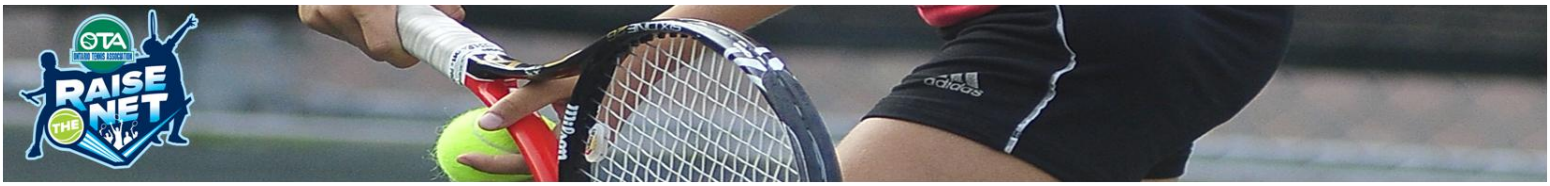


Section 1.02 COURT CONSTRUCTION AND MAINTENANCE

These entries are excerpts from TENNIS COURTS, published by the USTA

Tennis Courts

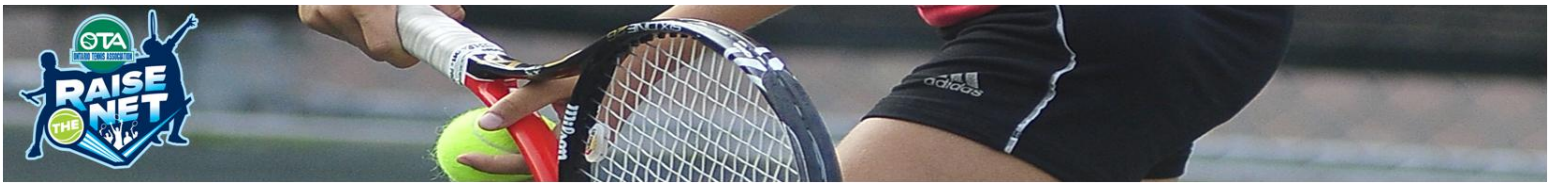
In the United States, there is an organization known as the U.S. Tennis Court and Track Builders Association (USTC & TBA). The USTC & TBA has combined with the United States Tennis Association (USTA) to produce a very comprehensive publication, "Tennis Courts". This publication contains extensive information on all aspects of the building and maintenance of tennis courts including fencing, lighting and peripheral equipment. It is an excellent source of information and has been a major resource for the documents we have prepared on these topics.

Court Surfaces

Over the years, tennis courts have been constructed using a wide variety of materials. Perhaps one of the reasons that tennis has flourished as an international game is the fact that almost any existing local construction materials can be applied to making tennis courts.

Most of us are aware that the original courts were simply the lawns of finer British country homes. Anyone who has ever played on a grass court knows that even the best prepared lawns are still very prone to bad bounces. However, within a short period of time, tennis players began demanding more consistent playing characteristics than a normal lawn can provide. This led the players of the day to begin playing on the smoother, more manicured lawns that many of the more exclusive clubs of Victorian England had constructed for what was one of the most popular outdoor activities of the time, croquet. The All England Club at Wimbledon, perhaps the most famous tennis club in the world, was originally a croquet club.

Beyond using existing lawns, we have also seen reference over the years to courts being made out of many other materials. Some players will remember a time when crushed cinders were a common material for courts. In his book, How to Play Winning Tennis, Rod Laver remembers his first experiences with the game being on a "crushed anthill court" which his father and brothers had constructed on their farm in Queensland, Australia.



Classification of Tennis Court Surfaces

A. Porous Construction
(water filters through the surface)

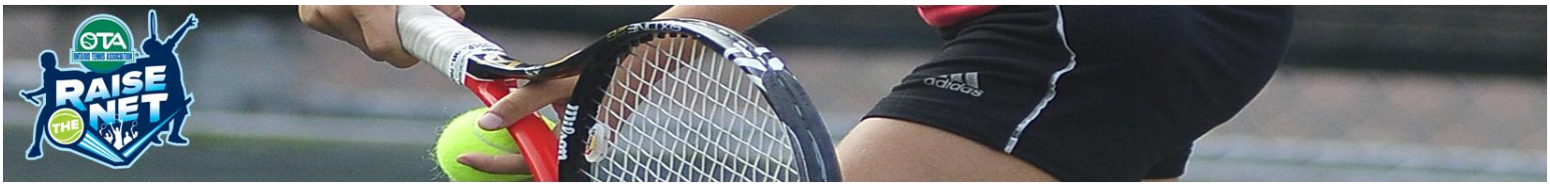
1. Fast Dry [*](fine crushed aggregate)
2. Clay
3. Grass
4. Porous Concrete
5. Modular

B. Non-Porous Construction
(water does not penetrate, but runs off the surface)

1. Non-Cushioned
    a. Concrete and Post-Tensioned Concrete
    b. Asphalt
        (1) Hot Plant Mix
        (2) Emulsified Asphalt Mix
        (3) Combination Hot Plant and Emulsified Mix
        (4) Penetration Macadam
    c. Others

2. Cushioned Construction
    a. Asphalt Bound Systems
        (1) Hot Levelling Course and Hot Cushion Course
        (2) Hot Levelling Course and Cold Cushion Course
        (3) Cold Levelling Course and Cold Cushion Course
    b. Synthetic
        (1) Textile
        (2) Sand-Filled Synthetic Turf
        (3) Removable Court Surfaces
        (4) Poured-in-Place Synthetic Systems
        (5) Synthetic Clay

[*]A general classification, not a trade name.



COMMUNITY PLANNING FOR TENNIS

Considerations

The proper planning for the growth of tennis in any community requires an informed approach by the authorities responsible for making decisions. Consideration must be given to the acquisition and use of land, to layout, to long range planning, to detailed design and specifications, and to financing and operational costs.

Invariably, once the game takes hold, there is a desire to have a tennis centre where courts are concentrated in one location. Such a centre allows economical control and maintenance, the establishment of a tennis house and a pro shop if desired, the running of special events, the development of a good junior instructional program, senior activities, as well as many programs and tournaments for the local residents.

However, in many communities, tennis growth follows a pattern that tends not to centralize facilities. Since initial tennis interest is often limited, the community finds a small plot of land, and on it builds one or two courts. As demand increases, another location is found since the size of the first site precludes expansion. Eventually, there are a number of courts, but no location large enough for a centre. With such a scattering of courts, but no location large enough for a centre, often teaching programs, running events, and routine maintenance become logistically difficult, inefficient and costly.

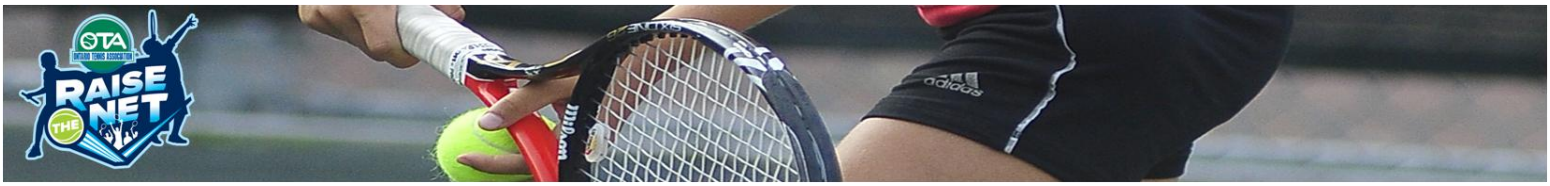
Community officials, therefore, should think in terms of a plot of land large enough to accommodate an eventual centre, even when their financial capabilities are limited. Such a centre can then be developed in stages. In doing so, they will satisfy not only the desire for courts on which to play, but all of the community's tennis program needs as well on a long term basis.

Feasibility Studies

Before owners spend sizable amounts of money for a tennis facility, they would be well advised to pay a small percent of that money for a feasibility study by an experienced independent consultant. Such studies, properly done, tell the owner whether the proposed facility will accomplish what the owner hopes will be the result.

