

A s p e c t s o f G o l f C o u r s e
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b y

B r a d l e y M. P o w e l l

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This practicum is submitted to the Faculty of Graduate Studies
of the University of Manitoba in partial fulfilment of the
requirements for the Degree of

MASTER OF LANDSCAPE ARCHITECTURE

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University of Manitoba
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ASPECTS OF GOLF COURSE ARCHITECTURE
A STUDY IN THE EXAMINATION AND APPLICATION
OF DESIGN PRINCIPLES IN GOLF
COURSE ARCHITECTURE

BY

BRADLEY M. POWELL

A practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF LANDSCAPE ARCHITECTURE

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A b s t r a c t

The study outlines the evolution of the game of golf from its early rudimentary forms through to the modern age. The design philosophies of early architects are presented in order to gain a clear understanding of the fundamental principles underlying the modern game. Those qualities of the game which are deemed essential for great golf are also recognized. Furthermore, the evolution of intrinsic course features are traced from their natural origins to contemporary interpretation. Individual design elements are examined with regard to their utilization in the overall design and strategy of each hole. In addition to identification of the key principles of design, this study also endeavours to address environmental considerations which have become an integral part of course design. Finally, the study presents an application of design principles to the ninth hole at PGA West's Stadium course located in Palm Springs California.

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I n t r o d u c t i o n

Golf architecture has been an accepted profession for less than one hundred years. The current profession owes its genesis to the early rudimentary attempts at regionalizing the sport that have existed, according to Scottish historians, as long as eight centuries ago.

Throughout its relatively short history in North America, golf has become one the fastest growing outdoors sports. There is no mistaking the rapid growth of the sport, especially when one considers the increasing number of people on waiting lists for club memberships.

What separates golf from other outdoor sports is its voracious hunger for land. This fact, coupled with the sports rapid growth, is of considerable importance if such large areas of land are required for the development of new courses.

Each year hundreds of golf courses are built, representing a considerable expenditure on the part of investors. With millions of dollars at stake, investors must make prudent decisions regarding design and project development if their investment is to appreciate

with time. As with any major investment, research must be conducted in order to determine the key requirements, of key elements, that will make that investment a success. The planning of a successful golf course is no exception. It is therefore of critical importance for the designer to establish what elements of the game itself, are of primary importance to the total golfing experience, and therefore significant to course design.

Through a greater understanding of the principles and philosophies governing golf architecture, one is able to achieve a greater understanding and appreciation for what comprises an exemplary golf course.

P r o g r a m O b j e c t i v e s

The purpose of this study is to examine current design philosophies regarding golf course architecture and the genealogy from which it developed.

The profession of golf architecture has been influenced in recent decades by an exponential increase in the demand for new course construction. This demand, coupled with escalating land costs has put a premium on suitable sites for golf course development. Furthermore, recent televised golf coverage on highly

publicized course designs has raised the level of expectation of today's golfer for all new course design.

It is the ultimate intension of this study to identify those philosophies which direct golf course design. Through a greater comprehension and appreciation of the principles governing golf course architecture we are better able to understand the effect of current trends on future golf course design.

H i s t o r y o f t h e G a m e

No one knows where or when the game of golf actually began or even if it evolved independently at different times and places. What we may be fairly certain of however, is that it borrowed extensively from many stick and ball games that had become popular in Europe by early medieval times.

During this medieval period several types of ball games were known to exist, any of which could have lead to the eventual development of the modern game as we know it. Games such as palle-maille and jeu-de-mail are considered to be early precursors of the modern game of golf. Palle-maille was very popular in Italy and France being played in the streets, and eventually in the 17th century, on constructed courts. The object of the game was to drive

the ball to a marked point or through a suspended hoop. Jeu-de-mail, another version of the game, was played across country rather than in a confined area, and the marked point was half a mile away. In Belgium the game of chole was developed for open fields. An elliptical ball of beechwood was struck with an iron spoon-shaped club in order to reach a distant target in as few strokes as possible. The game involved two or more teams, each playing at the same ball. Pargarica was played to a distant mark with a leather ball stuffed with feathers, and struck with a curved stick.

Finally, the game of colf was played within the confines of town with participants striking a ball toward a fixed object in the fewest possible strokes. This was a year round sport with the game being played on ice in the winter. It eventually died out in the late 17th century as the game was considered a nuisance proving to be hazardous to persons and property.

While golf may well have been a compilation of these games one can, with much certainty, state that the game was not invented but rather evolved over a considerable period of time.

From whatever sources it came, the game of golf as we know it today, developed in Scotland over a period of five-hundred years or more. During this same time period, playing fields of the game developed into today's golf courses. By the end of the 16th

century golf had evolved into the earliest form of the present day game, with the ball being played to several consecutive holes spread over a considerable area.

The earliest of these playing fields were found on linksland - those extensive strips of coastal land left when the seas receded after the last ice age. These areas of sand dunes and sparse vegetation were slowly shaped by time and natural forces, into the first grounds where rudimentary "golf" was played.

The earliest of these courses were designed entirely by nature, with the final product often consisting of hollows and high windswept sand dunes covered with grass. The terrain of the linksland usually dictated the route that the players would follow. While there were no trees or ponds on these early courses there were numerous natural hazards that the player had to contend with.

Sheep seeking shelter in hollows or behind hillocks would wear down the turf. The nests and holes of small game would often collapse, creating small pits. Erosion of these areas by wind and water created numerous sand and pot bunkers dotting the landscape. At this time there were no tees or fairways, as such, and no putting green to speak of.

With the sandy soil providing excellent drainage and grazing sheep helping to keep the grass clipped, early golf courses required

little or no maintenance. The course was played in essentially the same condition as it was found. Single holes were played out and back to the original starting point. At that time there were no standard number of holes for a round of golf, and players would wander as far as they could find playable ground before turning back. The preeminent course of this early period of golf in Scotland was St. Andrews. Records indicate that the "course" existed as early as 1414 and consisted of twenty-two holes.¹

By the middle of the 18th century people began to exert deliberate influence on the landscape. The ability to create change would have a profound impact on those future designers seeking to understand the basic principles of golf architecture.

The original links of Scotland form the historic precedent for golf architecture today. The "links" exert a profound influence on golf architecture, and will no doubt continue to do so for many years to come. In the early development of the game, players, rules, and equipment all were shaped by natural conditions found on the links.

During the following century the game of golf was introduced to many different parts of the world by Scottish

¹ Cornish, Geoffrey & White, Ronald E., The Golf Course, 1988, p25.

travellers. As a result, the game of golf was introduced to the Americas as early as 1779.² Most early courses were rudimentary in nature, consisting of only a few holes. Courses were laid out informally under widely different climatic conditions and on innumerable soil types and varying terrains. Despite far reaching introduction, golf did not become widely known or played until the middle of the 19th century.

While the widely understood purpose of course designers throughout history has been to imitate or even replicate those features found existing in nature, the actual practice of golf architecture has demanded modifications of existing terrain and soil to create conditions suitable for healthy turf growth. The practice of golf architecture might therefore be thought to begin in 1764 when the course at St. Andrews reduced from twenty two to eighteen holes.³ Afforded royal assent from King William IV, St. Andrews soon became recognized as the official home of golf. St. Andrews quickly became the standard by which all other courses would eventually be compared. Consequently, eighteen holes has become the standard for all courses built since that time.

² Cornish, p25.

³ Cornish, p26.

The introduction of the gutta-percha ball in 1848, which replaced the feathery, revolutionized the game of golf. Not only was the gutta cheaper and more durable, its durability permitted a far greater use of iron-headed clubs. The subsequent increase in iron clubs used led to the widening of fairways as the irons beat down the heavy grass. These factors increased the popularity of the game during the last half of the 19th century.

e a r l y d e s i g n e r s

The earliest records of golf course designers and their works dates from this period of growth during the latter part of the 19th century. Most of the philosophy of planning and design which we accept today as gospel, was set out between 1896 and 1920, by golfers none of whom has been trained in any of the disciplines usually associated with golf architecture beyond personal experience of play. Planning of the course was usually done on the spot, with the selection of natural green sites and holes arranged into a circuit. During these formative years little construction was undertaken. The natural contours of the site were seldom altered and existing hazards were incorporated wherever possible.

Modification of existing courses did eventually become

necessary in order to accommodate the increasing numbers of people taking up the sport as the game grew in popularity. In addition, courses existing before the introduction of the gutta-percha ball had to be lengthened in order to remain playable.

The second half of the 19th century was characterized by a significant expansion in the number of golf courses but not designers. The sites of early links indicate that golf architecture in its earliest form explored the same guiding principles of most designers in the 18th century. It was also during this period that designers for the first time began to document the necessary characteristics each felt were essential to golf architecture.

The first of such men to outline the attributes of good golf course design was Willie Park in his book, The Game of Golf, in 1896. To begin with, Park stipulates that the course must be composed of eighteen holes with the first tee and the last green near the club house. Furthermore, the first two or three holes should be fairly long and comparatively easy in order to alleviate congestion at the beginning of the course. Tees of the course should be placed on ground that is either level or sloped slightly uphill in the direction of play. The best locations for green sites were either in natural hollows of sufficient size or on larger plateaus. Park felt that greens should be as large as possible, comparatively level but

slightly undulating, and of various shapes and character. All hazards must be visible to the golfer before their first shot is made and at most should cost him/her only one stroke. The placement of such hazards should be varied in order to punish bad shots and to guard the green from the advance of the player. It was Park's contention that the player who managed to hit a good shot should never encounter hazards.

By the end of the century players were beginning to analyze the elements they found were most desirable in the game of golf. One such designer was Garden G. Smith, who in 1898 discussed many of the facets of early golf course planning in The World of Golf.

Smith first selected the position of the various holes based on their intrinsic suitability for proper play of the game. He placed a greater emphasis on the accuracy, rather than strength, of the players shot. This philosophy was realized through the introduction of cross bunkers, hazards along the fairway edge and closely guarded greens. All greens should be of reasonable size to provide a sufficient stopping distance for the ball. Smith felt tees were just as important as the greens and should therefore be of adequate size to accommodate changes in tee positions. Placement of the discs must be at absolute angles to the line of play of the hole. The

teeing area should be located within 30 to 40 yards of the preceding green; close enough to be convenient but not too close as to disturb play. The surface of this area should be absolutely level with no slope unless toward the green. Care must be taken in the construction and placement of hazards. There must be no question as to where the body of one starts and ends.

Finally, it was Smith's belief that the more the designer revealed those features of the site which reflect traditional golf, the more likely they would be able to develop the land to its full potential.

In Concerning Golf, written in 1903 by John Low, there can be found a further step in the evolution of golf course architecture. In order for a course to be a good test of golf, Low felt that each consecutive hole should test something new. The course must require the player to exhibit both power and accuracy in the greatest variety of strokes possible. Each stroke must be played in relation to the last, thereby requiring the golfer to establish a plan of action. As golf is a contest of risks, Low believed that the placement of a bunker should entice the golfer to play as close as possible in an attempt to gain every yard they possibly can. Short holes should be short enough to require the player to judge as to the strength deemed necessary to land the ball on the green. The green,

as well as any hazards along the way, must be clearly visible from the tee, before the shot is made. Subsequently, a perfect tee shot should make the following shot less difficult; a perfect second shot should only be possible after a perfect first.

By 1906 there came a changing attitude toward design features not matching the classic pattern. Designers like Herbert Fowler felt many hazards such as trees, hedges, and ditches were unsatisfactory and unfair. An early proponent of strategic design, Fowler believed the sand bunker was by far the best hazard by which to test the golfer's skill. Fowler placed the majority of his fairway bunkers on the right side of the fairway in an attempt to catch any wayward slice. Furthermore, bunkers should be placed so as to compliment those in close proximity to the green. In addition, the side bunkers of the green should be arranged to create an entrance to which the golfer must play. Consequently, the width of this entrance will vary with the distance from which the approach shot has been played. Therefore, the player who has placed their tee shot will have the advantage of a better approach to the green.

This philosophy would lend support to the school of strategic design which rewards the golfer for playing a good shot rather than penalizing them for making anything but a perfect shot.

The first hints of a movement away from the planning and

making greens and hazards primarily for theoretical reasons only, came from James Braid in 1906, with his book Golf Greens and Greenskeeping. Braid recommended that bunkers be raised in order to make them look as natural as possible. Furthermore, in 1908 Braid wrote Advanced Golf, in which he laid down a specific agenda for golf course design. Once again the use of every natural feature of the land is extolled. A complete variety of holes ranging in length, character and design are to be employed. Putting greens should always be well guarded and vary in size with the length of the hole - the shorter the hole the smaller the green and visa versa. Alternate tee positions must be provided with bunkering for positional play, providing alternate routes to the cup.

