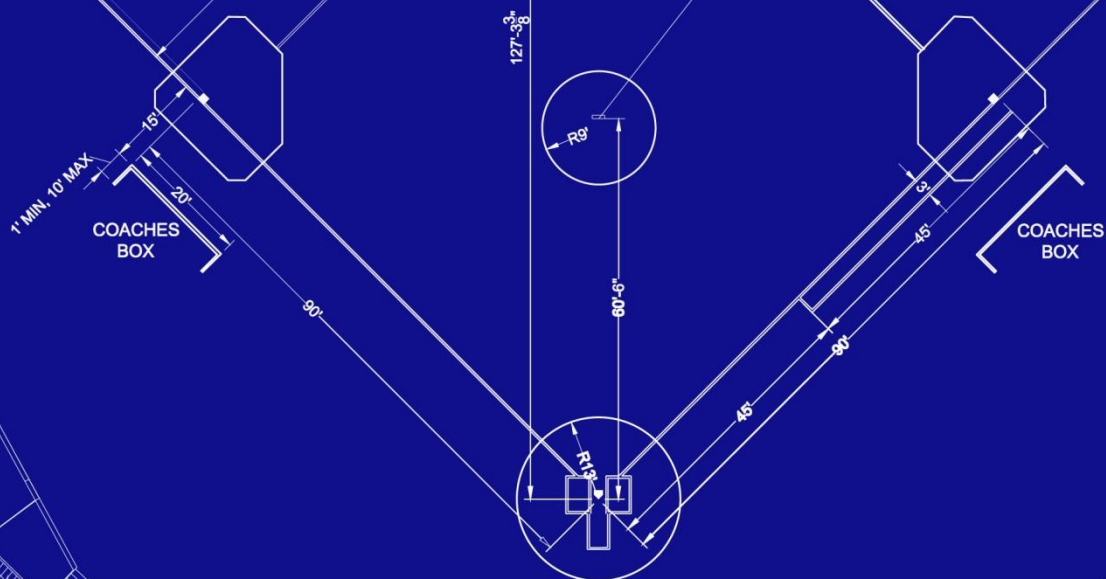


GRASS LINE



TORONTO BLUE JAYS FIELD MEASUREMENTS

TORONTO BLUE JAYS FIELD OPERATIONS DEPARTMENT
FIELD MAINTENANCE GUIDE

Prepared by: Thomas Farrell

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Revised 2017

Preface

Please allow me the opportunity to introduce myself; my name is Tom Farrell and I have been part of the Blue Jays Organisation since 1987. My first experience with field maintenance came in 1989 when I became part of the “World’s Fastest Grounds Crew”. It was while working under then Head Groundskeeper Brad Bujold that I started to learn what was involved in maintaining a baseball field. In 1993, after receiving the terrible news that Brad was diagnosed with Cancer, I was asked if I could temporarily supervise the Grounds Crew. Sadly after a strong battle, Brad succumbed to the disease in March of 1994. In 1997, with mixed emotions I accepted the position of Head Groundskeeper, a role that I continued to do until October 2017 when I was promoted to Director, Field Operations.

Being part of the Toronto Blue Jays Organization has been, and continues to be a great experience. I have had the opportunity to witness some significant moments in the club’s history. In 1989 I got to enjoy the thrill and challenges of moving from Exhibition Stadium to the Jays current home, now known as Rogers Centre. In 1991, I got to prep the field for an All-Star game; with a particular highlight being when the Grounds Crew came out on the field in a limousine at the end of the 5th Inning to clean the field. During the 1993 World Series I was kneeling on the field next to our auxiliary photo dugout when Joe Carter hit the Series winning home run. There was also the epic home run hit by Jose Bautista during game 5 of the American League Division Series followed by the bat flip that cemented the moment in Blue Jays, and Canadian Baseball history.

I have seen the surface of Rogers Centre go from the unforgiving artificial surface of the past to the modern, more player friendly infill Astroturf system we currently use, and the infield go from individual base pits, to an all dirt infield skin. It has been a pleasure and an honour to work on the field that has been used by such greats as Roberto Alomar, Roy Halladay, Carlos Delgado, Kevin Pillar, and Troy Tulowitzki to name a few.

Contained within this guide is information that I have gained about maintaining a baseball field. Although most of my knowledge comes from working on an artificial surface, a lot of what we do here at Rogers Centre can be transferred to a Natural Grass field. The techniques used for maintaining grass is very similar across most sports fields however, baseball has the unique challenges of maintaining dirt areas that require precise measurements and require a unique set of skills.

This guide does not cover all scenarios or situations, all baseball fields are different and may require unique solutions to problems encountered at specific parks. This guide should provide a good starting point to understanding what is required to maintain a ball field.

WHAT IS A FIELD OPERATIONS TECHNICIAN?

The primary role of the Field Operations Staff is the preparation and maintenance of the baseball field to ensure it is safe for play and meets “League” rules, recommendations and standards.