A market study is of the utmost importance to determine the number of people who are likely to use the facility. This may determine whether the operation is viable or not. The market area should be clearly defined. Consideration should be given to income level, competing tennis facilities, competing sports and existing tennis interest.

The report should include the evaluation of a site’s location, size, shape, zoning, access, cost,



topography, borings, relation to market, available utilities, allowances for expansion, parking, landscaping and so on.

The recommended number and types of facilities should be in the study.

The report should include the estimated costs of facility design, land, utilities, construction and landscaping. In addition, there should be the estimated income and operating expenses for the first three years of operation.

Suggested methods of financing are also important. If the report includes alternate uses of the facility, it makes financing easier. Finally, the consultant should give his opinion of whether or not the project would be successful with good promotion and public relations.

Financing Public Tennis Facilities

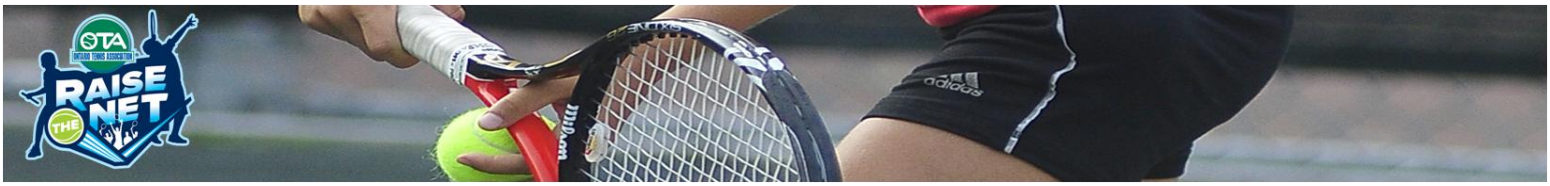
Current indications are that federal support for park and recreation systems will be significantly reduced, shifting responsibility to local governments and private citizens. Therefore, other funding sources should be considered such as bonds, foundations, gifts and donations, and combinations of private and public funding.

Number of Courts to Build

The number of courts required in a community can range widely due to the variance of tennis interests and the number of private tennis courts in the area. As a very rough guide based on surveys that have been made, the following is suggested according to the USTA:

POPULATION	NUMBER OF PUBLIC AND PRIVATE COURTS
15,000	20
25,000	30
50,000	50
100,000	80
250,000	130
500,000	210
750,000	270
1,000,000	320
1,250,000	360
1,500,000	400
over 1,500,000	1 per 4,000 population

The above figures are recommended averages for various sized communities based on known



statistics of participation in tennis. In large cities, each section or other sub-division should be considered as a separate community. Climate (length of playing season), athletic interest of the population, and the number of tourists are all factors which should be taken into consideration in determining the number of courts required. Each of these factors could increase or decrease the recommended number of courts in the preceding table. Competing sports must be considered.

The number of courts that should be built for private outdoor tennis facilities will depend largely upon the number of times per week the tennis players in the organization wish to play. On average, there should probably be one court per twenty to forty players. If time reservations are made for outdoor courts, one court can usually accommodate at least sixty players. Lighted courts extend the playing day and can therefore accommodate more players.

For college facilities, one court per 250 students is a reasonable number to provide.

Indoor commercial clubs will find that one court has a capacity of approximately 160-170 players for a 15-hour day.

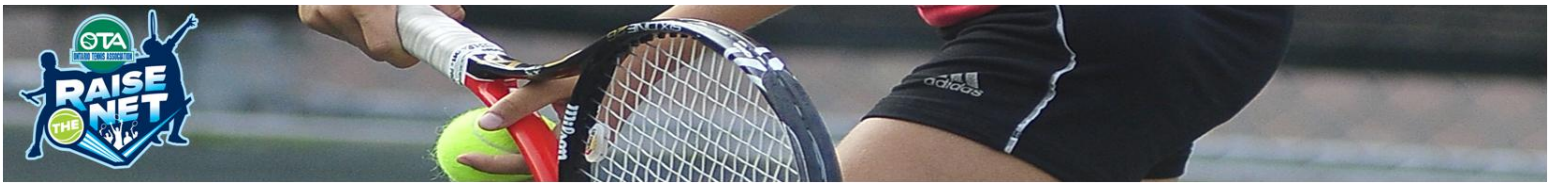
Selecting a Tennis Court Consultant

If the project architect/engineer/landscape architect is not experienced in tennis court design, it is recommended that a tennis court consultant who is fully aware of technical aspects of tennis court design be employed to work closely with the architect. The cost of a consultant could ultimately be of great economic impact to the facility owner, as well as produce a facility incorporating the latest design criteria.

Selecting a Tennis Court Designer

Since constructing or resurfacing one or more tennis courts is not only relatively expensive but also a long time investment, special care should be taken in the selection of professionals involved in the project. While construction of a tennis court doesn't always involve the skills of an architect or an engineer, there are many instances where problems relating to slope, orientation, layout, and the like are such that to proceed without the advice and experience of an architect and/or engineer experienced in tennis court design would be unwise.
Factors to be considered by a court designer are:

1. Proper court size and spacing between courts.
2. Orientation of courts.
3. Slope and drainage of courts.
4. Site drainage.
5. Base and construction materials.
6. Type and speed of surfaces.
7. General information on lighting, fencing, nets, net posts, windscreens, court accessories, spectator conveniences, ball machines, scoreboards, maintenance and resurfacing.



8. Climatic considerations.

In addition, the court designer should:

1. Be familiar with USTA recommendations and USTC & TBA guide specifications.
2. Be knowledgeable about zoning requirements.
3. Prepare quality specifications to receive comparable bids.

Selecting a Tennis Court Contractor

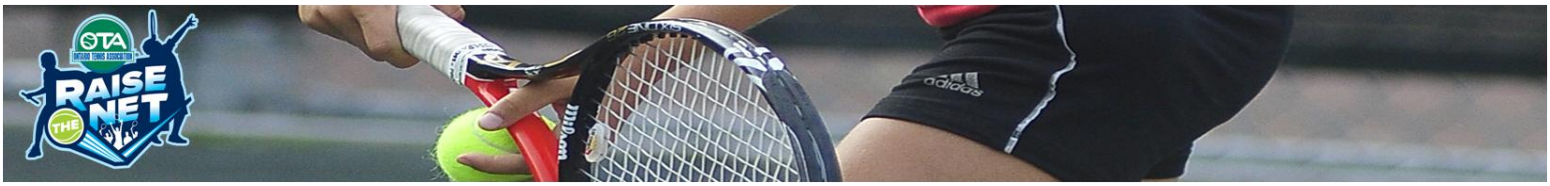
Once the working specifications have been developed, a qualified contractor should be selected. Consideration of the following factors is recommended:

- Bids should be based on identical specifications which are to be strictly followed.
- The contractor should be knowledgeable about and have had experience in dealing with slope, drainage, base materials, type of surfaces and variety of speeds, lighting, fencing, nets, net posts, windscreens, maintenance, resurfacing and acceptable tolerances.
- Upon request, the contractor should provide references. First hand inspection of courts built by the contractor is recommended. In checking these references, attention should be paid to experience, workmanship, ability to meet schedules, financial responsibility as well as previous customer's general satisfaction with the contractor.
- The contractor should provide a guarantee against defective materials or workmanship. The guarantee period should be a minimum of one year to experience the four seasons.
- If all else is equal, a local qualified contractor is usually more readily available for conferences and repairs when needed.
- Should be familiar with USTA Recommendations, rules, etc. and the guide specifications of the USTC & TBA.

The OTA keeps an updated list of all known court contractors in Ontario at:
http://www.tennisontario.com/documents/Court%20Contractors%20Sept%20%202012.pdf

Usage Fees

While not all facilities have been faced with the question or necessity of charging a fee for the use of public tennis courts, and while there still remains strong support for free recreation in many cities and towns, there is a growing realization that charging for the use of specialized facilities as a source of revenue may be necessary to provide, properly



maintain, and expand public services to the community. Towns with both a tennis centre and neighbourhood courts often offer free court time at the small neighbourhood complexes while charging user fees for the better equipped and managed tennis centres.