The course should consist of four short holes, all different: two long, at a maximum of 550 yards, with the rest between 320 and 420 yards, but preferably longer than 360 yards. In addition, three long holes are suggested to open, with the last two or three holes of the course also of good length. The total length of the course should be between 6000 and 6400 yards with a good balance of hole types between each half.

Putting greens should be of all kinds, sizes, and undulations. Bunkers should be used to catch particular kinds of errant shots. As such, there would be a preference toward the incorporation of side

bunkers, as the slice was considered to be the most common error. Above all, the more natural the hazards were on the course, whatever their character, the more interesting the course ought to be and generally is.

H.S. Colt in his essay, The Book of the Links, in 1912, regards working with the natural features of the land as the only way to provide a site satisfactory for golf. By developing such features to their full potential, and no more than was deemed essential, the result was a course unique in character.

Colt believed two long holes should start the course to allow players to get away quickly. After which there was no prescribed sequence of holes, although variety was considered essential to the playing quality of the course. Variety in the difficulty of hazards, bunkers, and the angles of tees to the fairway were also recommended. At all cost any hint of symmetry in the artificial features incorporated into the site must be avoided. The natural features present on each course must be used to the fullest extent possible. The designer must appreciate and respect both the character and context of the site and therein select suitable landscape features such as ridges, banks or hollows for the placement of bunkers and greens. Any changes to the existing landform must reflect the overall character of the site. Finally, no

regular dimension should be used in the construction of tees or greens, as Colt felt standardization destroyed the enjoyment of the game.

In How to Play Golf, written by Harry Vardon in 1912, the criteria for the layout of eighteen holes is as follows. Five holes measuring roughly 400 yards, four holes at between 330 and 370 yards and the remaining holes between 420 and 500 yards. Shorter holes should be well bunkered with bunkers appearing once between 80 and 120 yards and twice between 120 and 160 yards. Vardon reintroduced the cross bunker with a new twist. Instead of cutting straight across the fairway, it was diagonal in design, with its furthest section on line with the green. Consequently greens were long and narrow to match the scheme and angled toward the line of play.

Finally in 1920, Alistair Mackenzie wrote Golf Architecture, in which he established numerous criteria for the ideal golf course. Among them was the stipulation that there be at least four short holes, two or three drive and pitch holes and a large assortment of two shot holes. There should be an endless variety in strokes required and a different character to every hole. The player should not be confronted with a blind approach, and alternative routes to the green must be provided. Finally, the surroundings of the course

should be aesthetically pleasing with man-made features being indistinguishable from Nature.

Later practitioners have been unable to uncover any basically new philosophies beyond those set out from Park to Mackenzie. Within those 25 years a complete dossier on bunkering, tees, greens, layout and construction had been assembled.

t h e d a r k a g e s

The period between 1885 and 1900 has become to be known as the "dark ages of golf course architecture".⁴ Designers failed to reproduce much of the features of earlier courses, or to recognize the principles on which they were based. For a brief period the attempt to make the site look "natural" was often overlooked and some courses took on a stiff and unnatural appearance. Designers regularly incorporated stone walls, blind shots, hedges, regularly shaped mounds and greens of geometric shape. Such platform greens were invariably oblong, round or square in shape. Bunkers along the fairway were no exception, they too were rectangular in nature and positioned at irregular intervals across the course having

⁴ Cornish, p48.

little or no architectural value.

t h e i n l a n d c o u r s e

Toward the end of the 19th century there began a welcome return to simplicity and naturalness. With the discovery of the "heathlands" in England in the early part of this century, a major step was taken in the evolution of golf course architecture. The inland course owes its creation to these courses built on well drained, rock free, sandy soil and gently rolling terrain. This land was not unlike that of the links with the exception of the presence of trees and absence of ocean. It is at this stage that the manipulation of land form begins to become paramount. In order to create a course of comparable quality, designers were forced to create what nature had not. Trees were both felled and incorporated into design. Undergrowth was removed and where nature was lacking, earth was moved and contoured into green sites, tees and hazards.

New courses stood in stark contrast to the countless geometric layouts with square greens, steepbanked and cross bunkers which traversed the fairway. They featured landing areas that were built up or lowered. Most greens were raised above the fairway level, gentle in shape and were large and undulating. For

the first time manmade hazards resembling nature were introduced.

Golf course architecture came to be regarded as a respected and legitimate profession by the turn of the century. Designers of this era proved that pleasurable and challenging golf courses could be created on almost any site providing proper techniques in course construction were adhered to. They recognized that where a preferable natural contour existed, it should be utilized in the design of a hole whenever possible. If no suitable sites existed naturally for green, tees, landing areas or bunkers, designers would then create them. Designers soon came to recognize the important role aesthetics plays in the sport of golf. The successful blending of artificial hazards into the surrounding terrain as well as the subjugation of harsh natural features would prove to be an invaluable skill to the architect.

p e n a l v e r s u s s t r a t e g i c a r c h i t e c t u r e

Concurrently at this time, there followed in Britain a return to courses that emphasized the natural and the simple. This would eventually lead to a concerted movement away from penal architecture toward a more strategic form of architecture. The

distinction between the two design philosophies lies in the premise that penal design calls for a golfer to pay an immediate and decisive penalty for making an error, while strategic design places more emphasis on rewarding the golfer for playing a good shot. For example, the penal architect might place a series of bunkers edging into the fairway on both sides of the driving zone. This would thereby assure that only a straight shot would go unpunished. Similarly, the same strategy would be employed in the green area. Only a small opening from the fairway to the putting surface would be left open, otherwise the green would be essentially surrounded by bunkers. Therefore, only a straight shot carrying the requisite distance would go unpunished. In contrast an architect of the strategic school would be much more forgiving. A bunker might be placed just outside the driving zone to exact a mild toll from a wayward tee shot. The strategic layout of the green would be set up to favour an approach from a well executed tee shot, while requiring a more difficult shot from any other position.

The layout of a strategically designed hole implies how the hole should be played. Playing a strategic hole is not unlike playing billiards where each stroke must be executed correctly in order to set up the next stroke or strokes. Strategic design is substantially more generous to the less skilled golfer than penal design. While it

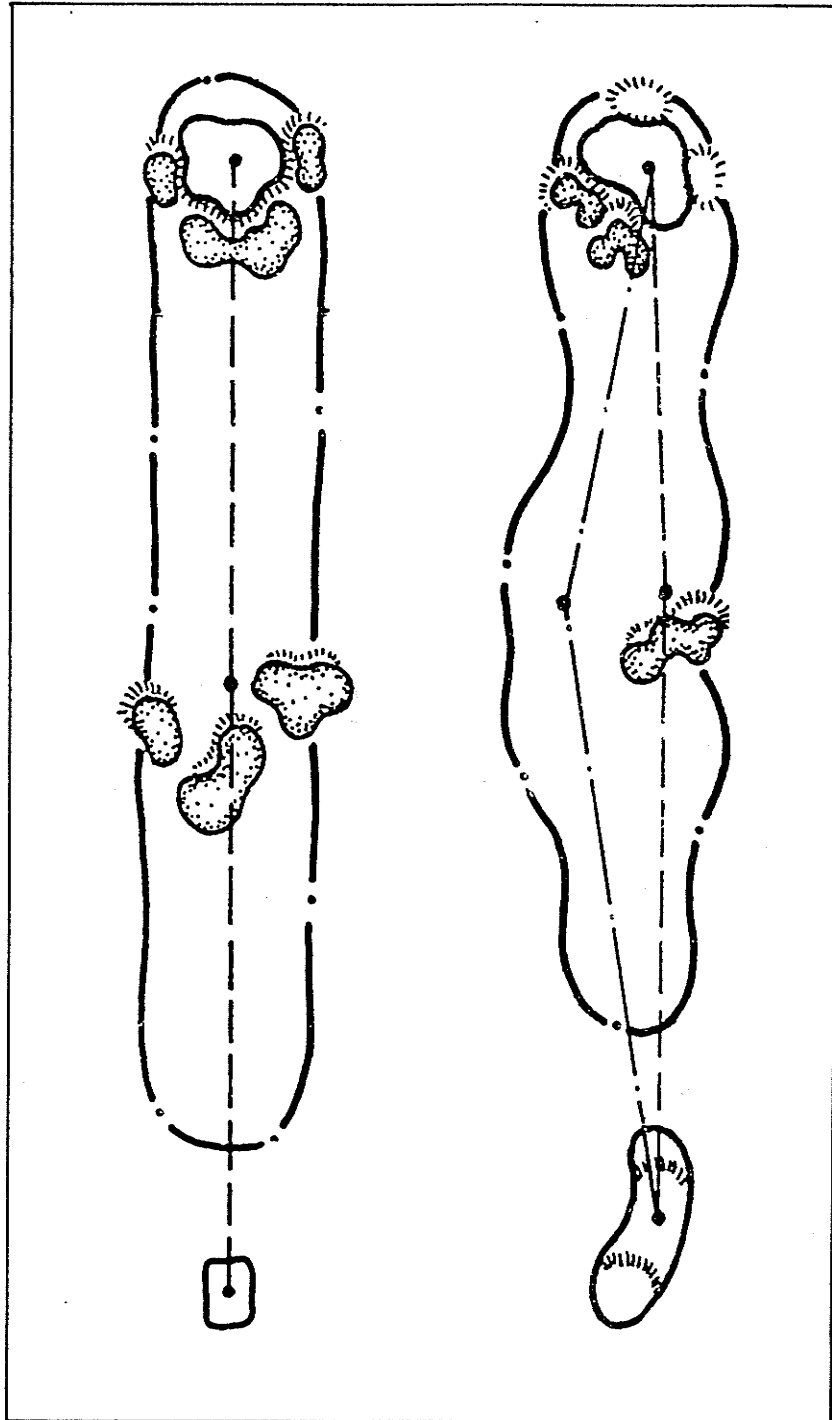


Figure 1: Example of a Penal vs Strategic Design, from An Introduction to Golf Course Design, 1978, p.7.

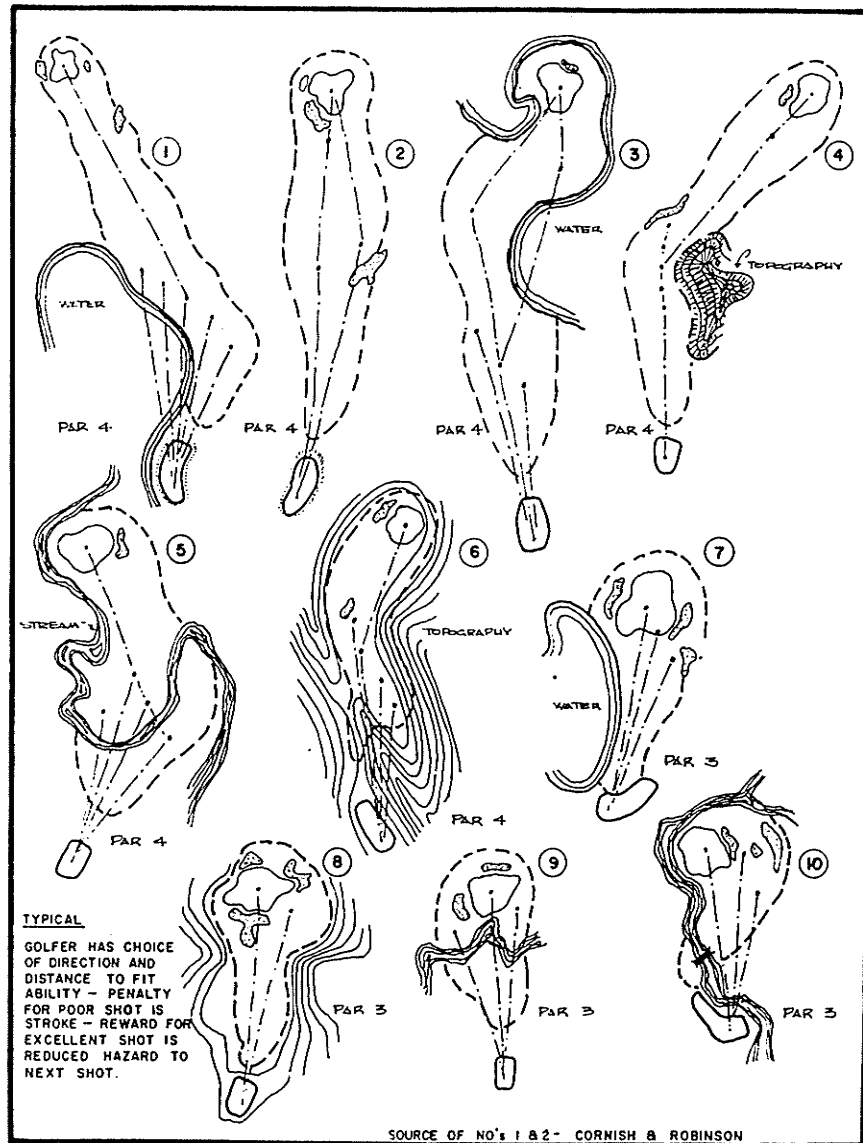


Figure 2: Additional Examples of Strategic Design, from The Handbook of Landscape Architectural Construction, 1976, p.464.

endeavors to punish the golfer in a just proportion to their degree of error, it stimulates initiative and rewards daring.