Responsibilities include but are not restricted to:

- Set up and maintenance of the baseball field.
- Set up and maintenance of the batting tunnel
- Set-up of the field for batting practice
- Set up of the field for games
- Set-up of the field for ceremonies or special events
- Ordering and maintaining supplies
- General upkeep of all tools and equipment
- General upkeep of storage and/or maintenance areas
- Ensuring the field and immediate areas are safe for workers, players, and fans
- Documenting and reporting any concerns or incidents, both major and minor
- Preparation of the field for the off season

GENERAL INFORMATION

Field Operations Staff can expect to be a Jack of all trades including; landscaper, painter, mechanic, and carpenter. You can go from doing an oil change and replacing spark plugs on a small engine to constructing a line box or sifter. It is beneficial to gather as much general maintenance and repair knowledge as possible because you never know when it will come in use.

In years past Field Operations Staff had to modify or manufacture some of the equipment they used, but now thanks to a vast network of suppliers who carry equipment specifically designed for the care and maintenance of baseball fields you can order items like a nail drag on-line instead of having to build one out of 2”x4”s and nails.

Use the internet; a simple search of “baseball clay products” will bring up a number of sites you can access that will help you to find what you need in order to get the job done.

TOOLS OF THE TRADE

There are many tools required to properly care for and maintain a baseball field, some familiar and some specialized. Below is a list of common tools used for the general maintenance and repair of a baseball field. The type and brand used will depend on individual’s preference and budget. Remember, inexpensive tools are cost effective in the beginning, but could cost you in the long run because they are more easily broken and a poor tool can negatively affect the quality of your work.

| Tools and equipment | Use |
|--|---|
| 200' Steel tape measure | Measuring distance to base and mound. Steel tape measures are required under MLB Official Baseball Rules. The reason they are required is because they don't stretch like a vinyl tape can. |
| 25' steel tape measure | Measuring mound slope and table |
| Mason's line, | Bright thin string, with little stretch. Used for measuring pitching rubber height and for aligning bases |
| Self-leveling laser level | For measuring height of pitching rubber, there are many types of lasers that can be used but ones with the self-leveling feature are the best During install of pitch rubbers you have to move and replace the laser a number of times until the rubber is set, having the self-level feature saves time. |
| Alternative to above. Line level (bubble level), | Used with mason's line for measuring mound height/slope |
| Torpedo Level | Leveling home plate and pitching rubbers |
| Large carpenters square | Squaring pitch rubbers |
| Level head rakes | Steel, 15 inch rake with flat edge on back which can be used as a scraping tool as well as a rake. Rakes with steel wire frame do not work as well. Trick of the trade (use an angle or bench grinder to sharpen the teeth of the rake, this makes it much easier for the rake to cut into the firm clay). |
| Beet Hoe | Hoe with thin sharp blade, used to scrape slope on mound, helpful for shaping slope. |
| Landscape rakes | Large, aluminum rake used for spreading top dressing and for leveling |
| Shovels | Steel coal shovel, large scoop makes it easier to move large amounts of material. |
| Small square spade | Used for digging out small areas, edging, scraping |
| Loopers (Custom made) | Wood leveling board |
| Steel Drag Mat | Used on artificial surface to level infill. Used on all dirt infield to level top dressing and remove debris. Can be pulled by hand or by utility cart. |
| Push brooms Large | 24" Coarse, for moving top dressing |
| Push brooms small | 14" Coarse, for cleaning out repair holes |
| Push broom large | 24" Soft, used for smoothing top dressing |
| Hand Tampers | Metal base, wood handle is personal preference. Wood handles help absorb impact if the tampers hits surface at an odd angle, lessening the impact on the users wrist and forearms. All steel tampers last a long time, but if they strike the ground at an odd angle the impact on the user is greater. There are some new tampers that have a removable handle with a rubber gasket at the connection point. These types of tampers are expensive but thanks to the rubber insert they do help reduce felt impact if you strike an uneven surface. |
| Power tampers/Vibratory plates | Are great for compacting large surface areas, i.e. entire slope of the mound. |
| Scuffle hoe | Steel loop, to maintain edge where grass meets infield material, or warning track |

| | |
|---|--|
| Power edger | Used to edge where grass meets infield or warning track material. Maintaining a good edge helps to reduce build up which creates a lip |
| Hose (must reach all dirt areas) | Important to keep dirt areas moist, or they will become too hard, dusty, difficult to work with and unsafe for players. |
| Watering cans | Used for watering holes before repairing wear spots. |
| Buckets | Rubbermaid, 10 gal. Brute containers with lids are preferred. Great for storing clay mixes, top dressing, line chalk. |
| Pitching rubbers | 4 sided rubber blocks, 24" x 6" preferred |
| Home plates | Metal backing, steel peg or bolt style |
| Pro Bases – Set of 3, with base sleeves | Jack Corbet Hollywood Bases with steel pegs |
| Base anchors, set of 3 | Used to secure bases. Make a square concrete form 10" x 10" x 4" Deep, set steel sleeves in the centre of the form, fill with concrete and allow to set. Used to secure bases. |
| Base plugs – Set of 3 | Used to plug holes in base anchors and prevent them from filling up with dirt |
| Base digout tool | Used to scoop out dirt from base anchors. |
| Base Cleaner | Used to clean bases, rubbers, plate. Degreaser agent, Pro Sprint works great. |
| Scrub brush | Used to scrub bases, pitching rubber, home plate clean |
| Rags (Clean, sturdy) | For cleaning pitch rubbers and plates |
| Bags line chalk | Used to mark lines |
| Batter's box template | Used to mark batter's box |
| Cather's box template | Used to mark catcher's box |
| Line template | Used to mark base lines |
| Hitting mat home plate | Used to protect batter's box during BP |
| Chalk liner , or painter | Used to mark field |
| Dirt sifter (Custom made) | Used to screen rocks and debris from field material. Constructed using plywood and steel wire mesh, with ¼" Holes. |
| Tarpaulin "Tarps" | They come in a variety of weights to meet different budgets. 18oz vinyl works best. Used to cover dirt areas for moisture management, keeps water you don't want out, and moisture you do want in. |