Fees charged to the user can help compensate for the increasing demands on the tax dollar, placing the financial burden of operations with the direct beneficiaries of the service, not with the general public.

Fees can serve as a supplementary or primary source of revenue by which to operate and maintain a facility in proper condition. Any tennis complex represents a substantial investment. That original investment remains viable only as long as the property is maintained, whether it be through the expenditure of public funds or by means of user fees or a combination thereof.
It is of interest to note that most of the award-winning tennis centres charge nominal fees for play. In some cases, the fees go into the general tax fund; in others, the fees are designated for the particular facility (as with corporate structure or revolving trust fund).

GENERAL CONSIDERATIONS BEFORE CONSTRUCTING A COURT

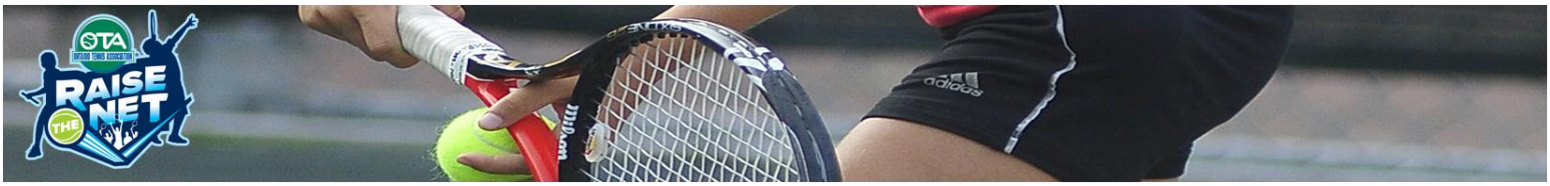
Individual Courts

The outside dimensions of the playing lines shall be 36` x 78' for doubles and 27' x 78' for singles. In order to have sufficient space behind and outside of the lines, an overall playing area of 60' x 120' is recommended standard. Where space is limited, an overall area of 56' x 114' is the minimum for an individual court that allows play with reasonable comfort. No reduction, however, should be made from the standard 60' x 120' dimensions are most important.

Battery of Courts

For recreational play, where courts are constructed within the confines of a common enclosure without divider fencing, it is recommended that there be at least 12 feet between sidelines of adjacent courts. It is also recommended that a maximum of three courts be constructed side by side unless they are separated by fencing. Only when space availability dictates, the space between sidelines may be reduced to a minimum of 10 feet.

For club play, where courts are constructed within the confines of a common enclosure without divider fencing, it is recommended that there be 15 feet between sidelines, and that a maximum of three courts be constructed side by side. A low divider fence is recommended between each court for most desirable club play, in which case each court should be 60 feet in width.



With a 12 foot separation, each additional court set beside another court adds 48 feet of width or 5,760 square feet per court to the initial 7,200 square feet; thus the area and cost per court diminishes. Allowing 12 feet between courts, two courts set side-by-side require 108' x 120' and three courts 156' x 120'. Where space and budget allow, it is desirable that each court be constructed in a 60' by 120' area (separated by fences of a design most suitable to the project).

Stadium Courts

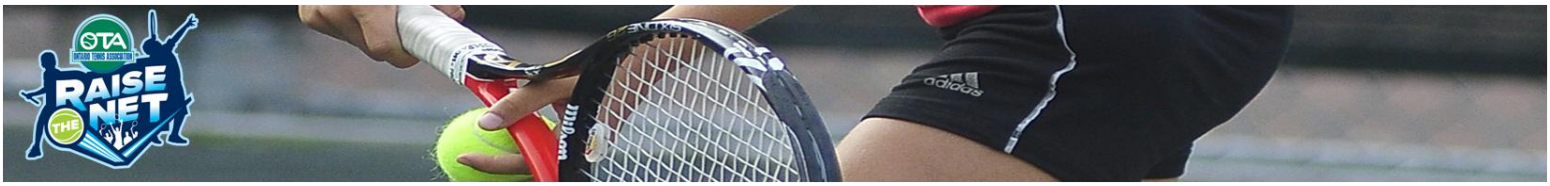
A stadium court should measure 70' x 130' in order to allow space for officials and ball boys.

Orientation

Courts should generally be laid out with the long axis in the north and south direction, to avoid having players look directly into the sun while playing.

General Guidelines Prior to Construction

1. Ground should be reasonably level, and preferably not low in relation to adjacent land; otherwise, special provisions for drainage will be required.
2. Space for future courts should be allowed.
3. The site should be sheltered from prevailing winds.
4. A dark background is desirable. Light-coloured backgrounds such as white buildings, and moving objects such as people or cars, should be avoided behind the ends of the court. Background curtains (windscreens) provide a good background as do plants or shrubbery.
5. Trees near a court may provide a wind break and a good background. However, trees may also cast shadows or drop leaves on the court, their branches may interfere with play, and their roots may cause damage to the court.
6. No vegetation or tree stumps should be left under a court as rotting will occur and cause settlement in the court surface.
7. Balls coming in and out of shadows cast by buildings, trees, lighting fixtures, etc., are difficult to follow.
8. Noise from a highway, swimming pool, playground, airport, etc., can interfere with the enjoyment of playing tennis.
9. Where a golf course is adjacent to tennis courts, be aware of the possibility of stray golf balls entering the tennis courts.
10. Tennis courts built on decks above grade or on rooftops present special problems which should be given careful consideration by an architect and/or engineer experienced in this type of construction.
11. It is highly desirable to provide a drinking fountain with a self-draining valve, hose bibs for watering landscaped areas and washing courts, trash baskets, telephones and a clock.



12. All tennis facilities should provide benches or seating for waiting players as well as for casual spectators.
13. Storage for supplies and maintenance equipment.
14. In order to cut grass adjacent to a court, it may be desirable to extend the court surface one foot outside of the fence. As an alternative, place coarse gravel one foot outside of the court surface to absorb water runoff from non-porous courts as well as granular surfacing material from porous courts.
15. It is extremely important before constructing any courts to take soil borings down to a depth of a least six feet to determine if the subbase below the court is suitable.

SELECTION OF TENNIS COURT SURFACES

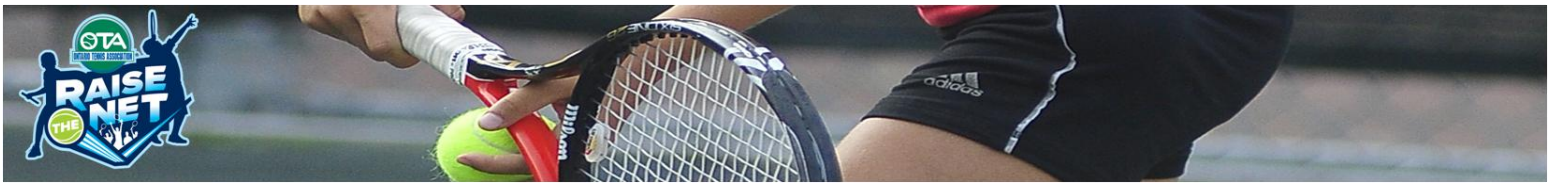
The selection of the tennis court surface depends upon a variety of factors. Among the factors to be considered are (1) the preference of the players who will be using the court; (2) the climate; (3) the amount of money available for construction; (4) the reputation, experience and availability of the court contractor; (5) maintenance cost and (6) cost of repairs.

One of the main factors to be considered is the amount of supervision to be provided at the court facility. For tennis courts constructed in areas such as parks or schools, where supervision cannot be provided, consideration should be given to the advantages of the non-cushioned type of surface. A hot plant mix asphalt or concrete court is sturdier and stronger and can take some abuse without damage. This also extends the playing season.

Cushioned tennis court surfaces, fast dry court surfaces, and other soft surfaces such as clay and grass, should only be constructed in an area where supervision is provided and tennis players use smooth soled tennis shoes. In general, tennis courts with these types of surfaces are found in locations such as country clubs, tennis clubs, etc., where supervision is provided by someone such as the tennis professional, who insures that the courts are properly cared for. Such courts can also be installed in parks and in schools, provided that supervision is available to insure that the surfaces are not abused, since bicycles, skateboards, and even street shoes could damage the court surface.