Incidentally, one of the reasons why penal design had become so widely endorsed was due to the fact that as golf balls and clubs were improved, holes naturally began to play shorter. Rather than lengthening the hole, the first response was often to increase the difficulty of the hole by adding more hazards or by making existing ones more demanding. In any event, a reaction against courses designed primarily based on penal design had begun to be felt by the late 1920s.

Popularity of the sport of golf continued to grow, especially in the United States where it flourished. While the 1920s were characterized by a period of prosperity and rapid growth of golf courses, the period between 1920 and 1930 did not produce any startling departures from the theories of golf course planning and design already established. The game itself had settled into a recognizable and comfortable pattern. The design process now found itself assisted by recent improvements in earth-moving capabilities. The designer now had the ability to create those features the site did not possess naturally. The resulting movement away from the genius loci of the site led many designers to introduce features that were often repetitive and over done.

Outstanding figures of the period were Donald Ross and Canadian, Stanley Thompson, both of whom touted the merits of strategic design, and their works reflected this philosophy.

The stock market crash of 1929 and the Great Depression brought about an abrupt halt to golf course development in the United States. Although the Great Depression was worldwide, golf course construction outside the United States continued at a steady pace. Just as the profession seemed to be on the road to recovery, World War II erupted in Europe in 1939. That event curtailed the golfing industry to an even greater degree than had the Great Depression. Courses in Europe were subject to destruction and in many cases were converted into training grounds or paved over for air fields. By the late 1940s golf would again become the great pastime it had once been, and golf course design would reemerge as a vigorous profession.

Concurrently courses began to exhibit characteristics resulting from trends that had become popular at what can be referred to as the start of the "Modern" era of golf architecture. For the first time courses began to exceed 7,000 yards. Large greens had become the fashion. With advanced earth moving equipment some designers ignored the natural features of the site and instead chose to create whatever naturally appearing features

were desired. This movement away from the origin of the site has led to a style which however beautiful in itself can become repetitive. This similarity has led later designers to develop their own vernacular in an attempt to establish their own inimitable stamp on their creations. One example of this is the creation of the green which is totally surrounded by sand or water, which has become quite popular.

Changes in golf course architecture have been primarily matters of degree as numbers, skills, construction techniques, and implements have been improved. Architects have come to realize several important factors with regard to the design of the modern golf course. The first of these is the fallacy that a hole is thought to be better if it is longer. There is no strength to the argument that the 6800 yard course is superior to one of 6500 yards. If the object of the game was to hit the ball farther than your opponent then there might be merit to this point of view. On the contrary, greater emphasis must be placed on the players shot making ability, thereby requiring a wider variety of clubs and approaches to the green. With the increased numbers of players taking to courses in recent years, preference should be given to designs which help to disperse traffic, rather than concentrate it. This is of particular importance at both tees and greens.

Whatever the final product is to be, the golf course remains an organic entity, ever changing, developing and maturing over time.

W h a t M a k e s a G o l f C o u r s e G r e a t ?

The game of golf is much more than either a test of distance or accuracy. It is as much a mental exercise as it is physical. A great golf course must be capable of putting to the test a players physical skills of strength, coordination and finesse. In more subtle terms its should also test their character, their stamina, patience, daring and resolve. The test of greatness is more than just the numerical factors of yardage and score. It is a measure of the intangible attributes that comprise the game making it as much a source of enjoyment as a form of competition.

T h e o r i e s o f G o l f C o u r s e D e s i g n

One of the more unique features of the game of golf is that it is played on natural terrain, or on land that has been reshaped in

order to exhibit a natural quality and feel. Nearly every other game must be played on a court or field whose dimensions must be strictly adhered to certain prescribed measurements.

It is generally agreed that the best land for golf resembles the gentle rolling terrain on which the game reached its first stage of maturity. As the game began to evolve, there came a time when courses were actually laid out. The sites of greens were determined by the existence of attractive hollows or plateaus and by the proximity of suitable hazards.

The earliest inland courses were laid out on public commons, where there already existed an ample variety of natural difficulties and hazards in the form of ditches, to take the place of the bunkers and dunes of the seaside links. As golf spread across Europe and North America, it was soon discovered that first class holes could be carved out of forests, providing sufficient drainage was possible. In 1909, Charles B. MacDonald designed the National Links at Long Island successfully demonstrating what was possible in the way of reproducing the strategy and appearance of the worlds best holes.

The first golf course architects were primarily concerned with the functional layout of the course. The aim of the designer was to the interest of the player from the first tee to the last green

by presenting a series of challenges in such a way so that they may register in the mind of the player before a shot was taken. These challenges to the golfer's mental and physical abilities are considered the shot values, or playing values of the golf hole. The measure of shot values is based on how attainable the objective is and how difficult the shot required is. Therefore, a hole can be considered to be an genuine test of a players skill if the shot values balance the severity of the problems with the attainability of the objectives.

As they began to develop and hone their craft, accomplished designers consistently created holes with well conceived shot values. These architects viewed each hole as a unit with the green as the ultimate target, and obstacles such as bunkers, prevailing winds, trees, mounds and water as the obstacles. The ultimate aim was to create a series of holes with fair shot values by attempting to balance a numbers of these obstacles. Accomplished architects strove to create each golf hole, so that every single shot presented an objective with one or more problems. The goal was to achieve holes with appropriate shot values on every required shot, providing an genuine test of a players ability.

As far as possible the course should be designed in such a manner that it may provide a challenge for each class of golfer.

The problems encountered should match each players skill level and their ability to solve the problem presented to them. In any case while these problems must be sufficiently interesting, they must always be within the realm of the players skill level.

E v o l u t i o n o f G o l f C o u r s e F e a t u r e s

The modern golf course has increasingly become an artificial space subject to tradition's imposed by its birth place, yet prepared to function in a very different and contemporary environment. The architects role is to layer design theory and historic precedent over the variables of the site, climate, client and player desires while taking the unique features of the site into account in each instance. Changing players desires, equipment, regional variations, and particularly the economic pressures of construction and maintenance have all combined to produce a distinctly modern game.

Both nature and the golf architect have had a hand in the evolution of course design. Each has exerted their own influence on the style, shape, size and placement of greens, tees, fairways and hazards, although the degree of each influence has varied in different periods.

Early links courses generally went out from the starting point for the first nine holes and returned to it with the second nine. As the game moved inland, the convenience of a second starting point became instrumental, on sites of a more compact rather than linear nature.

Changes in golf architecture evolve slowly in response to how the golfer perceives the game. As a physical space, the golf course necessarily reflects the regional influences of the site and echoes the definition of golf at one particular point in time.

During the 1960s designer Desmond Muirhead first appeared on the scene of golf course architecture and quickly became recognized as one of the most innovative and influential golf course architects in the world. It was during the mid 80's however, when Muirhead began to build a new kind of golf course, that his work began to create controversy. The new and unmistakable design approach drew heavy scepticism.

The contemporary design philosophy that golf course design is the manifestation of a designers interpretation and abstraction of the naturally inherent qualities possessed by a site, is a tradition that goes back at least as far as Donald Ross. In order to begin to fully understand Muirhead's departure from traditional course design one must hold to the belief that perhaps golf courses are not inherent in

nature, but rather that golf course design is all invention, artifice serving contrived nature. This is perhaps why Muirhead's push to extend golf's design vocabulary, to use representational figures, having his courses tell a story, seem so contrary.

The first of Muirhead's controversial course designs is located in Boyton Beach, Florida and was opened in 1986. One hole, from the air, looks like a mermaid stretched supine across several hundred yards. A forked tee is her tail and a large pot bunker is used to represent her navel. The green forms her face, with an encircling trap of wild white hair.

Another hole, modelled after Marilyn Monroe, was to feature two giant "mammary mounds", complete with nipples. However, they did not stay exactly as Muirhead had designed them as the club drew the line at nipples. Another hole at Aberdeen looks very much like the puppet Ollie, from the early children's show. The orbs of Ollie's eyes are bunkers behind the green, while its pupils are semicircular mounds.

Many critics referred to it as "miniature golf on a grand scale". The thought of forming representational figures in the landscape seemed absurd especially when they could not be perceived from the ground. To Muirhead however, symbols seemed a natural starting point for something new. Muirhead had

recollections of the symbols associated with St. Andrews in Scotland, such as the "Valley of Sin" and "Hell Bunker". St. Andrews suggested that a more deliberate use of symbols might form the basis of a new vision of what a golf course could be.

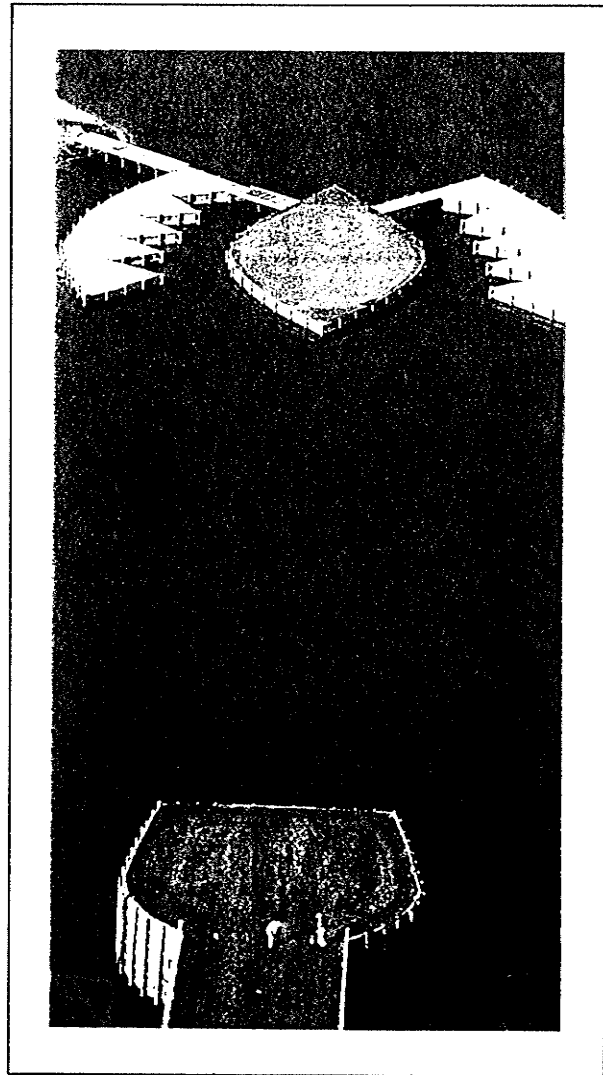


Figure 3: Muirhead's "Clashing Rocks", depicting the ship of Greek hero Jason and the clashing rocks that threaten the Argonauts journey, from Metropolis Magazine July 1989, p. 50.

At his course in Hokkaido, Japan, Muirhead began to experiment with rather simple forms of symbolic expression. For instance, the fairway of one hole is comprised of a tortoise-like shape with the green being used to represent his head. The hole was surrounded by pines and bamboo trees to extend the analogy to Japanese life. Another hole had a ying-yang green surrounded by water and sand.

At Stone Harbour Golf Club in New Jersey, Muirhead created a golf course which figuratively interprets symbols from Greek and Norse mythology into the landscape. Holes have names like "Ulysses", "Prometheus", and " Pandora".

It is this sense of designing with symbolic coherence, of supplying overall themes that distinguishes Muirhead's work. While response to Muirhead's brave new design theology can best be describe as reactionary, this has been part of the plan. Muirhead not only expected controversy for his work, he welcomed it.

The problem encountered as a course designer is the same as that of any other artist. They have no control over the response of the viewer. They can't know what the viewer (the player) brings to the experience. Unlike other works of art, a golf course is not static, it is affected by wind and rain and by the seasons.

G o l f C o u r s e D e s i g n

s p a t i a l c r i t e r i a

The amount of space necessary to construct a golf course varies with the shape of the site and the degree of topographical change as well as the need to incorporate existing vegetation where possible. The selection of the site largely determines the overall character, quality and cost of the golf course. The total area provided for the course is fundamental. A range of size from 125 of 150 acres is deemed sufficient to provide a course of substantial quality.⁵ Anything less than this will seriously compromise the length, interest and variety of possible holes. Understandably, a site with greater acreage will provide the opportunity for better planning, landscaping, and greater separation of holes.