LAYOUT OF THE BALL FIELD

Layout and dimensions of the field will depend on the age of the players using it. For the purpose of this guide we will be looking at laying out a field according to the rules that govern Major League Baseball fields.

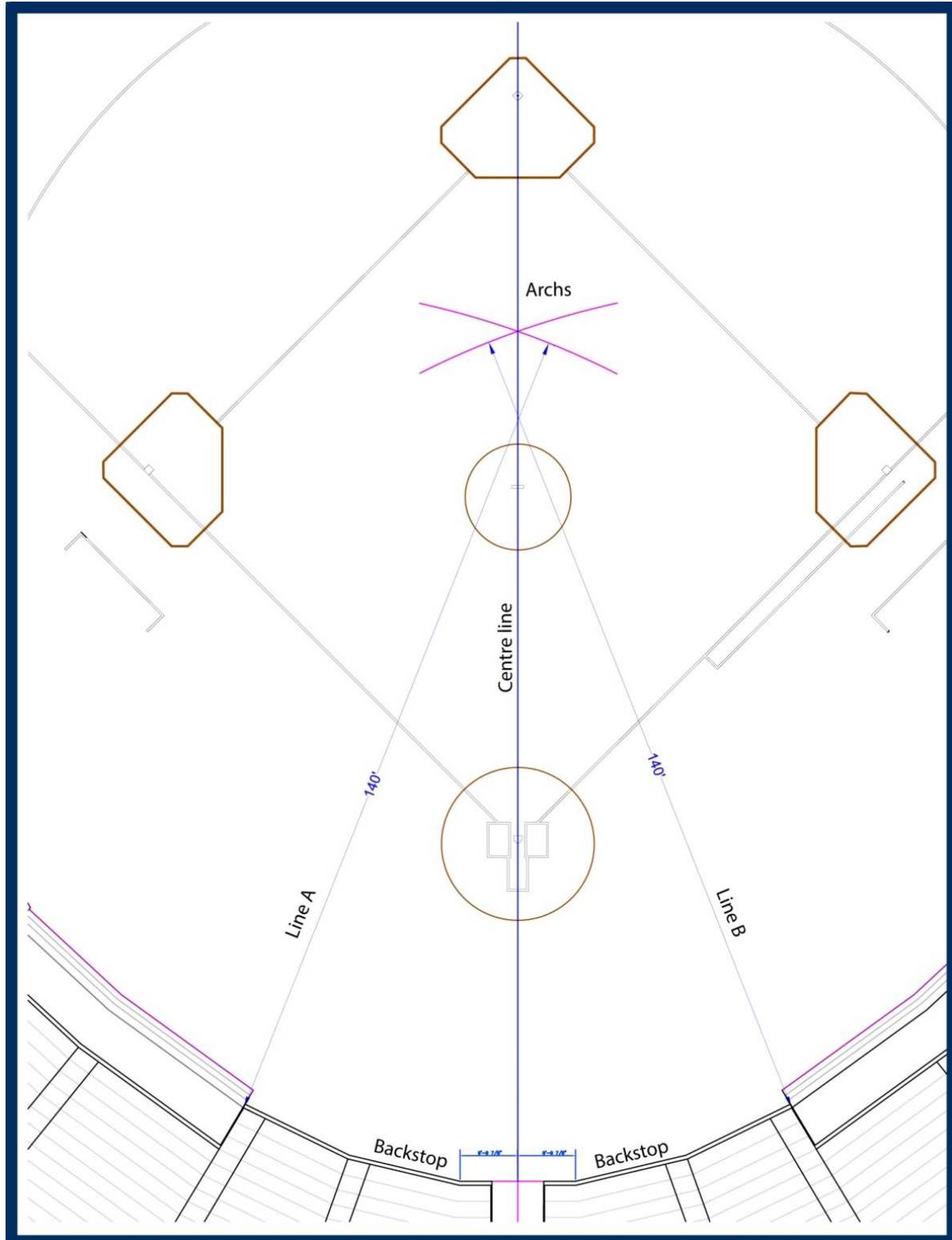
If conditions allow, a baseball field should be constructed with a line that goes from the apex (back point) of home base (home plate) through the center of the mound and 2nd base in an East-Northeast direction. The reason for this is to ensure that the path of the sun as it crosses the sky during the day has as little impact on the batter and position players as possible. Imagine a field constructed with a line intersecting home plate, the mound and second base in an East to West direction; the pitcher and fielders would have the sun in their eyes during the morning and the batter, catcher and umpire would have the sun in their eyes all afternoon. This makes for a dangerous situation because it negatively affects that players ability to see the ball.