Climate may affect choice of courts. Extreme heat may produce softening of certain surfaces, glare, heat radiation or cracking of surface. Extreme cold and frost action may be more likely to damage certain surfaces unless specific precautions are taken by an experienced court contractor and maintenance personnel.

On the following pages will be discussed the "pros" and "cons" for each surface, including the amount of maintenance required and surface hardness. All of these factors should be carefully considered in the selection of the tennis court surface.



Factors to Consider in Selecting a Tennis Court Surface

1. Player preference.
2. Surface on which player can slide which is easier on one's feet, knees and back.
3. Softness of surface.
4. Fast or slow surface.
5. Uniformity of ball bounce.
6. Lines: effect on ball bounce, possible tripping hazard, and line maintenance.
7. Effect of colour on glare and heat absorption.
8. Colour-fastness of surface and its effect on ball discolouration.
9. Effect of abrasive surface on balls, rackets, shoes and falling players.
10. Climate conditions.
11. Drying time after a rain.
12. Initial construction cost.
13. Maintenance cost and amount of maintenance relating to above grade or rooftop courts.
14. Special problems of moisture requiring attention for granular courts when used indoors.
15. Dust and surface material tracking when granular surfaces are used indoors.

TENNIS COURT DIMENSIONS AND LAYOUT

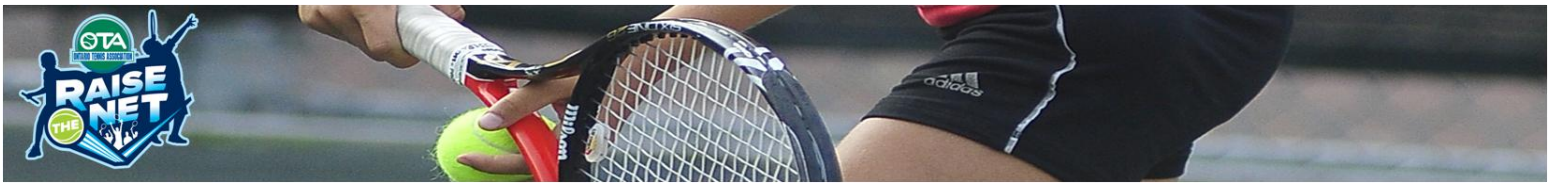
Dimensions

The court size (within the playing lines) is 36' x 78'. The playing area (court size plus area outside playing lines) should be a standard sixty feet (60') by one hundred twenty feet (120'). There are acceptable variations in the playing area, because it is necessary in particular circumstances for the court designer to balance the needs of the players and spectators, the expected quality of play, space limitations, and cost. There may be situations in which one or more of the suggested playing area dimensions should be varied, depending on the physical characteristics of the site, possible accommodation for line umpires and photographers, or other factors.

Area of Court

The outside dimensions of the playing lines shall be as follows:

Doubles 36' x 78' (10.973m x 23.774m)
Singles 27' x 78' (8.230m x 23.774m)



Back Space

Twenty-one feet (21') (6.401m) from the baseline to fixed obstruction (i.e., backstop, wall, etc.) is the minimum requirement for tournament play. Only where space limitations become a factor and the 21' (6.401m) minimum cannot be provided that the clear-playing back space may be reduced to not less than 18' (5.486m).

Side Space

Twelve feet (12')(3.658m) from sideline to fixed obstruction (i.e., sidestop, light pole, wall, etc.), is the minimum requirement for tournament play. Only where space limitations become a factor and the 12'(3.658m) minimum cannot be provided, the side space from sideline to a fixed obstruction may be reduced to not less than 10'(3.048m). For indoor courts where netting is used between courts, the netting is considered to be a movable obstruction, in which case 9'(2.743m) is allowed between sideline and netting.

Space Between Courts

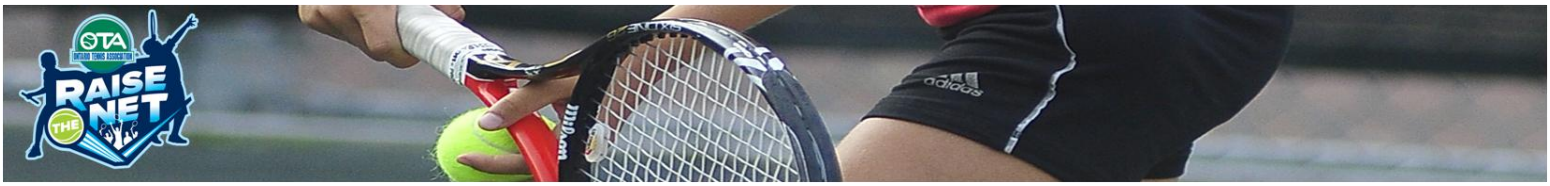
For recreational play where courts are constructed within the confines of a common enclosure, without divider fencing, it is recommended that there be 12'(2.658m) between sidelines. Only when space availability dictates, the space between sidelines may be reduced to not less than 10'(3.048m). It is also recommended that a maximum of three courts be constructed side by side.

For club play, where courts are constructed within the confines of a common enclosure, without divider fencing, it is recommended that there be 15'(4.572m) between sidelines, and that a maximum of three courts be constructed side by side. A low divider fence, a minimum of 36 inches in height(0.914m), is recommended between each court for most desirable club play, in which case each court should be 60'(18.288m) in width.

Backstop/Sidestop

The backstops should be 10'(3.048m) in height above the court surface. Where local conditions dictate additional security or ball retention, a higher backstop may be required. For residential courts, 8'(2.438m) in height is adequate when the adjacent area is such that a ball going over the backstop or sidestop can be retrieved without hardship and undue intrusion on adjoining property.

The sidestops should be the same height as the backstops for a minimum distance of approximately 20'(6.096m) from the backstop; however, 30'(9.144m) is recommended. The height of the sidestop (if used) for the remaining area may vary to suit local conditions. In no instance shall the sidestop, where used, be less than 3'(0.914m) in height.



Backstop and sidestop material, when manufactured to metric standards, varies slightly from the English dimensions set forth above. The equivalent standard dimension material may be substituted.

Overhead Clearance

For outdoor play, the space directly above the area within the playing lines should be free from any overhead obstructions. For indoor play, it is recommended that there be a minimum height of 16'(4.877m) at the wall behind the baseline, not less than 20'(6.096m) over the baseline, and 35'(10.668m) over the net line.

Net Posts

The centre of the net posts shall be set 3'(0.914m) outside the sidelines 33'(10.058m) singles, 42'(12.802m) doubles. The top of the net at the inside face of the posts, or of the "singles sticks" when used to support a net for singles play on a doubles court, shall be exactly 42"(1.067m) above the court surface. The net posts, which shall not be more than 6 inches (15cm) in diameter or square, shall not be higher than 1 inch (2.3cm) above the top of the net cord.

A centre strap hold down and anchor shall be provided to hold the centre of the net at a height of 36"(0.914m) above the court surface at the centre line.

For tournament court use it is recommended that a second set of net post sleeves be installed for use during singles play (33") and that a singles net be supplied.

Playing Lines

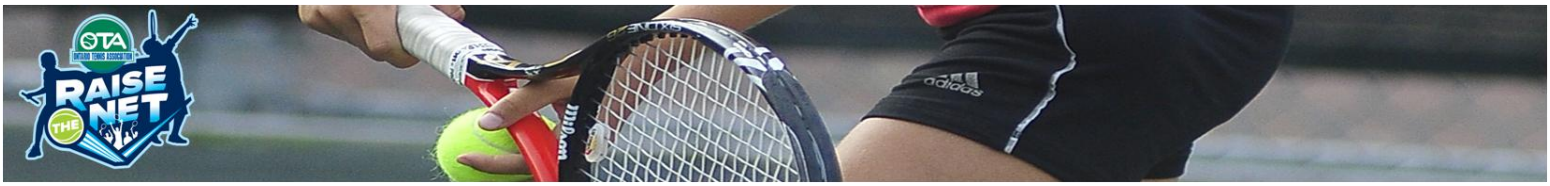
All lines shall be not less than 1"(2.54cm) or more than 2"(5cm) in width, except the baseline which may be up to 4"(10cm) in width and the centre line which shall be 2"(5cm) in width.