In general, a site of rectangular shape oriented in a north/south direction and with gently undulating terrain is considered to be the most efficient. However, efficiency of land use may not necessarily be the prime criterion in the selection of a site. Many other factors can, and will, come into play at this time. For example, golf courses that are part of a larger residential housing

⁵ Hawtree, F.W., The Golf Course Planning, Design, Construction & Maintenance, 1983, p47.

community are often not the primary concern of the developer. Understandably, the inclusion of a golf course in a proposed residential development can generate greater revenue by increasing lot values. Subsequently, through careful routing of the course the maximum number of fairway lots can be accommodated, while still providing a challenging experience for the golfer. Finally, roads and houses on the boundaries will require a wide safety margin,

Type Course	Acres Required
Par 3 (Pitch & Putt)	15-25
Total Par 27-9 holes	
Par 3 (Pitch & Putt)	45-60
Total Par 28-29 - 9 holes	
18 - Regulation	110-180
18 hole - 6200-6500 yds.	110 min.
	120 rolling
	140-180
18 hole - Regulation	120-160
18 hole - Regulation	120-200
Par 3 (Pitch & Putt) FHA	20 min.
Par 3 (Pitch & Putt) NRPA	20-35
18 hole - Regulation, Colo.	150 min.
18 hole - Regulation, Wisconsin	
9 hole - FHA	45
9 hole - Tennessee State	75-90
9 hole - 3100-3400 yds.	50 min.
rolling	60
hilly	70
9 hole	70-90
9 hole - Executive	30-50

Figure 4: Area Requirements, from the Handbook of Landscape Architectural Construction, 1976, p.460.

which can effectively and substantially increases the required acreage.

Ideally a site with a diverse number of inherent landscape features, providing a number of alternative choices for tee and green locations should be selected. The gradients of such land should vary from 2 to 15%, with land of predominately higher gradients requiring a greater area than that of a flatter site.⁶ The soil composition of the site should be predominantly medium to light sandy loam with a reasonably porous subsoil. Whenever possible, natural drainage patterns should be incorporated into the design of the course.

l e n g t h

Due to the wide range of skill level and strength, each golfer will undoubtedly propel the ball a variable distance with the same club. For this reason the designer must assume an average distance or range of distances from a club in order to allow for the proper range of distance on the course. The optimum length of a course is one which allows the golfer to use all or at least most of the clubs

⁶ Handbook of Landscape Architectural Construction, 1976, p460.

in their bag. When hit with reasonable accuracy, each club is capable of reaching a prescribed distance. Therefore, distance becomes a key qualitative value in judging the difficulty of a particular course.

The length of the hole, and the corresponding score standard set for each hole of a golf course, is deemed par. The term "par" is, in effect, a numerical value analyzed relative to distance. The U.S.G.A. has established a par number within a range of distances off the tee. For example, a par four hole is designed to allow for one drive off the tee, one approach shot to the green, and two strokes to put-out.

The architect should therefore strive to design each hole accordingly, requiring an unrepitive combination of clubs. Similarly, consecutive holes should be of significant variation in their length in order to maintain flexibility.

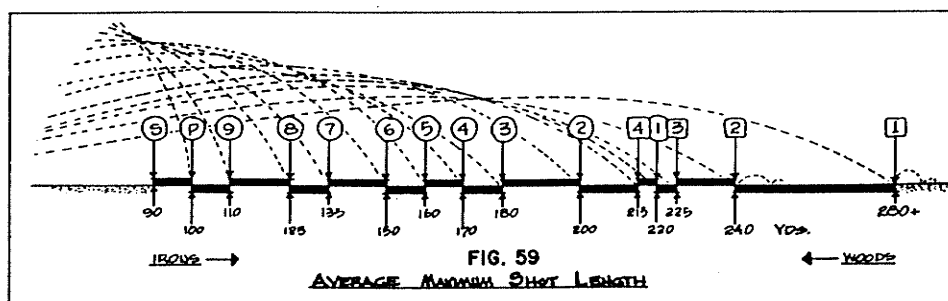


Figure 5: Average Maximum Shot Length, from the Handbook of Landscape Architectural Construction, 1976, p.461.

s e q u e n c e

The arrangement of holes, and their respective par value, relative to their position in the progressive chain of the fairways, is of critical importance to the golfer's enjoyment. The normal sequence begins with a relatively easy par 4 or 5, allowing the golfer a chance to warm up, and usually ends with a challenging par 4 or 5, creating a lasting impression.

While theoretically the sequence of holes should allow for a par 3 or 5 between each par 4, in reality this is not always possible or desirable. Inevitably, the designer will be forced to follow one hole with another of the same par due to site limitations. In order to compensate, one hole may be designed to maximum length, the other to its minimum unless the natural features of the site negate any similarity in length. The overall theory of sequential patterning is to provide a distinct character and shot production from progressive holes, without similarities or duplication.

	Par	Minimum yds.	Champion- ship yds.	Par 3 holes	Par 4 holes	Par 5 holes
18 hole Regulation	70-72	6200-6500	6700+	4@ 130-200 yd.	10@ 350-470	4@ 471-550
9 hole Regulation	35-37	3000-3200	-	2	5	2

Figure 6: Recommended Course Length and Dimension, from the National Golf Foundation, 1978, p.65

D e s i g n o f G o l f H o l e s

The United States Golf Association has set guidelines for the lengths of holes to which the various pars are prescribed. For men, a par 3 hole is up to 250 yards, a par 4 is 251 to 470, and a par 5 is anything longer than that. For women, a par 3 is up to 210 yards, a par 4 is 211 to 400, and a par 5 is 401 and greater.⁷

Within these guidelines the architect is then free to design whatever challenges and hazards he or she sees fit. It is important to mention that the above mentioned guidelines are not site specific. Therefore allowances should be made for the topographical nature of the course and whether the hole plays up or downhill.

p a r t h r e e s

The par 3 hole is essentially a one shot hole, encompassing the tee, the hazards and the green, all within visible reach. Such holes have an enhanced sense of drama as the golfer must hit the green with the tee shot in order to make achieving par probable. Within the design of the course the designer should incorporate

⁷ Jones, Trent Robert, Golf's Magnificent Challenge, p78.

short, medium, and long versions of the hole in order to maintain variety and balance. For example one par 3 should be longer than 200 yards, requiring the use of a wooden club or metal fairway club. This is essential if one is to provide a change of pace among consecutive holes.

p a r f o u r s

Of the three types of golf holes an architect creates, the par 4 is usually considered to be the toughest to design. This is primarily due to the fact that, in general, there are more of them. There can be as many as ten, as compared to four each of the rest on a standard course. Therefore in order to establish some variety, the length of par 4's must vary more dramatically than on 3's or 5's. Consequently, there is a greater limitation in the opportunity to create a lay-up position for the second shot.

p a r f i v e s

The par 5 offers the greatest variety of options, in terms of club choice, than any other hole. In addition, it provides the designer with the greatest creative licence with regard to routing,

placing of hazards, and the size and contour of greens. The concept of the par 5 has changed considerably over the years with improvements in technology and the strength and skill of better players. Consequently, many par 5's have quite simply, become a long par 4's.

Water has been introduced and is quite prevalent on a number of par 5's, especially around the green. One of the most difficult aspects of designing the par 5 is determining just how long it should be. As with the par 4 hole, the par 5 must also vary in length and character. Ideally, a course should consist of one short, one long (unreachable in two strokes) and two of medium length that incorporate different hazards, such as water, sand, or elevated greens. While available land will dictate the nature of the holes, a creative architect can use his or her imagination to create a series of holes, each of which plays differently.

D e s i g n E l e m e n t s t h e f a i r w a y

Through the length of the course, setting of the tees and greens, and the character of the fairways, the designer is able to control the nature of the game. The fairway becomes the backdrop

onto which the hazards, be they sand or water, are to be placed. It comprises the main body of the hole and therefore forms much of the visual experience for the golfer.

The fairway reflects the natural features of the land form and consequently determines how the course should be played. The overall dimension and shape of a fairway is intrinsically tied to the strategy the architect wishes to create for a particular hole. Contemporary golf courses are designed to offer the player an alternative number of choices as to the direction, length, and placement of the golf shot. In any case, the golfer must rely on their ability in order to select the best possible strategy. The player of limited ability must be afforded the option of forsaking serious penalty by choosing to take a longer route with less hazards, at the cost of more strokes. Similarly, the accomplished golfer should be enticed to play over or between hazards in an attempt to reduce the number of strokes and achieve a better approach to the green.

A hole is still often thought to be superior due to its greater overall length. The reason length is considered to be a factor is due to the greater difficulty of hitting woods and long irons versus shorter irons. Despite this questionable theorem, the majority of writers will agree that the best course design encourages thought and choice rather than indiscriminate hitting. Therefore, primary design

emphasis should be placed upon accuracy of the shot rather than the distance achieved.

In general terms, a fairway of 50 yards in width is considered to be fairly broad, while a narrow width would be about 25 yards. In practice 25 to 40 yards is a useful average, assuming that there is a comparable area of rough beyond the fairway from which the ball may be directed to the green.⁸ Courses which utilize trees within the rough will require greater width. The width of the fairway should fluctuate, oscillating broadly throughout the length of the hole with fairway contouring reflecting the sites topography, adjacent tree cover (if any), and the placement of hazards. It is of utmost importance for safety that centres between adjacent fairways be no closer than 70 yards at critical points.⁹

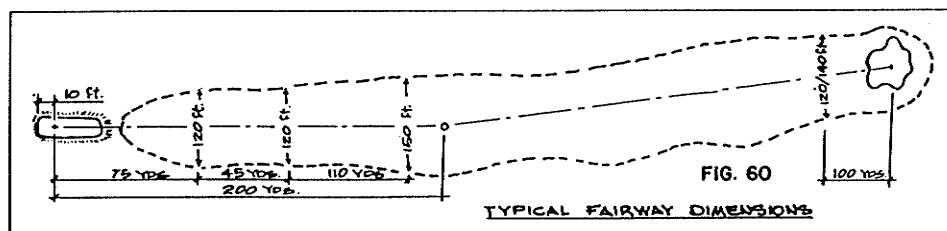


Figure 7: Typical Fairway Dimensions, from the Handbook of Landscape Architectural Construction, 1976, p.463.

⁸ Hawtree, F.W., The Golf Course Planning, Design, Construction & Maintenance, 1989, p122.

⁹ Hawtree, p122.

h a z a r d s

Hazards make the game of golf what it is, a game of uncertainties, of risks, rewards and consequences. At the same time they add to the overall beauty of the course while proving to be of immeasurable psychological value.

Hazards should consist of natural site features wherever possible. These include bodies of water, existing sand areas, rough, and depressions or ridges which can be modified and shaped to fit the overall character of the design.

b u n k e r s

Of all the design elements available to the golf course designer, none is greater in importance than sand. As a landscape element its effect is the strongest in the identification of a golf course. Sand not only modifies the landscape by contrast, it emphasizes the fairway, green and natural features of the course.

Sand bunkers are utilized in order to guard the driving area of the fairway, and the pin positions on the green. Bunkers help to influence the golfer before the first stroke is taken. The player is forced to select a strategy that will hopefully breach those hazards

between the tee and green. The purpose of bunkers and other such hazards, is to exact a penalty for an errant shot of up to one stroke.

During the 1950s and 60s many courses found themselves with an over abundance of bunkers as new ones had been added in an attempt to make courses more challenging. Today the tendency is for designers to raise fairway bunkers above the level of the ground and positioned so as to be parallel to the line of play. The advantage of this layout is greater visibility provided to the player.

The design of bunkers should not be so severe (deep) that there is absolutely no chance of getting a decent shot to the green. Furthermore, the farther the bunker is from the green, the flatter it should be, as well as the lip. As guards, bunkers are instrumental in the influence and direction of play. They instruct the golfer to the manner in which the tee shot should be played, dictating the most preferable route to the cup.

The size, shape and overall pattern of a bunker complex is determined primarily by the total topography of the hole as well as the ultimate shape of the green to be guarded. The orientation of the green along a particular axis will dictate the best line of approach which in turn will indicate appropriate positioning of wing bunkers. Placement of sand in relation to the putting surface is important for maintenance and play with many contemporary

designers favouring sand 10 to 12 feet from the putting surface.

Often bunkers are designed with capes of turf jutting into the sand, resembling the natural formations of the Scottish coast. These caps also act as walk-ins and walk-outs.

Further bunkering of the hole will be elaborated in accordance with fairway slopes. The modern bunker, as contrasted to the pit bunker of the past, is raised above fairway level primarily in response to course construction on flatter sites with heavy soils. It is constructed through the formation of a mound and then excavating the bunker in the face of this mound. This raised hazard is clearly visible allowing for easier drainage. The infinite variety in the size and shape of bunkers can provide distinct visual effects, vastly different in character among holes.