All field measurements are based off of home plate so it is important to establish the location of home plate before doing any other measurements. Don't assume because you are working on an established field that home plate is in the correct location. Over the years of plates being replaced it is common for them to be accidentally moved and no longer in the position it was when originally installed.

Establishing exact location for home plate:

1. Assuming the back stop is centred and square with the field as it should be; find the centre of the back stop and mark it with a stake.
2. Now find 2 spots on the back stop, one to the left of the centre mark (A) and one an equal distance to the right of the centre mark (B) and drive stakes.
3. With a steel tape measure starting at mark (A) run a straight line out to an area between the mound and 2nd base then draw an arch on the grass using water based paint or marking chalk. Remember the distance you use (i.e. 140') because you will need to know it for the next step.
4. Starting at mark (B) and using the same measurement used at (A) run a line out to the area between the mound and second base then mark another arch. Where the 2 arches intersect mark with a stake.
5. Now run a line from the centre mark at the back stop out to the stake where the arches intersect; this will establish the centre line for the field.
6. From the centre mark at the back stop measure along the centre line to establish where the apex (back point) of home plate will be and drive a stake. The distance between the back stop and the back of home plate will be somewhat determined by the existing conditions of the field; not all parks will allow for the desired distance of 25' minimum up to 60'.
7. Now you are ready to set home plate. Using a carpenter's square and pencil, mark a centre line on home plate that intersects the apex.
8. Temporarily move your centre line to one side so that you can dig a hole in front of the stake where you marked the location for the apex of home plate. The hole should be wide and deep enough to accommodate the plate and anchor.
9. Place the plate in the hole, make sure the Apex of the plate is located at the stake, and then move the centre line back into position. Position the plate so that the centre line intersects the centre line you marked on the actual plate.
10. Use a torpedo level to check that the plate is level in all directions. Next, using a large level to make sure that the plate is level with the surrounding ground. Depending on the drainage conditions of your field you may want to have a slight crown at home plate. This means you will build home plate approximately 1" higher than the surrounding areas gradually sloping the dirt away from the plate to the back stop and

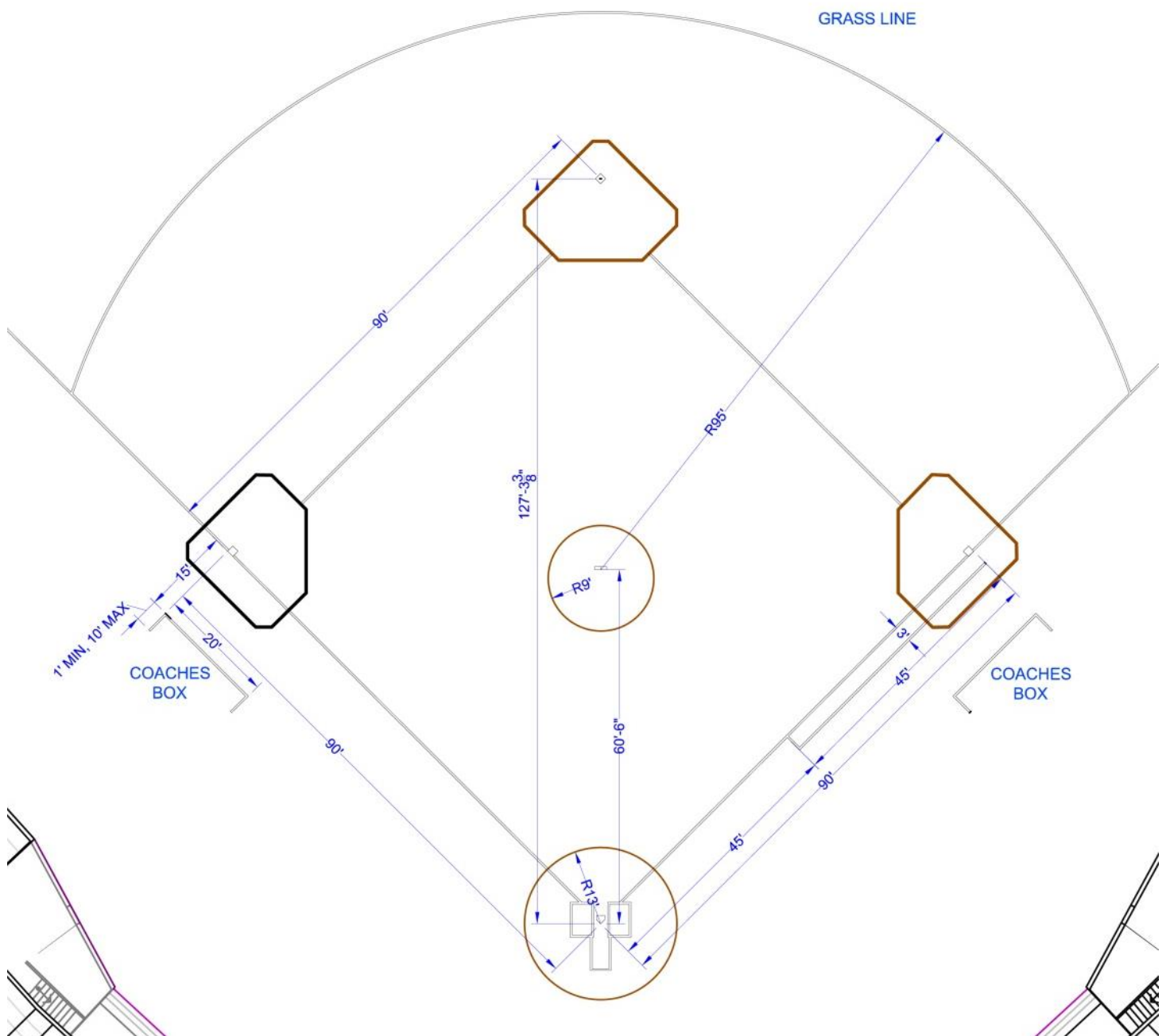
- out of play. This helps to direct rain water away from the batter's box.
11. Once the plate is established carefully pack clay around it making sure it doesn't move when tamping.
 12. Complete a final check to make sure the plate is still centred and level. If anything moved you will need to adjust the plate to the correct position.