This allowable variation in line width results in non-uniformity and confusion and, therefore, the USTA and the U.S. Tennis Court Builders Association recommends that all lines be 2"(5cm) in width except the baseline, which may be up to 4"(10cm) in width.

All measurements shall be to the outer edge of the lines except the centre line and the centre mark which shall be on the centre line of the court. The centre mark shall extend 4"(10cm) inside of the baseline.

All lines shall be of uniform colour. The customary standard line colour for tennis is white.

OPTION: According to the ITF Rules of Tennis, all lines on the court should be continuous. However, an option in line painting (which is not uncommon in the USA in spite of its non-



conformity to the Rules of Tennis) is to leave a space of 1-1/2"-2" (2.77cm-5cm) in the singles sideline immediately behind the service line. This "gap" facilitates line calling (particularly on the serve) for both the player and the line umpire without hampering line calling during play of the game.

TOLERANCE: The lines should be laid out and applied as close to the exact measurements as possible within the limitation of the surface on which they are being applied. The line dimensions should not vary more than one-quarter inch from the exact measurement. However, the type of surface and intended purpose of the court, i.e., recreation, club, tournament, etc., shall be some of the factors considered in determining the allowable tolerance.

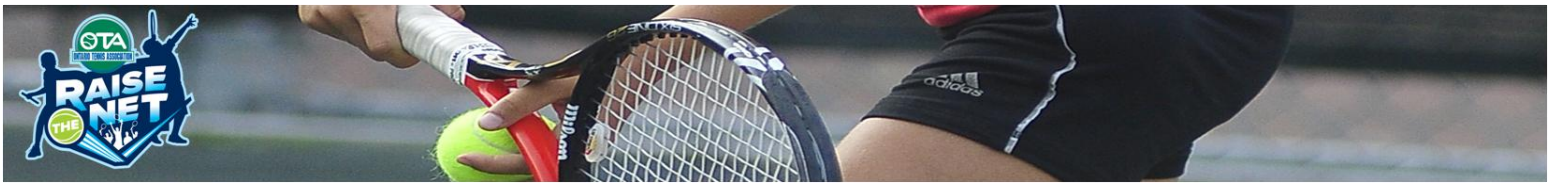
HOW TO LAY OUT A TENNIS COURT

Accurate results are obtained if a tennis court is laid out by the proper use of two accurate 50-foot tape. All courts should be laid out for singles and doubles play. However, since the same lines--except for the side line extensions for doubles play--are required for each, it is best to first lay out the singles court. Courts should be laid out with the long dimension north and south. First establish the net and centre line. Using this point and the net line, drive a nail at Point A, then a second nail--27 feet from A--at Point B. Then take the two 50-foot tapes and attach their respective ends to the nails A and B. On the first, which will determine the side line A-E, measure off 39 feet; on the second,which will determine the diagonal B-E, measure off 47'-51/4". Pull taut such that at these distances, they meet at Point E. Drive a nail at E. Then establish Point D in a similar manner. (Note that the distance from E to D should be 27 feet - the same as from A to B).

Check this for accuracy before driving a nail at D. Point F (21 feet from A) and Point C (21 feet from B) should then be established and nails driven at these points. This gives you the lower (or south) one-half of the court. The upper (or north) one-half is determined in a similar manner. This completes the boundaries for the singles court. The doubles court boundaries are established by prolonging the base lines (from Points E & D on lower half and similarly for the upper half) 4 feet 6 inches in each direction and joining the four new points to establish the side lines for the doubles court. (Note that the doubles court is actually 9 feet wider than the singles court, with side lines parallel to those of the singles court).

ORIENTATION OF COURTS

There are a number of factors that should be taken into consideration when deciding in what direction to place the long axis of any tennis court. In general, one needs to consider the angles and direction of the sun at different times of day during the seasons when tennis is to be played on the court. This is to minimize the adverse effect of one player having to look directly into the sun while trying to see the ball and his opponent. Since players usually change sides, prevailing winds need not dictate the orientation.



For example, a stadium court which hosts a national championship should determine the optimum orientation for the period of the tournament, such that the net line on the stadium court points in the direction of the sun during the hours when the main matches are being played. It should be recognized that a tennis court on a Caribbean island, due to the extreme temperatures, will most consistently be played on in the early morning or late afternoon. The courts should be oriented accordingly. Should a school's tennis team have a season in the fall or spring, it, too, should orient the tennis courts to its best advantage for those several months.

Generally, in the northern and mid-section of the USA, if play is about equal morning and afternoon, the north-south orientation is most desirable. In the southern part of the country, where play continues through the winter, the sun is low in the sky. Therefore, if a substantial amount of play takes place between three and four in the afternoon, it is advantageous to orient the court northwest and southeast, fifteen to twenty-five degrees off of true (not magnetic)north. This avoids the player on the north side from having to face directly into the low lying sun.

If there is a substantial slope in the land, the cost of the court construction may dictate the orientation. Also, the shape of the land, zoning requirements, and owner's wishes may dictate the orientation. It has happened that due to the shape of the land available, courts have had to be built oriented largely east and west. This is, however, to be considered a last resort, since in those cases, players will need to compensate for conditions by playing at times of the day when they are not seriously handicapped by the sun.

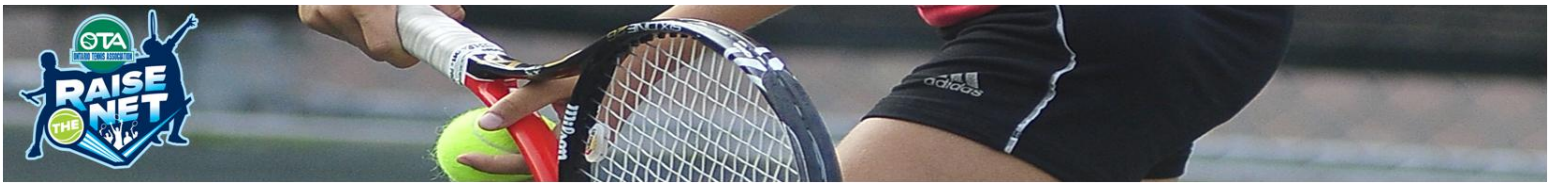
Tables and diagrams giving sun elevations and directions for various times of the day during different seasons of the year at various latitudes are available through tennis consultants as well as in some architectural offices and many libraries. Such sun azimuth-elevation tables should be studied carefully before a tennis court is placed in a given position "just because it fits." There are unfortunate examples of tennis courts being practically unusable at desired prime times because of improper orientation, where other alternatives were possible.

Slope

Each court should be a true plane. A court should drain (in one true plane), in order of preference, (1) side to side, (2) end to end, (3) corner to corner; it should never drain to or from the centre (net) line of the court, as this in effect lowers or raises the net. Likewise, it should never slope from the centre line to the sides. Draining from end to end, particularly on a granular surface, tends to make the lower end wetter after a rain. Therefore, it is preferable to drain from side to side where feasible.

When all else is equal, there are also advantages to sloping a tennis court in the direction of the natural terrain, towards an existing drain or ditch, and, when not in conflict with considerations stated above, with the prevailing wind.

The slope for non-porous courts should be approximately one inch in 10 feet, with a permissible maximum of 1%. More slope than this will be bothersome to the player.



The slope for porous courts should be 1" in 20' to 30'. The higher side dries faster than the lower side which may tend to retain puddles or more moisture, thereby causing a slower bounce.