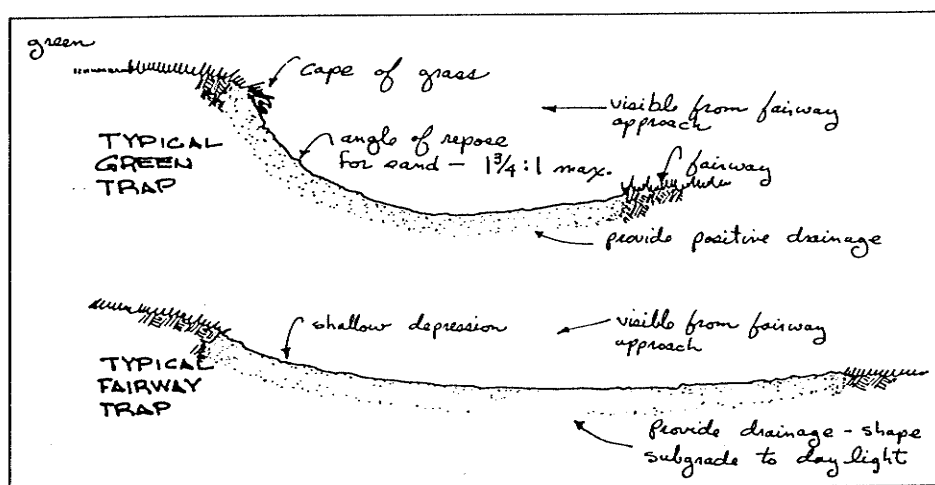


Figure 8: Construction of Bunkers, from the Handbook of Landscape Architectural Construction, 1976, p.465

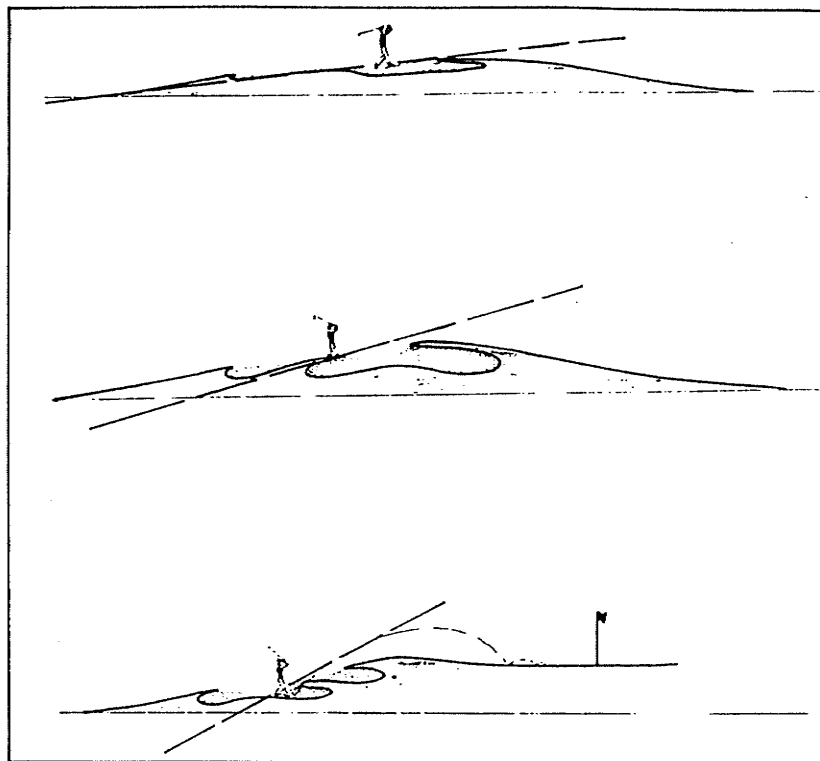


Figure 9: Depth of Bunker in Relation to Distance from the Green,
 from *An Introduction to Golf Course Design*, 1978,
 p.144

w a t e r

Of all landscape features a designer can have at his or her disposal none can have a more dramatic or beautiful effect than that of water. A water hazard is immediately recognizable to the golfer, they are both intimidated and fascinated by it. There can be no doubt that water is the most dramatic hazard and unfortunately for the golfer, the most penal.

Historically, the use of water as a potential hazard was limited to linksland and sites which already contained a natural body or stream. Wherever desirable, water should be incorporated into the design of a course. If a body of water does not exist, one may be created through the damming of an available stream. Water is especially important on courses where there are no other natural hazards, no contours or trees, or where the terrain is otherwise uninteresting. Unfortunately, flat sites make water hazards more difficult to see and therefore require more care in siting and mounding to define their presence.

One must be careful in the selection of its location and exercise restraint in the frequency of its use. Water as a hazard should only be brought into play on five to six holes at the most. It should never be hidden or placed where it cannot be circumvented. While the designer must afford a player the chance to make a long carry over it, the opportunity to play around it must also exist.

Finally, water can also be used merely for its scenic value and may not necessarily be brought into play.

t e e s

Historically; the tee was merely a turfed or sandy elevated plateau with straight sides. Contemporary courses place a much greater emphasis upon the tee as a convenient and inexpensive means of introducing variability to the course layout. By incorporating four or five separate tees rather than one long one, the length of a hole may be revised as desired to vary the fairway character. Breaking up the tee into individual areas has the added advantage of increasing both the flexibility of a hole and the aesthetics of the teeing ground and reducing maintenance costs. The dispersal of teeing area to positions with little disturbance to existing flora will not only cost less but will also vary the traffic pattern. Where tees are separated the possibility of different lines of approach to the green expands the potential variety of the hole.

Shapes should reflect the context of their location with free-form design being employed wherever possible, unless space limitations force the tee into a geometric form. Because regular tees are subject to greater use, they should be made larger, especially wider, which significantly reduces wear and allows for easier maintenance. Back tees should be smaller, but not so small as to inhibit flexibility.

On flat ground it is recommended that tees be built-up to provide better visibility. Where possible the placement and relative elevation of the tees should be varied in an attempt to enhance the beauty and character of the hole. Especially on rugged terrain, the selection of more elevated tee sites enhances the drama of the hole.

Tee placement and elevation can significantly alter the difficulty and playability of a course, and are of critical importance to the designer. In general, the tee should be located near the preceding green, allow a view of the fairway, and fit into the landscape discretely. A tee should be no further than 60 yards from the previous green, as long walks between holes can interrupt the progress of the round.¹⁰ A reasonable distance is required however, to avoid disturbance, by sight or sound, created by player circulation between adjacent tees and greens.

With regard to size it has been suggested that the total area encompassing the tee should be a least 300 to 350 square metres at par 4's and 5's and 400 to 450 at par 3 holes.¹¹ Teeing areas should also be increased on shorter par 4's if the architect intends or expects players to hit irons primarily. In the instance where a tee

¹⁰ Hawtree, F.W., The Golf Course Planning, Design, Construction & Maintenance, 1989, p65.

¹¹ Hawtree, p73.

must be divided into separate areas, it has been suggested that at least half of the total area should be allocated to the middle and tees. This is due to the fact that this is where the majority of players will tee up. The remaining area must then be divided between the back and forward tees. Actual measurements will vary as the local requirements indicate or frequency of play dictates.

With regard to gradient, it is desirable that the upper surface of the tee should possess a subtle gradient scarcely if at all noticeable to the player, but sufficient enough to promote the flow of surface water where infiltration rates are significant.

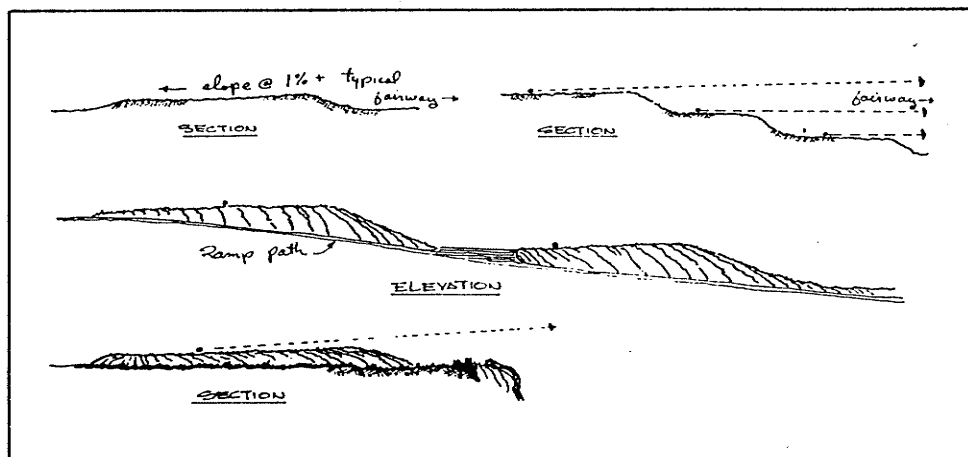


Figure 10: Golf Course Tees, from the Handbook of Landscape Architectural Construction, 1976, p.466.

This gradient should be in the approximate ratio of 1:100.¹² As a general guide, this slope should rise from back to front and be oriented upward on an uphill hole and downward on a downhill hole.

Since its introduction in the late 19th century, the rectangular tee has proven to be quite popular. The reason for this appears to be in the orientation to the green provided by the sides of the tee. However, the sharper side slopes that such a shape can evoke must be avoided at all costs. If such a tee is to be successfully adapted to its location, special care must be taken to blend the external slopes of the tee into its surroundings. On flatter sites this requires the designer to resist the temptation to build-up a tee, so that it may appear less obvious in the landscape.

The trend has been for architects to explore designs which relate to the particular landscape in which they are to be placed. While this design approach has the added advantage of relating the tee to its surroundings, especially in difficult contours, it must still provide the golfer with some indication as to the orientation in which the hole should be played. The mowing pattern is also very important in these instances and therefore maintenance practice must

¹² Hawtree, p73.

be anticipated and established to enhance design forms. When designing random shaped tees the architect must ensure that not only must an orientation to the green be provided, it must present itself clearly to the golfer.

g r e e n s

The putting green forms the most important part of golf course construction, and is the ultimate target of the player. In early times greens were naturally flat, gently undulating areas, little more than a mere extension of the fairway. This is in contrast to the contemporary green which is raised above fairway level with a definite break between fairway and putting surface levels. The raised surface allows for air circulation across the turf, while the break between the fairway and green allows the green to drain faster during wet periods. This again is a reflection of flat sites with poor drainage conditions.

Early rudimentary greens were relatively unprotected, and were of the same bristly grass of the surrounding course. Bunkers were further introduced as a means of complicating and controlling play as well to offset improvements in golf clubs and balls.

Many types of greens have evolved since those early days.

Greens have been elevated, terraced, tilted, dished-in, and mounded. In each case the designer strives to create a strategy based on the positioning and size of the mounds and bunkers which frame the green. The modern green has preserved its origins, and inherently possess the same mounds and slopes of its predecessors.

The well designed green is made up of a series of reverse curves, one being slightly convex that gradually descends to an adjoining area that is concave in configuration. This procedure is repeated to varying degrees and gently blended onto each other creating a green with rhythm and flow. On flat sites this serves to fix the green in the landscape, adding to the interest of the hole through complication of stance, lie and judgement. The architects goal in designing the green is to deceive the player if possible. As Robert Trent Jones once stipulated, no birdie should come easy. Contours should be developed that require the golfer to exhibit a fine sense of touch to negotiate the green properly. Without contour putting becomes simply an exercise in judging the pace of the each putt. With contour the correct line must also be determined in order to make putts or ensure an easy "tap in".

The location of the green has to be correct, consequently selection of the site is of critical importance. If perhaps the area chosen for a green should tilt in a particular orientation, the

designer should attempt to accommodate that tilt in the design for the green. Above all, the green must fit the landscape and must look as if it belongs. The contours of the green should flow easily from its centre and continue into the surrounding ground. The result of these operations should leave a land form which is not only pleasing to the eye but one which appears to have always been there.

On short par 4's, or par 5's which otherwise might lack interest, the designer may choose to incorporate a green built on two levels. Consequently, the area of the green will be increased proportionally in order to allow for adequate holing space. The lower green must also be large enough and at such a gradient to be able to contain a ball passing down the intermediate slope. The intermediate slope must be subtly executed and preferably be incorporated into some related featuring of the surroundings. Some degree of visibility must be maintained to allow the player to estimate the position of the hole. This design is also popular when greens must be built into rising ground because less excavation is required.

The designer must not overlook the need for external featuring, whether artificial or natural, to surround the putting surface. This is essential in relating the putting surface to the

surrounding contours and creates the illusion of a natural conclusion to the hole. Marginal curves should be sinuous and related to the encircling contours so that the putting surface forms one cohesive unit, divided only by different height of grass. It is recommended that for featuring surrounding the green, a maximum gradient in the ratio of 1 in 4 be observed, with 1 in 3 behind greens. In general gradients of 1 in 6 or 1 in 7 are more common.¹³ Too much variation in elevation in too short a distance produces an unnatural appearance. The height of mounds introduced in the featuring must clearly vary in order to avoid any apparent artificial look. Higher mounds will look best toward the back of the green rather than too early in the design. The mounding of the land above the sides and backs of greens should collect and lead away heavy rainfall through the creation of suitable swales which will distribute water outside the area of play. Traditionally, popular green sites have been on elevated plateaus or set into hollows. In order to create variety, sometimes one must look for unusual green sites, for example island greens, or those set against a hill or cliff on mountain sites. In any case, the designers primary concern must be to successfully blend the green into the existing surroundings, whatever they may be.