Establishing the location of the bases

1. Using a 200' steel tape, from the apex of home plate measure toward second base, and making sure you keep on the centre line drive a stake at $127' 3 \frac{3}{8}"$
2. For the next steps you will need 2 steel tape measures at least 100' long. Using the first tape measure start at the stake located at 2nd base and measure 90' toward 1st base, using the second tape measure 90' from the apex of home plate toward 1st base. Where the two tapes intersect at 90' mark the location with a stake. This will establish the outfield/foul side corner of 1st base.
3. Repeat the above process to establish 3rd base.

NOTE: When done correctly you will notice that the stakes mark the centre of the bag at second base, but it marks the outfield / foul side corner of third base and 1st base. So, if you were to draw a square from home plate, to 1st base, 2nd base, 3rd base, and back to home you will see that home plate, 1st base and 3rd base fall completely inside that square, but 2nd base falls inside and outside of that square.



Establishing the location of the foul poles

To determine the foul poles you will need to recall your grade school math, in particular Pythagorean Theorem $a^2+b^2=c^2$ which you will use to calculate the location for the foul poles.

1. Determine the distance you would like the foul pole to extend past 3rd base (e.g. 238')
2. Now using the formula above and the information we now know you can calculate the distance required in order to triangulate the location of the foul poles.

$a=238'$ (Desired distance to foul pole from 3rd base)

$b=90'$ (Distance from 3rd base to 2nd base)

$c=$ Unknown (Distance from 2nd base to left field foul pole).