COURT CONSTRUCTION AND MAINTENANCE GUIDELINES

Cleaning Non-Porous Tennis Courts

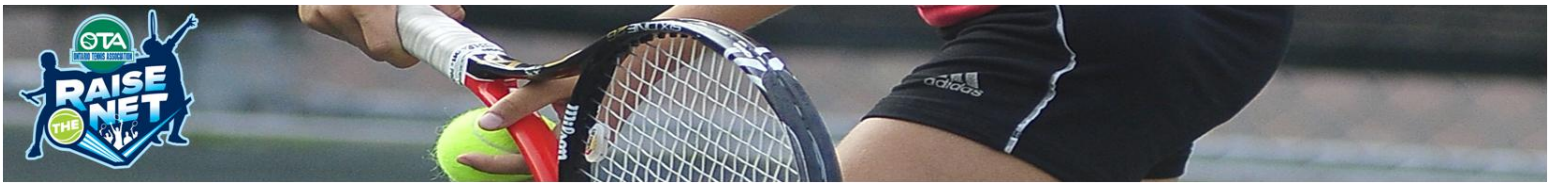
The surface of non-porous tennis courts may become discoloured and/or stained over a period of time as a result of being exposed to the elements. The type and extent of this discolouration and/or staining depends upon the atmospheric conditions existing in the immediate area of the installation--i.e., industrial wastes, sap from trees, leaves, blowing sand or debris, etc. In general, normal rainfall will flush the surface in sufficiently wet areas and keep the court surface in a reasonably clean condition. In areas with excessive dirt, it may occasionally become necessary to clean the surface of the court. The manufacturer of any particular court surface should be consulted for recommended cleaning instructions. In general, however, a mild detergent and water will remove most common stains and contaminations from the court surface. Care should also be exercised to insure that all detergent residue is flushed from the surface, to prevent the possibility of creating a slippery condition. Two parts water to one part bleach may be used to remove mold or mildew. Indoor non-porous courts should be cleaned regularly (every day or two) with a scrubbing machine to avoid tennis balls becoming noticeably dirty.

Colour Surfacing of Non-Porous Courts

Colour surfacing of asphalt courts is now almost standard practice at all facilities, public and private, as compared to laying out courts on uncoated asphalt. The objectives in applying colour surface to all-weather asphalt courts are to provide a uniform texture with the desired playing quality and to obtain a weather-resistant, durable, non-staining, non-glare finish that is aesthetically pleasing. The colour surfacing also protects the asphalt from the elements and extends the life of the asphalt structure.

The "speed" (of the bounce of the ball) is determined by the material as compounded in the factory. Within limits, further adjustment in speed can be achieved during mixing and application.

Two-colour courts (one colour within the playing lines and a different colour around the perimeter) now find popular acceptance. Although there are studies that have shown it is more difficult for the human eye to follow a rapidly moving tennis ball against backgrounds of widely contrasting colours than against a uniform one-colour background, many feel that line calls are made easier with the presence of two distinct colours on the court. It is best to avoid light and bright colours on outdoor courts, since the glare they can create make it difficult to see the playing lines. All of these factors should be considered along with aesthetics and personal



preferences.

The choice of colour for courts is a personal one. However, the following may be considered a guideline. The colour of the court indoors could be lighter than those outdoors because there is no sun glare. Anything lighter than a medium tone reduces the desirable contrast between the ball and the court. It is a personal preference whether one applies one or two colours defining the court inside and outside the lines. Lighter colours outside the court lines produce a brighter atmosphere, and reduces heat absorption outdoors.

The curtains and walls directly behind an indoor court should be the same dark colour for at least the lower twelve (12) feet so the opponent can readily see the ball being tossed by the server. The side walls can be dark or light up to eight(8) or ten(10) feet and light above that for maximum reflectance. The ceiling and all structural members should be a uniform light colour that produces maximum reflectance.

Outdoor courts should avoid very light or bright colours which can cause glare on the court surface. Medium blue inside the lines is not a good colour choice for outdoor play. It creates glare, it is very difficult to see the lines and usually tends to fade. Dark green within the lines and medium green outside the lines is restful and creates the feeling of spaciousness.

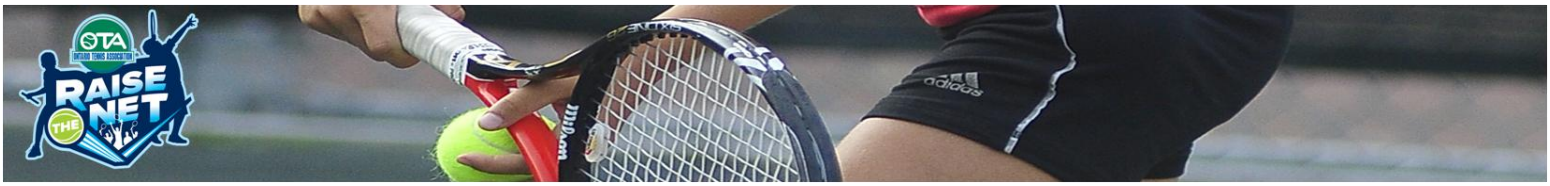
Preparation: Surface course and subsurface materials must have been installed to proper slope requirements and must be thoroughly cured (which normally takes seven(7) to fourteen(14) days for asphalt and four(4) to six(6) weeks for concrete), before application of any filler or colour finish materials.

Prior to application of a colour finish system, the court surface shall be flooded with water and allowed to drain. Then, if remaining water in any area covers a five-cent piece, that area shall be patched and levelled in accordance with recommendations by the manufacturer of the colour finish system specified. (Note: If the standing water does not cover a five-cent piece, it is considered within tolerance and will evaporate within a reasonable time.) Reflooding and patching may be necessary until "bird baths" are minimized.

Filling: Once the proper grade is established, the next step is the application of filler or texture materials as recommended by the manufacturer of the colour finish system. This is to achieve a uniform texture without ridges on the entire court area, including patches applied above. Filler materials must cure to a uniform texture. They must be capable of application at variable thicknesses with minimum shrinkage.

Cushion Course: Some colour finish systems may, at option, include resilient layers. Proper installation according to manufacturer's recommendations of filler and cushion materials is of prime importance in obtaining a surface of uniform texture, desired resilience, and playing quality.

Application of Colour Finish System: The colour finish course shall be applied only after the



underlying courses are thoroughly cured. The colour finish materials shall be applied in multiple applications in the selected and approved colours as specified so as to form a uniform texture and colour when viewed from a distance of twenty-five feet(25') from any direction at mid-day. Application work shall be performed by skilled mechanics in a workmanlike manner in accordance with the manufacturer's standard printed instructions and warranties. No work shall be performed when rain is imminent or when the temperature is below safe limits as specified by manufacturer.

GENERAL MAINTENANCE

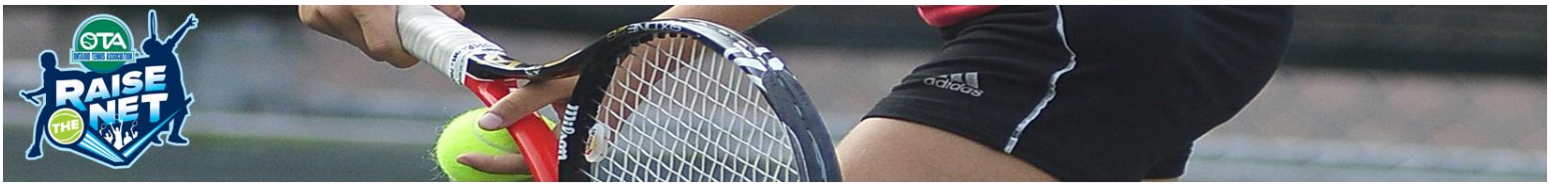
Outdoor Acrylic Surfaces

Outdoor acrylic surfaces are relatively easy to maintain due to natural cleaning by rains. Problems may develop due to lack of proper drainage or soil erosion. Surfaces may become coated with mud, dirt, pine needles and leaves as well as other foreign matter, which should be removed as necessary.

Suggested maintenance for outdoor acrylic surfaces is to keep the court clean at all times by occasional sweeping, in order that dirt and foreign particles do not get ground into the surface by foot traffic. Use of a soft nylon broom is preferable to a stiff bristle broom for sweeping. During the tennis season, the courts shall be hosed off with water periodically (once a month) and allowed to dry. Use normal water pressure for hosing (approx. 70lbs. per sq. inch or less). Should there be any stains on the court, they can be removed by an application of a mild cold-water detergent and scrubbing with a hair-type scrub brush. Should mold or mildew form on the courts in shady areas, an application of dilute strength household bleach (minimum two parts water to one part bleach) may be used to remove the fungus and retard its further growth. Where areas are treated, they should be rinsed off after a few minutes to remove the surface contamination. (Note: Fungus grows on surfaces contaminated by foodstuffs, soft drinks and decaying matter. Acrylic coatings do not support fungus growth.)