¹³ Hawtree, p104.

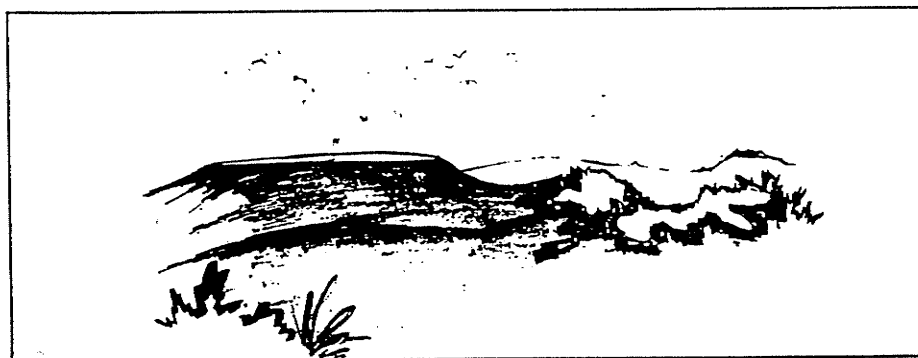
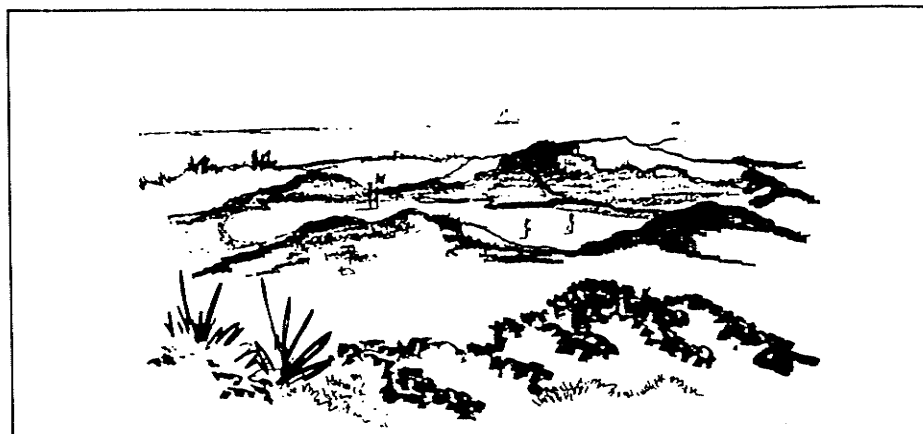


Figure 11: (top) Green set in a hollow, (middle) Green set on a plateau, (bottom) Sculptural green of contemporary design, from *An Introduction to Golf Course Design*, 1978, p.138.

Equally important to the selection of an appropriate site is the manner in which the green is set into the site. This includes the angle at which it is constructed in relation to the approach shot, as well as its overall shape. The outline of the greens perimeter will generally produce both narrow and wide sections of putting surface. Consequently, the general orientation of the green will be provided by the surrounding bunkers, mounds and slopes. Orientation is also linked to the strategy built into the design of the hole. Therefore, the approach shot should benefit the player who has successfully risked the hazard rather than those who played it safe.

Orientation will also be related to the general fall on the green. The green should be designed to provide a variety of options for different circumstances. It should be divided up into areas, each with a different problem to be overcome. Each area should be such that the cup can be located in a fair position where, if the shot is properly executed, the chance to make the putt is a good one. Each green should offer a challenge, yet it must also offer players of all ability levels the opportunity to conquer it with a properly conceived plan and a well executed stroke. If the green is properly designed, there will be enough variety in possible hole locations that, coupled with changes in the tee placement, the hole can and must be played in an infinite number of ways. Variety is not only important within

an individual green but among all greens on the course. Each green should ideally have a slightly different mould or character than the others. There are an unlimited number of ways that an architect can accomplish this. They may vary the slope in individual portions of the green, vary the tilt of the whole green or vary the tilt of the pockets and swales built into the green. While the general concept may be the same, the overall look should vary. Whether this is achieved through the subtle or sharp manipulation of contours, each must be blended in the most natural way into the site chosen for the green.

Since 1945 it has been customary to construct the putting surface with a general fall from back to front, improving visibility of the hole. In the early days it was understood that the relation of area to length of the hole could be simply stipulated as, the shorter the hole the smaller the green. While there is merit in this philosophy, one cannot ignore the extent to which internal and external contouring may inevitably modify any judgement on what is considered an appropriate area. In many cases it will often be desirable to introduce considerable rolls or different levels into a green in an attempt to give it some distinction. Care must be taken, as the introduction of strong internal contouring can considerably restrict holing space and thereby increase the workable minimum area.

Although orientation and area of the green are of significant importance, none is perhaps greater than that of drainage. A green must be able to remove excess surface moisture both quickly and efficiently. Rolling and fast greens require a greater area in order to incorporate adequately level spaces for holes, as well as room for a breaking putt. In all, the designer should limit undulations in excess of 3% to 25% of the total surface area of the green.¹⁴

The dimensions of the putting surface are closely related to the location of the green and the length and type of approach shot required. Generally, shallow greens are provided for short approaches with deep ones for long approaches. The long axis of the green is usually placed on line with the required approach shot. The long axis should be no less than 25 yards and the short one 14 yards.¹⁵ With a rounding of both front and back of the green this would produce a putting surface of roughly 300 square yards. For practical purposes, the designer might take dimensions from 30 by 20 yards to 40 by 25 yards as the range within which to operate.¹⁶ This should allow adequate room for a variety of cup placements

¹⁴ Hawtree, p99.

¹⁵ Hawtree, p91.

¹⁶ Hawtree, p93.

while at the same time the speed of play is not adversely affected.

Of further importance to the architect is an understanding of the underlying factors responsible for how and why players move around the green. The circulation patterns of players on, off and around the green are the primary cause of soil compaction and loss of turf and consequently influence the playing quality of the green.

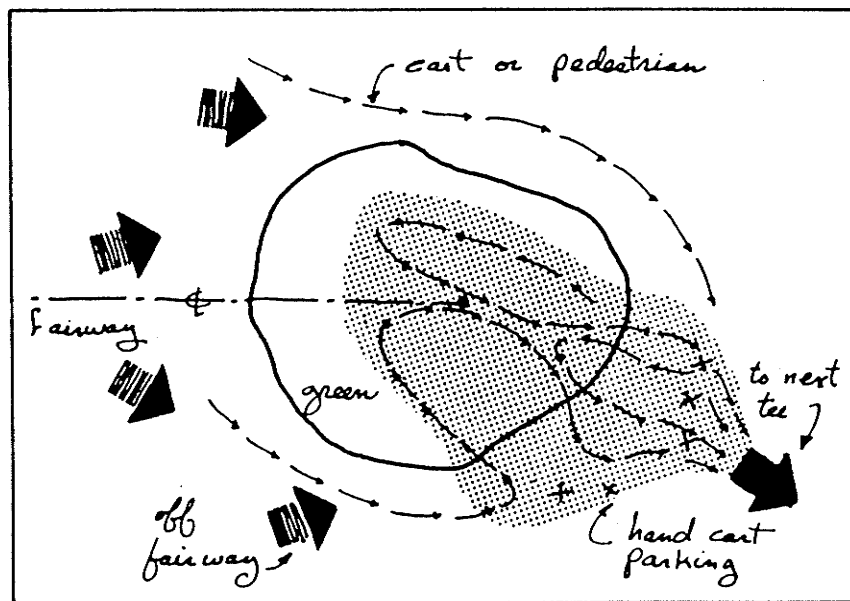


Figure 12: Typical Circulation Patterns, from the Handbook of Landscape Architectural Construction, 1976, p.465.

Several types circulation patterns typically exist around a green. Unless hindered by topography or unfamiliarity, the golfer will typically exit the fairway in a manner which allows him/her the opportunity to quickly leave the green and proceed to the next tee.

This circulation pattern on and off the green can, however, be altered by changing the placement of the pin. Through the size and shape of each green, the designer allows for the opportunity to change the circulation pattern.

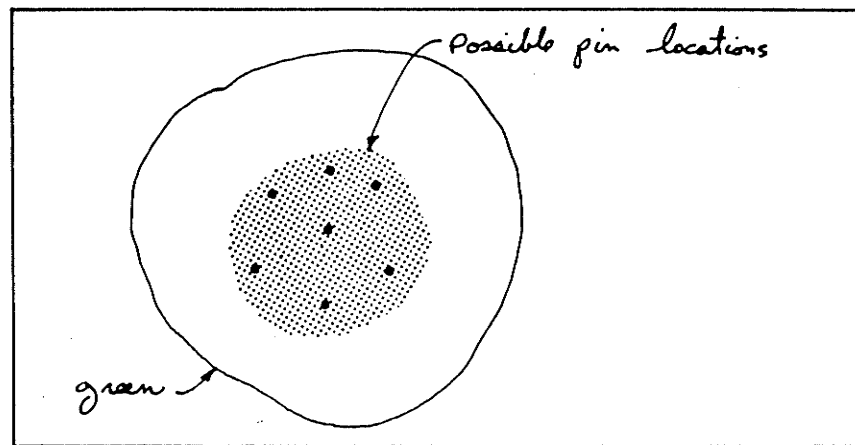


Figure 13: Circular Forms Limit Possible Pin Positions, from the Handbook of Landscape Architectural Construction 1976, p.465.

Greens that are circular in nature provide a limited number of optional pin placements as the pin is understandably always in the centre, in order to maintain sufficient putting room around the perimeter. An irregular shape, on the other hand, will provide a greater variety of pin placements and will alter the circulation patterns, subsequently spreading the pedestrian traffic over a far greater area. However, the designer must be careful to ensure that

the shape of the green will compliment the surrounding topography, the fairway and access to the next tee.

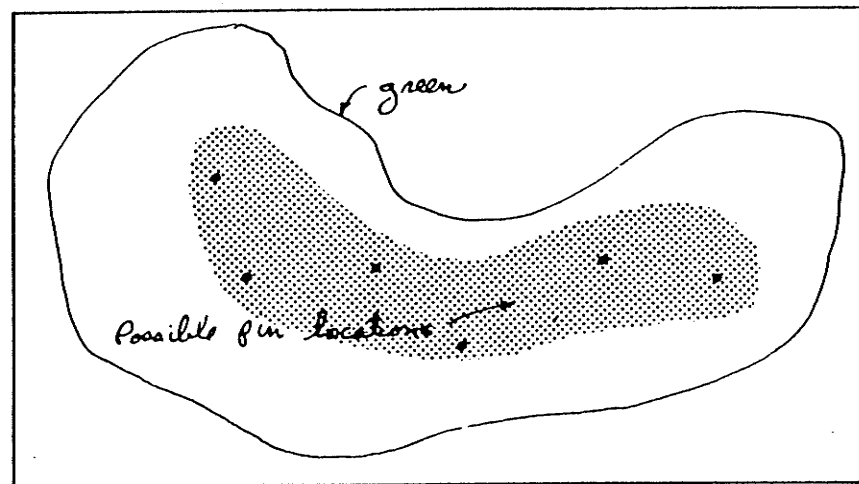


Figure 14: Irregular Shaped Greens Provide Greater Variety of Pin Placements, from the Handbook of Landscape Architectural Construction, p.467.

For example, a green similar in shape to Figure 15 allows for flexibility in hole placement, yet the basic circulation pattern remains essentially the same regardless of the placement. Traffic is concentrated in a narrow corridor, giving little or no relief from soil compaction near the exit to the next tee.