$$= a^2+b^2=c^2$$

$$= 238'^2 + 90'^2 = c'^2$$

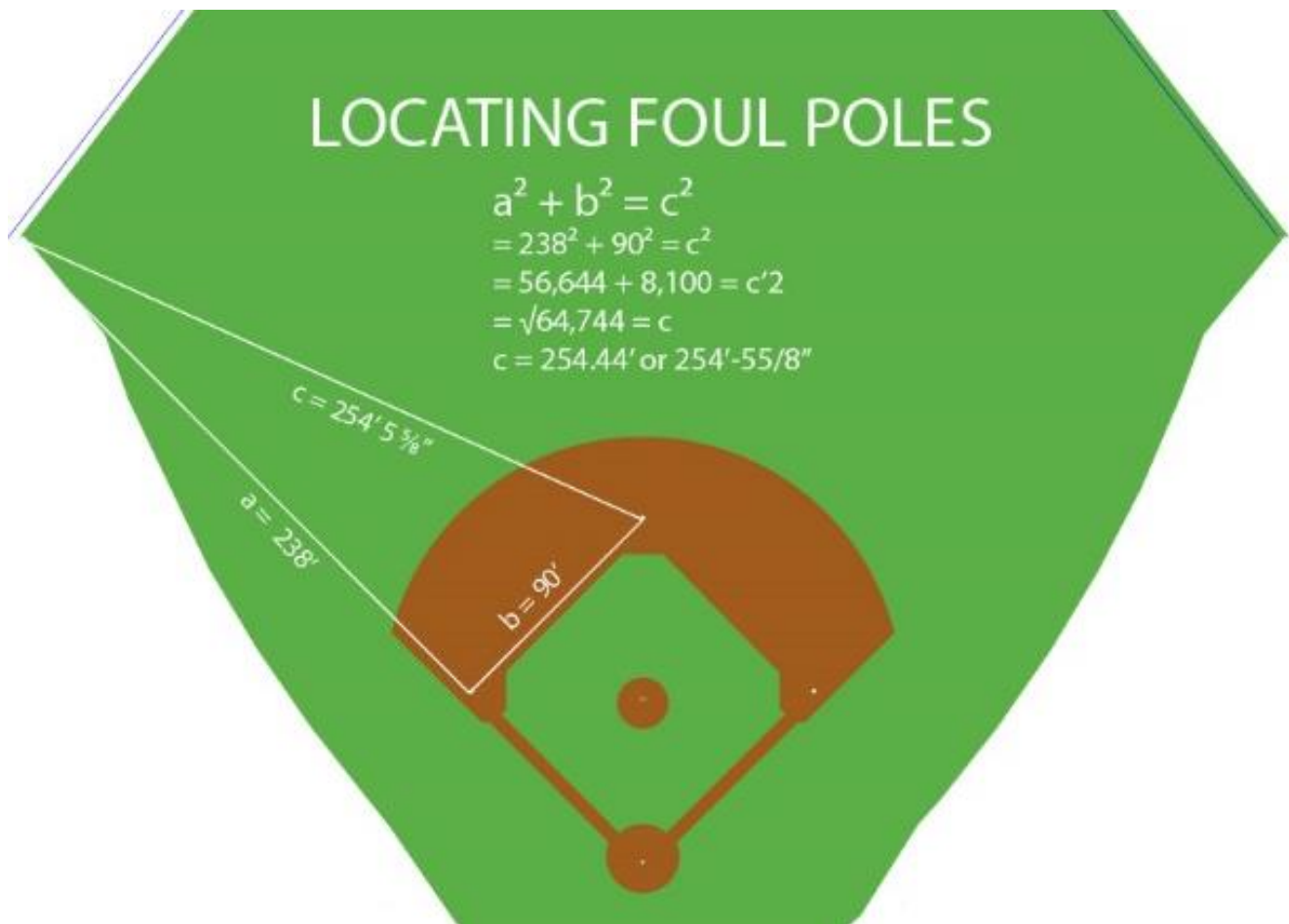
$$= 56,644' + 8,100' = c'^2$$

$$= \sqrt{64,744} = c$$

$$= 254.44' \text{ or } 254'-5\frac{5}{8}"$$

Now we know all the distances required for marking the locations for the foul poles.

3. Starting from the stake marking 3rd base run a measuring tape 238' towards the left field corner, run a second tape measure from the stake placed to mark 2nd base out towards the left field corner.
4. Pull both tapes tight and adjust until the 238' distance on the 3rd base tape intersects with the 2nd base tape at 254'-5⁵/₈" then mark with a stake. This will be the location for the foul pole.
5. Repeat this step to determine the location of the right field foul pole.



Establishing the pitching mound and rubber

1. Using a steel tape, measure 60'6 inches toward 2nd base and install a stake being sure to keep the stake on the centre line that you established earlier.
2. Using a steel tape, measure 18" from the stake towards home plate, keeping on the centre line drive a stake. This will mark the centre of the pitching mound.
3. From the stake at centre of the mound measure out 9' to establish the radius of the mound. Using chalk or water based paint carefully draw out a 9' radius around the stake located at the centre of the mound.
4. Using a hand or power edger cut out the marked area to establish the perimeter of the mound, level and compact the area inside the circle you just created.
5. Set up a self levelling laser level behind the mound with the laser pointing towards home plate. Set the level so that it is 11" above the surface of the home plate.
6. Start adding some clay material slowly building up the areas at the back of the mound, approximately 15" behind the centre stake. Build up the area making sure you compact each layer well until the area measures 5" on the laser level.
7. Now you can start to establish the location where the pitching rubber will be installed. Begin by marking a line in the centre of the pitching rubber using carpenters square and pencil.
8. Now place the pitching rubber on the north side of the stake that marks 60'6". While making sure the leading edge of the rubber is at the 60'6" mark, also make sure you line the centre mark you drew on the rubber with the line that marks the centre of the field.
9. You can verify that the rubber is square with the plate by taking a measurement from the front right corner of home plate, to the front leading edge of the mound, then repeat on the left side and if the two numbers are the same then you know the rubber is square to the plate. Adjust accordingly until the pitch rubber is square.
10. Now check for height of the rubber which must be 10" above home plate. Using the laser level that you set up earlier check the height of the pitching rubber. Placing your tape measure on the top surface of the rubber measuring where the laser hits the tape. It should read 1" because you set up the level so that it would read 11" off the surface of the plate. If you get a reading of 1" great, that means your pitching rubber is at the correct height and if you get any other reading carefully lift the rubber and add or remove material until it is at the desired height.
11. During this process you are also going to use a small torpedo level to ensure that the pitching rubber is level, both right to left and front to back.
12. If you don't have the budget for a laser level, don't worry you can go old school and use a mason's line and line level.
13. Use a wood dowel (old shove handle or broom handle works), cut one end of the dowel square; this will be the bottom. Now measure from the bottom of the dowel up 10" and make a mark, it's best if you can cut a groove at the location of the mark so that the mason's line will sit in the groove and not move.
14. You will need 3 people for the next steps. Tie the line around the dowel where you made the mark and then have someone hold the squared end onto the surface of home plate; they will need to hold it with force so that it does not move.
15. Now have another person pull the mason's line tight to the pitching rubber placing it so it lays flat on the surface of the rubber. The third person will hook the line level on the string and check the bubble for level. If the bubble is too close to the mound then you need to lower the rubber, if it is too close to home plate then you will have to raise the pitching rubber. To adjust remove the rubber, add or remove material below it and repeat the steps above until you get the measurements you want.