Indoor Acrylic Surfaces:

Indoor acrylic surfaces become significantly dirtier than do outdoor surfaces and, because of dust, tracking in of dirt, ball fuzz, and other extraneous materials, can become rather unsightly in a short period of time. Indoor clubs generally have a regular schedule of cleaning maintenance in which the courts are swept by vacuum or by rotary sweeper once a day, and cleaned either by water vacuum or self-contained water brush units approximately once a month. If they are not water-cleaned approximately once each month, dirty indoor courts may show the formation of mold or other fungus growths due to a combination of humidity and temperature along with contamination from perspiration, foodstuffs, soft drink spills and dirt tracking. Again, this fungus may be removed by the use for a bleach solution such as mentioned above (under Outdoor Acrylic Surfaces).



In using the water brush unit, detergent should not be mixed with the water, and the water should be clear, cool and free from contaminants. During the cleaning process, the water should be changed frequently. Again, as with outdoor courts, if the indoor courts are stained by foreign matter, such as soft drinks, food, grease or other materials, a mild cold-water detergent should be applied to the stained area and lightly scrubbed with a soft bristle brush.

The majority of colour surfacings are based on acrylic synthetic polymers. For synthetic surfaces other than acrylics, contact the manufacturer of specific maintenance instruction.

RESURFACING, REPAIRING, AND MAINTAINING NON-POROUS TENNIS COURTS

The repairing and/or resurfacing of non-porous tennis courts should be entrusted to an experienced tennis court contractor, since each court to be repaired and/or resurfaced will require one or more of several different processes, depending on the conditions of the existing surface and the quality of the surface desired after resurfacing is completed. Work operations need to be customized if existing deficiencies are to be corrected and the desired results for the repaired surface are to be achieved.

Repair Conditions

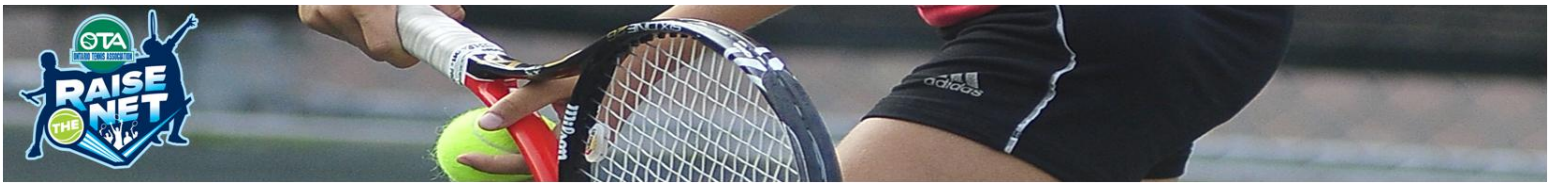
The following illustrations depict conditions that may occur either in the base construction or on the surface of an asphalt tennis court. The cracking pictured in this section may stem from construction or job site conditions such as improper slope of the court, inadequate drainage of the site, base movement, or poor compaction of the subgrade. Where any of these conditions are present, major reconstruction of the court may be required instead of repair.

A. Alligatoring

Alligator cracking most often occurs in the surface treatment applied over asphalt pavement. Its readily identified pattern of interconnected cracks will vary from a faint surface pattern to full-depth cracks and loose particles of the surfacing material.

B. Bird Baths

A bird bath is a minor depression on a non-porous tennis court surface in which water settles after a rain or flooding. An accepted industry method of determining a bird bath is to flood the courts and wait until surrounding areas have dried. Then, if remaining water covers the thickness of a five-cent piece, it can be considered a repairable bird bath. If the standing water does not cover a five-cent piece, it is considered within tolerance and will evaporate within a



reasonable period of time.

Possible Method of Repair: Multiple applications of surface coating materials may minimize or eliminate bird baths on a tennis court.

C. Blisters or Bubbles

Blisters or bubbles appear on the surface of an impervious court due to vapour trapped between the top of the asphalt or concrete and the bottom of the acrylic colour coats. This is caused by excessive moisture beneath the court being drawn toward the surface by the heat of the sun on a warm day. To address this condition, it is first necessary to intercept water from entering the court subbase. It is then advisable to allow the area to rest for several months to lower the moisture content of the subsoil.

Depending upon the severity and extent of bubbling and the existing drainage condition, the court surface can either be scraped of all loose, bubbled material and a new surface system applied or, if the old asphalt levelling course is cracked, a stress absorbing layer of crushed stone, approximately 3-4 inches in thickness should be applied over the entire surface and a new hot plant mix asphalt or concrete levelling course applied thereon followed by the application of a new coloured surface system. It may also be advisable to saw cut 1/4-1/2" wide expansion joints between courts and under the net. These cuts must be filled with a good quality joint sealing material that is compatible with the surface system.

Trees or buildings near the south side of tennis courts can cause that portion of the court that is usually in the shade to develop a mold. When this mold is damp, it is very slippery and very dangerous to the players. It is essential to apply a mild solution of detergent and scrub off the mold. Liquid chlorine in dilute solution will usually retard the formation of mold or fungus. However, care must be exercised not to bleach the court surface.

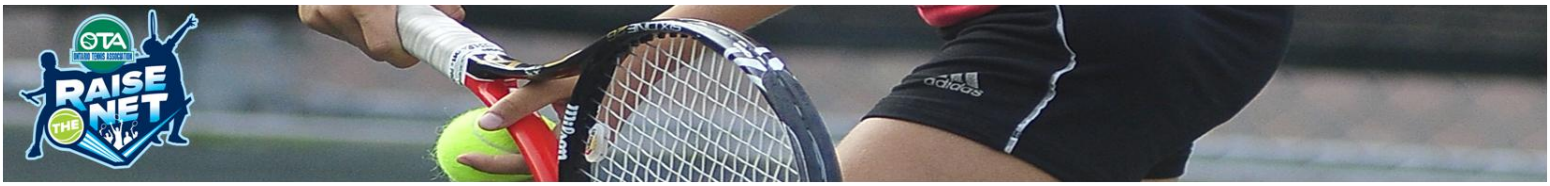
D. Hair-Line Cracks

Hair-line cracks are of variable lengths usually prevalent over entire areas, and may be caused by a variety of factors such as foreign matter (leaves, worms, clay), improper mix design, solvent-type coatings, and improper seal coats. They may develop into more significant types of cracks (i.e., alligatoring or structural) requiring more extensive maintenance.

Possible Method of Repair: Early repair with surface treatment coatings may remedy this condition.

E. Net Posts

Court repair problems as outlined above often involve net posts and net post footing failure.



Because the problems of net post failure vary significantly in degree, an experienced court contractor should be consulted to determine the proper course of action for repair. In northern climates, to reduce cracking around net posts, remove nets in cold weather.

F. Ravelling

Ravelling or spalling is the progressive loss of material on the surface of the asphalt, usually caused by oxidation of unprotected asphalt.

Possible Method of Repair: This condition may be corrected with the use of surface treatment coatings or an overlay of asphalt mix followed by surface treatment coatings, depending on the severity of the condition.

G. Reflection Cracks

Reflection cracks occur in asphalt overlays. These cracks reflect a crack pattern in the pavement structure below. Reflection cracks are caused by vertical or horizontal movements in the pavement beneath the overlay resulting from temperature fluctuations and/or earth movement. If reflection cracks occur in an asphalt overlay on a concrete slab, the cracks frequently follow the construction joints of the original slab.

Possible Method of Repair: The court must be redesigned and reconstructed.