By shifting the green 90 degrees, in relation to the fairway, the designer is able to spread the circulation over a greater area, but does not completely eliminate a concentration of traffic exiting

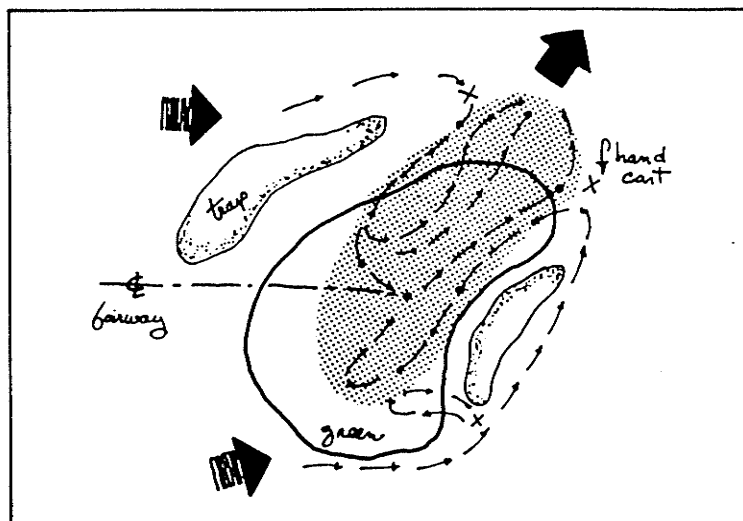


Figure 15: Green Concentrates Traffic Flow, from the Handbook of Landscape Architectural Construction, 1976, 467.

toward the next tee. Figure 16 illustrates a green design which does not concentrate traffic to a single point exiting the green. A variety of pin placements are possible, each varying the circulation pattern on and off the green.

With the advent of the mechanized golf cart, a totally different set of circumstances regarding circulation patterns must be considered. Greater area must be conceded to allow for the direction and parking of such motorized vehicles. Therefore, a choice of parking areas and a variety of access points to and from the green should be available in order to spread the walking pattern. One single parking area will concentrate both the cart and pedestrian traffic at one point and make movement of the pin inconsequential.

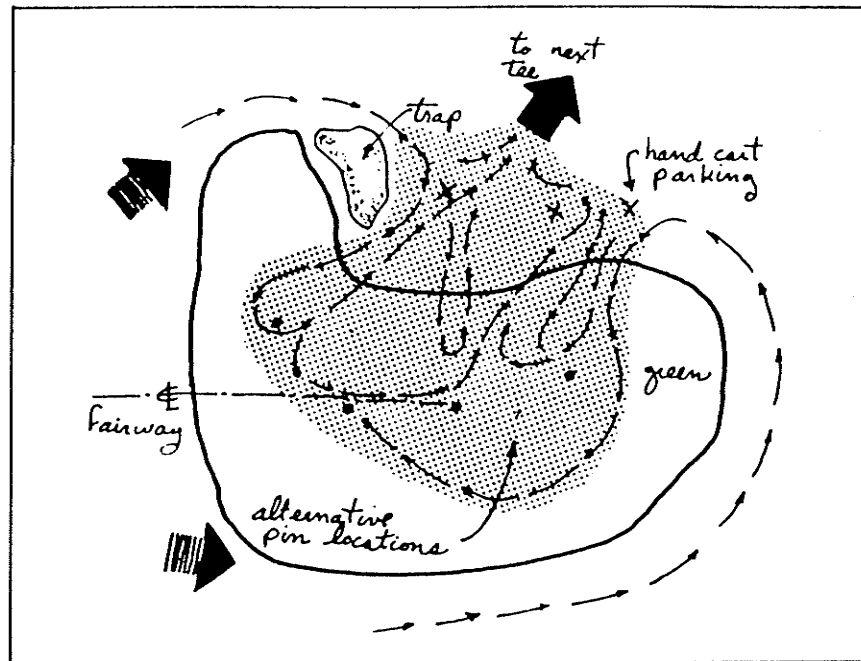


Figure 16: Green Orientation Concentrates Circulation Pattern Toward Next Tee, from the Handbook of Landscape Architectural Construction, 1976, p.467.

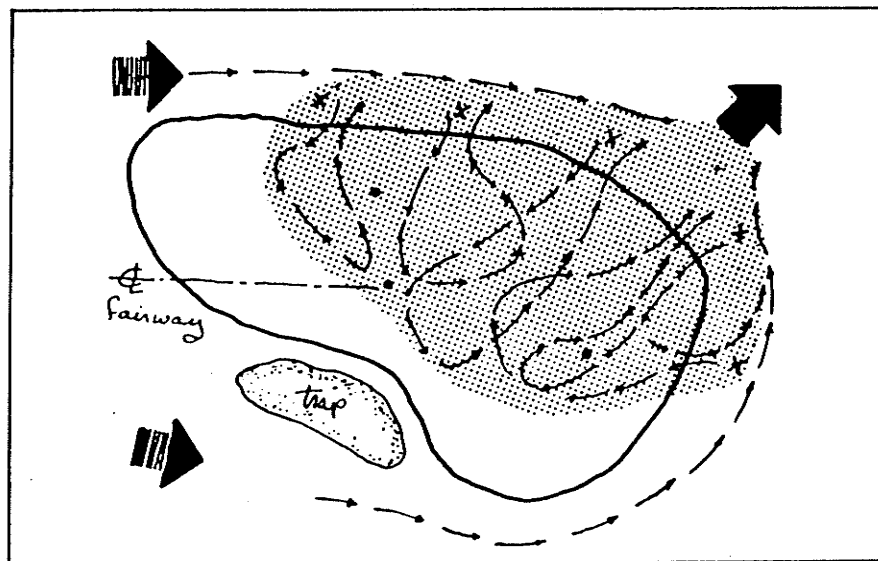


Figure 17: Variable Circulation Patterns, from the Handbook of Landscape Architectural Construction, 1976, p.467.

In conclusion, it can be seen that there exists an infinite variety of possible strategies at the architects disposal for putting the golfers ability to the test. It may be safe to say that no two greens are created equal and it is this infinite variety that adds to the appeal of the game. The general alignment of the green, its perimeter, dimensions, orientation and surface slope are all ultimately a blend of elements which will vary according to wind, weather, and line of approach.

r o u g h

One of the most overlooked and under utilized segments of the course is the rough which frames the fairways and green areas. It can be an important element in adding beauty and character to an individual hole. The extent to which this area should influence play has not reached a point of consensus yet among designers or golfers. What is generally agreed upon is that it should be high enough to create some difficulty, yet relatively short so as not to adversely effect the pace of play. The primary rough, adjacent to the fairway, should be slightly longer than the fairway turf while the secondary rough beyond being longer yet, thereby exacting a greater penalty. The player should be able to get the ball out of the rough and close

to the green, but not on it. The type of grass on the course will dictate how high the rough should be. Above all, the rough should be native to the area. An abundance of trees and rough should be avoided whenever possible as maintenance is more difficult and play is slowed as golfers attempt to locate errant balls.

t r e e s a n d d e s i g n

The incorporation or addition of trees can add considerable beauty and appeal to a course. As they are not generally considered to be acceptable hazards, selective clearing may be required to make the hole more playable.

Trees may be used around the teeing ground and to frame target areas, although their proximity must be carefully established, as too much shade can create difficulties in the growth and maintenance of turf. In addition, free spaces around the green must be provided to allow for air circulation across the putting surface. Trees behind a green aid depth perception while providing an effective back-drop. Mass planting between fairways defines the line of the hole and can add to strategy and alleviate safety concerns, while windbreaks make the game more comfortable on a windy day. A single tree can be utilized within the strategic design of a hole,

with play being directed around or over it. However, with design of a hole around a single "specimen" tree there is also the matter of the consequence of it's loss, which will likely make play on the hole unsatisfactory. In any case, it is usually better to group trees, generally using them only where they have been standing under the same conditions throughout their lifetime.

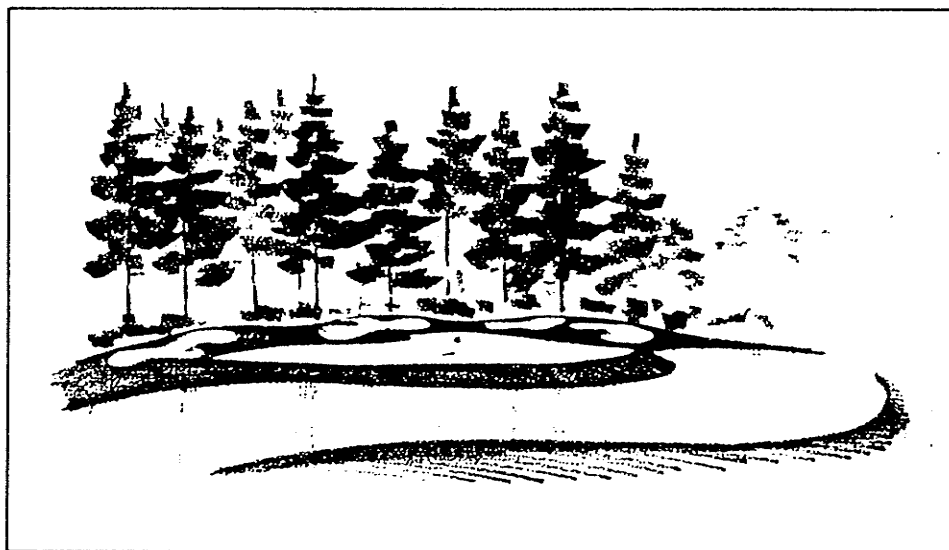


Figure 18: Trees Behind a Green Aid in Depth Perception, from *An Introduction to Golf Course Design*, 1978, p.7.

Several principles of design must be observed in the use of trees if they are to be incorporated into the design of the course. Unity in planting must be maintained through the selection of species and their relationship to the form of the site. Plantings should therefore move with the contours of the site in clump-like

groupings rather than lines or avenues. Significant tree groupings should be linked to open spaces with a gradation among groups and species. The selection of tree species will ultimately dependant upon the ecology and climate of the region. Additional planting may be required to soften hard edges. Contrast and opposition of form and colour can be introduced through the careful selection of tree mixtures. Overall, harmony must be maintained and established tree patterns and types must be respected . A healthy mixture of native coniferous and deciduous varieties are considered to be the best on a golf course with additional attention played to the placement of species such as spruce which are difficult to play in and around.

E n v i r o n m e n t a l I s s u e s

Perhaps the most important factor which is becoming a major issue for the modern golf architect, is growing awareness of and consideration for the environment. With increasing regard for environmental protection, the scope of the designers responsibilities has taken on a new dimension.

Among environmentally sensitive areas none is more important than that of flood plain and wetland areas. To further

complicate matters, in many cases a designated buffer area between the wetlands and any development is often required.

Environmental concerns after the course is completed must also be considered. These are basically related to the area of maintenance and use of pesticides and fertilizers and their impact on ground water which invariably run off into other bodies of water. Erosion control is also a major factor, particularly during construction.

The issue of water conservation is equally important, especially in these arid and desert regions with limited supply. The response of many designers to this sensitive issue has often been to draw inspiration from the early target style of play. Principle teeing areas, landing areas and greens are irrigated leaving the remainder of the fairway in a more "natural" state. Unfortunately, the economic reality still exists that golf course development is big business with developers willing to spend considerable sums to create a lush environment for the golfer. This is particularly true in the exclusive desert communities of the southwest United States where the "economics" of the game can often supersede environmental concerns. In such cases, course designs which help to reduce water consumption and promote water conservation should be heavily promoted.

In truth, golf courses can be beneficial to the environment and the community in many ways. Besides their obvious aesthetic value a golf course acts as a natural filtration system, a natural drainage area and provides space for water reclamation which can supplement irrigation requirements. As open spaces they provide a haven for birds and other small wildlife while their extensive stands of trees effectively absorb noise in the environment. As the leaf and grass surfaces release moisture, the resulting evaporation has a natural cooling effect on the environment. Furthermore, grass and trees reflect the sun's radiation in contrast to asphalt and concrete. During hot periods of summer, temperatures on and surrounding a course may be as much as 10 degrees below downtown areas. The leaf surfaces of the vegetation also attract particle matter which is otherwise dispersed into the atmosphere by industry and automobiles thus serving as a natural air conditioner.

Finally, through the process of photosynthesis, the plant matter converts carbon dioxide into oxygen and helps restore the quality of the air.

K e y D e s i g n E l e m e n t s

The following are presented as a synthesis of the primary design elements and issues as compiled during the course of this study.

1. Ideally a site with a diverse number of inherent landscape features, providing a number of alternative choices for tee and green locations should be selected.
2. As far as possible the course should be designed in such a manner that it may provide a challenge for each class of golfer.
3. The optimum length of a course is one which allows the golfer to use all or at least most of the clubs in their bag.
4. Consecutive holes should be of significant variation in their length in order to maintain flexibility.
5. The design of the hole must offer the player an alternative number of choices as to the direction, length and placement of the shot.
6. With the possible exception on doglegs, each hazard, landing area and putting surface should be visible from the tee.
7. Sand bunkers are utilized in order to guard the driving

area of the fairway, and the pin positions on the green.

Placement of such hazards are instrumental in influencing the direction of play as well exacting a penalty of up to one stroke for an errant shot.

8. Multiple tee placement allows for greater flexibility in the way a hole may be played while also varying traffic patterns.

D e s i g n A p p l i c a t i o n t h e s i t e

Set in the Coachella Valley of southern California PGA West's Stadium course serves as a template for tournament golf. Opened in 1986 the Pete Dye designed course may be the most difficult course a player will ever encounter, measuring 7261 yards from the back tees.