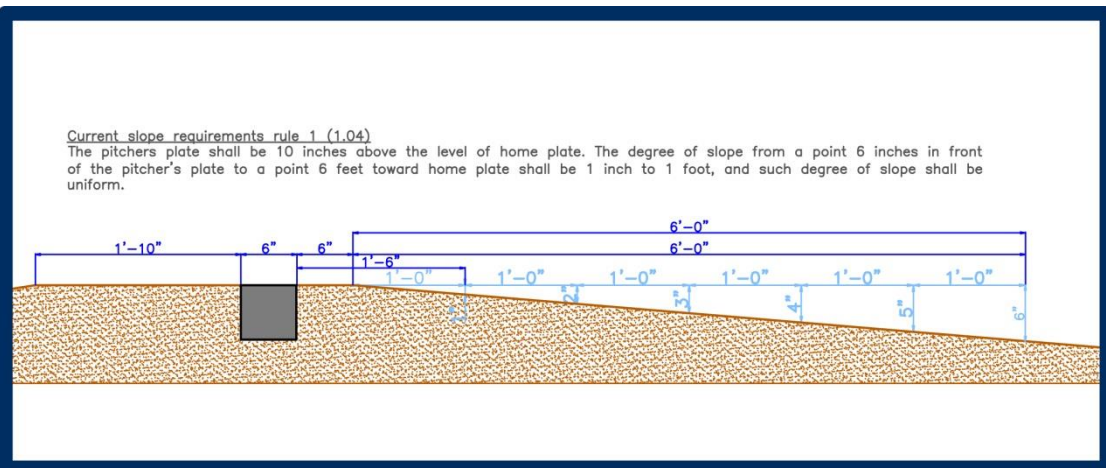
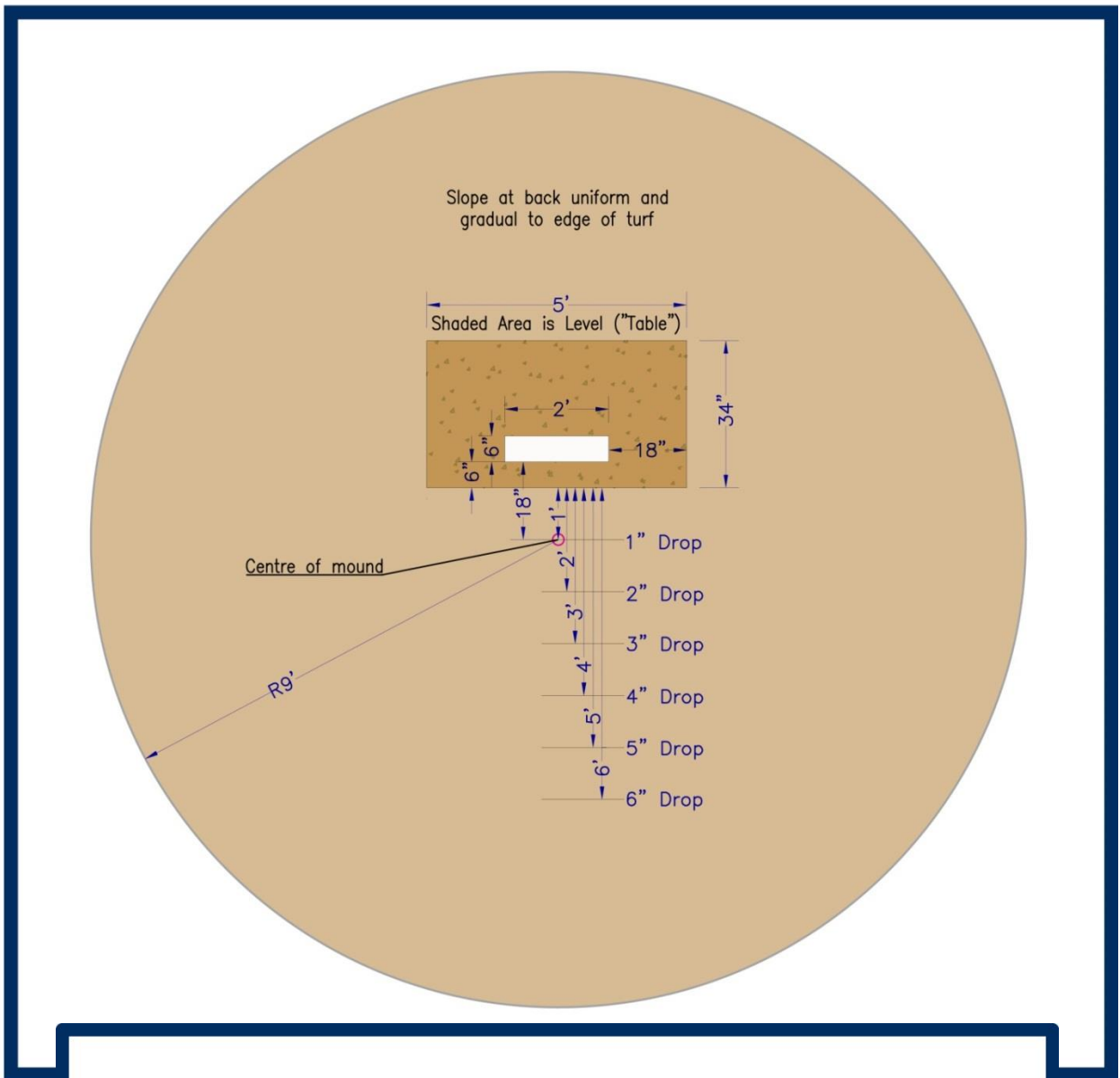
16. Once the rubber is exactly where it needs to be, carefully pack clay around it; slowly building up the clay until the rubber is secure. It is very easy to knock it out of position so use care during this process.
17. At this point you will want to start to establish the level surface around the pitching rubber also known as the table. Gradually pack clay around the pitching rubber building up surface that is 22" behind the back edge of the rubber, 18" on either side of the rubber and 6" in front of the rubber. At this point the measurements do not need to be accurate you are just starting to build up the area around the rubber so you can start to create the slope.