H. Rust Spots

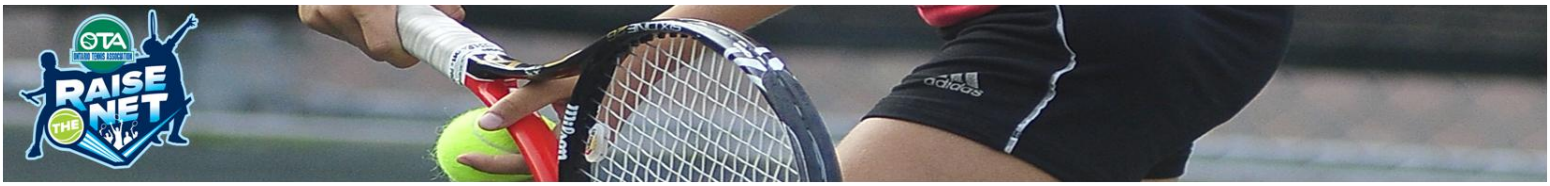
Rust spots occasionally occur on court surfaces resulting from iron oxide contaminated aggregate in hot plant mix asphalt levelling course. Spots become evident by rust spots on the court surface or trails of rust originating at the iron oxide and trailing toward the low side of the court.

Possible Method of Repair: Coatings have recently been developed which can be applied to court surfaces to resist the migration of the iron stains through the court surface system.

I. Shrinkage Cracks

Shrinkage cracks are a random pattern of interconnected cracks, usually forming irregular angles and sharp corners. Often, it is difficult to determine whether shrinkage cracks are caused by volume change in the asphalt mix, the base, or the subgrade.

Possible Method of Repair: Overlay with hot plant mix asphalt.



J. Structural Cracks

This condition is usually due to failure of the subgrade or improper mix design of the asphalt.

Possible Method of Repair: This condition can only be remedied by correcting the subgrade problem and/or rebuilding the court.

K. Surface Twist

After a new acrylic surface has been applied, the owner is very anxious to try it out. However, if it is warm, the acrylic coats may not be fully cured. As a result, the colour coats may get detached from the dark undercoats when some player stops quickly or twists his shoe. This is particularly true if the player has tennis shoes that have deeply grooved patterns on the soles. Players should be warned to exercise care when playing on a newly surfaced court.

L. Upheaval or Depression (Movement of Subgrade)

Upheavals or depressions are the localized displacements of pavement due to changes of the subgrade or some portion of the pavement structure. Upheavals are most commonly caused by frost expansion in the granular courses beneath the pavement or in the subgrade. Upheavals may also be caused by the swelling effect of moisture on expansive soils. This type of failure is usually due to improper drainage below and/or around the court area. Major depressions are often caused by decaying organic matter below the subgrade or improper compaction of the subgrade.

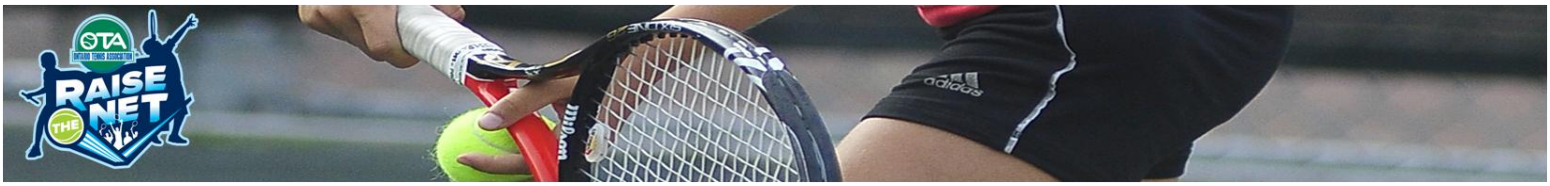
Possible Method of Repair: Reconstruction of the court is usually required to remedy this.

Repair Methods

A. Colour Finish Course Recoating

Recoating of the colour finish course should proceed after all repairs have been completed and all appurtenances such as net post sleeves, net anchors, fences and gates have been checked, and maintenance performed where needed. On tennis courts requiring only recoating, the following procedure should be followed:

Over the suitably prepared surface of the tennis court, apply one or more coats of material in accordance with the coating manufacturer's recommendations. Where possible, it is recommended that acrylic systems manufactured for tennis courts be used for resurfacing.



B. Fibreglass, Polyester or Jute Membrane Systems

These methods are designed to restore the surface of certain types of cracked courts and provide a smooth, dense, water-tight playing surface. There are several products on the market, and all should be installed according to manufacturer's specifications. These treatments are not intended to restore badly cracked or broken surfaces nor to permanently seal cracks subject to base movement.

C. Full Depth Repair

In any patching, the area requiring a patch should be cleared of all loose material, dust and dirt. Any defective materials should be removed to the full depth of the defect. If the defect is in the asphaltic courses but caused by a failure of the underlying base course, the defective base course material should also be removed. If it is necessary to replace base course material, it should be ascertained that the subgrade condition is as it should be prior to replacing any base course. If the subgrade requires attention, it should be brought up to specification requirements prior to patching any of the asphaltic courses which the base course supports.

A tack coat, in accordance with the manufacturer's specification, must be applied to the bottom and sides of the patch, and allowed to cure thoroughly.

D. Hot Asphalt Overlay Method

This is a method of placing one inch(1") or more of hot plant mix asphalt over an existing asphalt tennis court. The overlay method can be successfully performed over a court that has minor faults. The overlay method may not prevent the reappearance of major cracks in the overlay originating in the underlying structure.

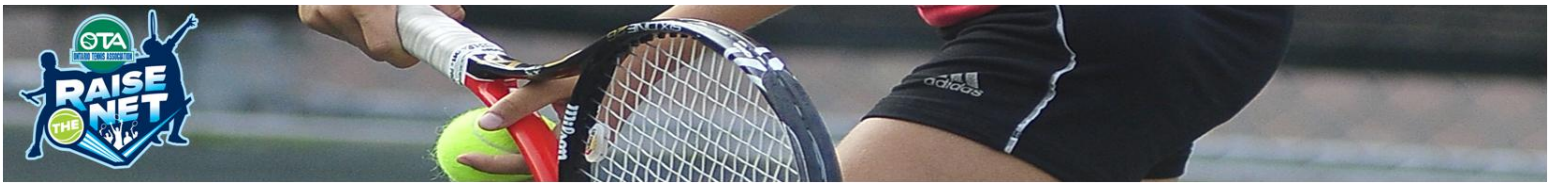
For adhesion of the overlay to the existing pavement, a tack coat of emulsified asphalt must be used.

If the defective material is old asphalt pavement, and the depth of the defective material and the subsequent repair will exceed 3/8", hot plant mix asphalt may be used. The compacted lift should be brought to the elevation of the surrounding sound surface.

E. Surface Repair

Bird Baths. Any areas holding enough water to cover a five-cent piece should be outlined with chalk, and the water removed. After the area is surface-dry, a tack coat of suitable material must be applied to the entire area within the chalk-line.

Estimate the required quantity of the thin patching mixture required to fill such bird baths.



Apply it to the area to be patched and strike off with a straightedge. A proper strike-off will level off such a bird bath to the same elevation as the surrounding surface. After the levelling operation, the patch should be allowed to thoroughly cure before proceeding with successive work operations.

There are various emulsified asphalt and acrylic materials to accomplish the above patching methods. They should be used in accordance with the manufacturer's specifications and recommendations.

F. Resurfacing

Asphalt pavement with acrylic surface coatings, by far the most prevalent type of construction, require resurfacing periodically. This resurfacing can range from a simple new colour finish system to full asphalt overlay(s).

G. Colour Finish System

The application of a new multiple coat acrylic finish system (in accordance with manufacturer's directions) is recommended over a surface which is essentially sound but showing loss of colour and texture. Prior to application of the colour system, "bird-baths" should be corrected by using the material and following the instructions of the manufacturer selected to furnish the acrylic finish. This material is generally applied by squeegee and is intended to blend any patching with surrounding areas to a uniform texture.

H. Complete Overlay

The application of a complete in-depth hot or cold asphalt overlay(s) is dictated over surfaces that are badly oxidized or aged. In addition, an overlay is recommended to improve poor planarity and/or surface drainage. Factors that should be considered in determining the depth of the overlay(s) are how poorly the base was constructed and/or drastic variations from a true plane.