For the purposes of this study the ninth hole has been selected as the subject of the practical design application based on principles presented in this study. Appropriately named "Reflection", the hole has been designed to play as a long par 4 at 450 yards. In addition to being very long the hole is very narrow, the fairway varying only between 25 and 30 yards over a distance of 250 yards.

The hole requires extreme accuracy in shot making. A tee shot down the left side is imperative if the player is to avoid the water and sand bunker which guard the right side of the fairway.

No less intimidating are a series of mogul sized earth mounds paralleling the left side of the fairway, dictating a very accurate and straight tee shot. A successfully executed tee shot will still leave a player with a long iron over both sand and water.

approach to the green remains unchanged:
however now a larger entrance is provided
for golfers choosing not to play over water

PGA West Stadium Course
9th Hole "Reflection"

PAR 4

outline of proposed design

Rough

Mounding

Cart Path

green shape and bunker arrangement
maintain the orientation of the approach

Water

bunker to catch a wayward hook
shot and guard the landing area



Scale 1"=40 yards

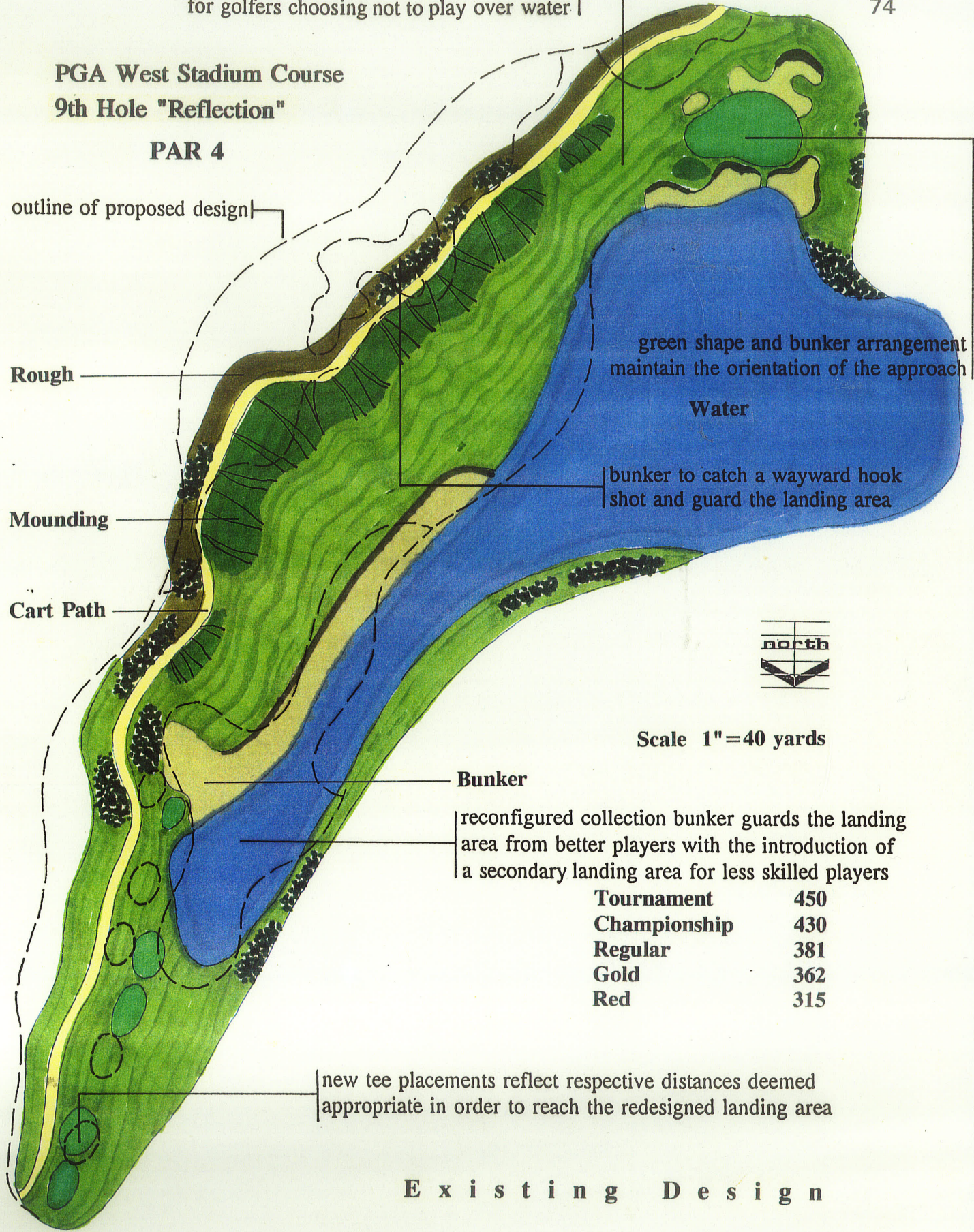
Bunker

reconfigured collection bunker guards the landing
area from better players with the introduction of
a secondary landing area for less skilled players

Tournament	450
Championship	430
Regular	381
Gold	362
Red	315

new tee placements reflect respective distances deemed
appropriate in order to reach the redesigned landing area

E x i s t i n g D e s i g n

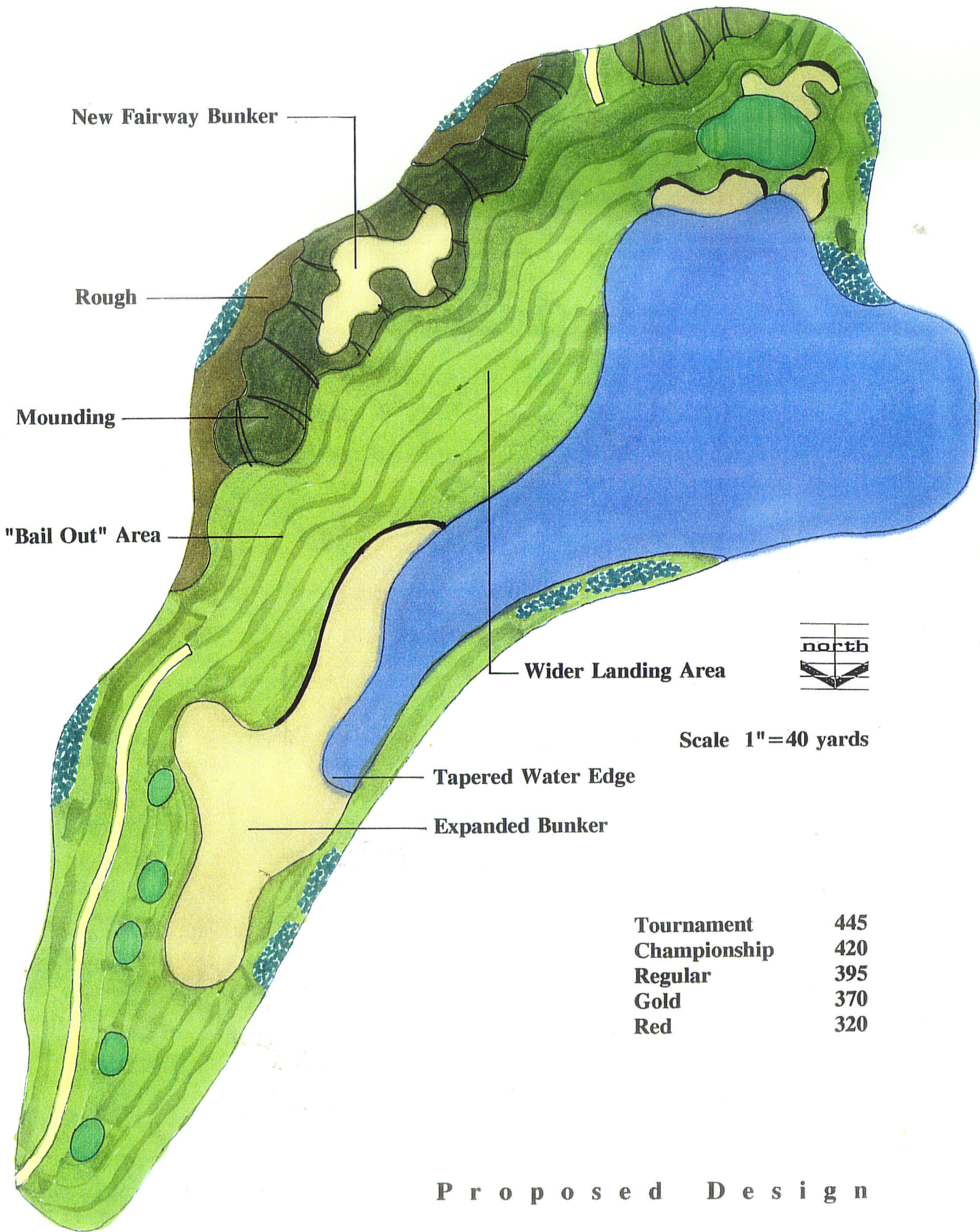


While this may provide an effective challenge for the professional golfer, it can easily strike fear into the hearts of average players. Subsequently, the design strategy to be undertaken will focus on making the hole more playable for the higher handicap player while maintaining the level of difficulty for better players inherent in the original design.

d e s i g n c o n c e p t

The objective of the prescribed changes to the existing design has been to maintain the inherent integrity and strengths of the hole while allowing it to play in a more "forgiving" way for the less skilled player.

The first issue to be dealt with is the requirement of all players, with the exception of those using the front tee, to play their tee shot over both water and sand. While there may be no rule against requiring a player do so, it is somewhat unfair to present the golfer with more than one obstacle to overcome at a time. In order to achieve a more reasonable challenge the lower portion of the water hazard would be pulled back out of the line of play from the tees. The remaining area would then be occupied by an expanded area of sand.



Scale 1"=40 yards

Tournament	445
Championship	420
Regular	395
Gold	370
Red	320

P r o p o s e d D e s i g n

Of critical importance to enhancing the playability of the hole is the need to reduce or eliminate the "restrictive" feel on portions of the existing fairway. In order to accomplish this task the perimeters of the fairway have been expanded both into the existing water and rough. The resulting configuration creates three landing areas each ranging in width from 40 to 65 yards. The purpose of this is to provide not only more prominent landing areas but to also introduce a degree of flexibility in the number of ways the hole can be played thereby accommodating a wider range of skill levels.

The first landing area provided to players is located beyond the front tee for approximately 125 yards. This "bail-out" area would give shorter hitters or those unable to clear the sand bunker an area to comfortably play their ball. The majority of golfers will play to the central portion of the fairway. Here the fairway is at its widest proving more than accommodating to a well struck tee shot.

Framing the landing area are the water's edge and the introduction of a large fairway bunker. Set in the same pronounced mounding, this bunker would be utilized in capturing hook and other wayward shots. Players who are successful in circumventing these early hazards are presented with the opportunity to risk a shot over water to reach the green. Those feeling less adventurous can play to the area created at the entrance to the green. At the cost of

an additional stroke the player is provided with an unobscured approach to the green.

The pot bunker which guarded the entrance to the green has been eliminated. This was done primarily to not only open up the approach to the green but also to disperse the concentration of traffic entering and exiting the green. The remaining bunkers provide more than adequate protection of the green and therefore will remain in their present position and configuration.

Edge treatments will emulate existing topological and vegetative conditions. The rough consists of unmaintained mounding and a scattering of low spreading coniferous and deciduous shrubs combined with individual and small stands of high headed deciduous trees. Vegetation is utilized primarily to define the boundaries of the hole as well as to provide a backdrop to the green, aiding the player in correctly gauging distances.

Tee locations have been modified somewhat in order to reflect changes in the fairway layout. Position and orientation of each tee box has been selected on the basis of what one can reasonably expect players to be capable of driving from each corresponding tee.

The continuous cart path has been eliminated from the design. With the pronounced expansion in the width of the fairway

the time necessary for players to traverse the fairway in order to play their next shot would contribute to slower play. Therefore, the cart path will terminate at the entrance to the fairway and reemerge at the entrance to the green, leading to the tenth hole.

C o n c l u s i o n

It has been the intention of the preceding study to present the fundamental design principles of golf architecture. In tracing the genealogy of its development, it has become evident that the sport has evolved considerably from its humble beginnings. From its rudimentary forms to modern sophistication, the golf course has adapted throughout its relatively short existence to the varying needs of its players as well as given contexts. In all, the integrity of the game has managed to remain intact.

As the sport continues to grow and new courses are constructed it will become increasingly important for course designers to recognize that an inherent flexibility must be incorporated into the design process in order to accommodate a wide variety of players skill levels. By designing holes that can be played in numerous ways the architect can not only challenge better players but also those higher handicap players who want to improve

their game.

Above all, the designer must strike a balance between what can be considered to be an effective challenge for most players, while at the same time ensuring that the course can be enjoyed by all players.

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