost effective,
- secure independent estimates of verified change order requests and recommend approval levels,
- challenge the validity of change order pricing by the contractor,
- prepare a proper change order agreement,
- make changes to the project budget and schedule, and
- maintain a log of all change orders approved.

Pre-Final Inspection and Preparation of Punch List
The initial review of a completed construction project is called a pre-final inspection. This inspection should have the affected parties’ decision makers present including the owner or his or her representative, the architect, the contractor(s), and any subcontractors. At this time, it is also desirable to have the facility operation supervisor present. During this review, a “punch list” is prepared of any work the contractor needs to complete prior to a final inspection. All items that are not completed or are not completed according to specifications should be included on the list. The punch list is then agreed upon and signed by all affected parties. The contractor must then correct and/or finish all the items on the list. When the punch list is completed, it is time to call for a final inspection.

As-Built Drawings and Catalogue Cuts
As-built drawings and catalogue cuts are the drawings prepared by the contractor showing how the project was actually built. These drawings will be of great value to the operations and maintenance staff. They must know exactly what facilities were actually built and their locations to be able to maintain the project effectively.

Catalogue cuts are printed information that the manufacturers supply on materials and equipment used in the project construction. This material is necessary so that the operating staff will be able to learn about the material and equipment. In addition, it is needed for locating necessary replacement parts. It must also be included in working drawings and specifications of future renovations and/or expansion of the project.

Preparation of an Operations Manual
An operations manual contains written instructions on how to operate and maintain special equipment. The minimum data should include how to start up, how to shut down, inspection(s) time intervals and what should be inspected, schedule of required maintenance, safety precautions, and whom to contact for specialized repair assistance.

Training on How to Operate the Project
This contract item is usually included only for larger projects that are unfamiliar to the people who will operate them.

Final Inspection
The final inspection should concentrate on items not found acceptable during previous inspections. The same review team that made the pre-final inspection should be assembled for the final inspection.

Acceptance of Completed Project
Assuming all the work has been completed as shown on the plans and described in the specifications, the project should be accepted and turned over to the owner or operator. Furthermore, if the contractor has posted a performance bond guaranteeing the work, it should be released by the contracting agency.

If at all possible, avoid partial acceptances. Sometimes it is necessary to take over a part or parts of a project prior to completing the entire project. If this becomes necessary, the contractor will have the opportunity to blame future problems and/or delays on having to work around the people using the project.

Maintenance Period
When living plants are involved, many contractors have a maintenance period included after the acceptance of the project. This can last anywhere from 30 days or more for lawns to 90 days for flowers and, frequently, one full growing season for ground cover, vines, shrubs, and trees.

Bond Period
Most government projects and some larger projects require the contractor to post not only a performance bond but also a 1-year (or some other specified period) warranty on the quality of the work. Usually the bond requires the contractor to replace or repair any defective or damaged items during the time covered by the bond. Typical items are leaking roofs, infiltration of groundwater into sewer lines, puddling of water in parking lots or tennis courts, and so forth.
Bond Inspection and Final Acceptance

At the end of the bond period, the original final inspection team holds another inspection. Prior to release of the bond, any problems that have been uncovered during this inspection must be rectified at no cost to the contracting agency. It is important to note that when the bond is released, the contractor no longer has any responsibility to the project.

Review

The project has been completed and turned over to the client. Does the project do what it was designed to from the standpoint of the (a) client, (b) user, (c) affected neighbors and/or public, (d) manager and operator, and (e) design team? There are two basic kinds of information to be gathered: information on people and information on physical conditions.