Building the slope

Keeping the degree of slope on the mound accurate is important because if the slope is too steep the pitcher can have an advantage over the batter, and if it is too shallow the advantage will go to the batter. The most important part is keeping the slope consistent. Pitching is about power and precision and it is important for the pitcher to find the release point that works best for that individual. It becomes difficult for a pitcher to find and develop the ideal release point if they have to make adjustments to compensate for mounds with different degrees of slope.

1. Now that your pitching rubber is set to the correct height you can move your self levelling laser level to the surface of the pitching rubber. Once the level is set you will need to take a reading to determine the height of the laser above the surface of the rubber. This height will vary depending on the model of laser you are using. The reading you will take here must be added to the measurements you take when measuring for your slope.
 - a. Example: You get a reading that shows the laser level is $2\frac{1}{4}$ " above the surface of the pitching rubber. Your first measurement where you want a drop in slope of 1" you will want to see a measurement of $3\frac{1}{4}$ " to compensate for the $2\frac{1}{4}$ " that the laser is above grade.
2. Plot out on the mound where you are going to take your readings. Measure 6" from the front of the pitching rubber and make a mark. Move the tape measure to this mark and measure 6 feet towards home plate making a clear mark at 1 foot intervals up to 6 feet.
3. Using a stiff steel tape measure holding it vertical from the surface of the mound you will want to get the following measurements (See Diagram No. 3)
 - a. @ 6" – Level
 - b. @ 1' – 1" Drop ($3\frac{1}{4}$ " with compensation for laser level)
 - c. @ 2' – 2" Drop ($4\frac{1}{4}$ " with compensation)
 - d. @ 3' – 3" Drop ($5\frac{1}{4}$ " with compensation)
 - e. @ 4' – 4" Drop ($6\frac{1}{4}$ " with compensation)
 - f. @ 5' – 5" Drop ($7\frac{1}{4}$ " with compensation)
 - g. @ 6' – 6" Drop ($8\frac{1}{4}$ " with compensation)
4. If you get a measurement that is lower than required (i.e. 4" at the 3' mark) then you will need to add material. If you get a measurement lower than required (i.e. $2\frac{1}{2}$ " at 3') then you will need to remove material.
5. Keep repeating the above process of removing or adding material until you have a uniform slope from rubber to edge of turf making, ensuring the slope meets all measurements.
6. Once again, if you don't have the budget for a laser level you can do this same process using a string and line level. The results will be the same, the only drawbacks being that you will need 3 people to complete the task and it is more time consuming

Diagram of the mound



BASEBALL DIRT

The modern Groundskeeper has an advantage over their predecessors because in today's market there are many different clay products and brands available for use in the construction and maintenance of a baseball field. The product used will depend on preference, area being serviced and budget. It is important to select the correct type of material for the part of the field being maintained.

Below is a list of the various dirt areas and what should be considered when selecting material for use in the each location.

PITCHERS MOUNDS

The mound is the most heavily used area of the baseball field and because of this it needs to stand up to a lot of wear and tear. For this reason it is a critical that you select a product that will hold up to nine, or more innings of intense impact in order to provide the pitcher with a firm footing throughout the game.

The mounds should be constructed using a material with high clay content. The clay provides compaction and stability to hold up to the continuous wear caused by the pitcher. A properly constructed mound with the correct material can last an entire game with minimal holes.

Using a product with a higher clay content has its own challenges, the greater concentration of clay the more difficult the product is to work with; it is harder to mix and harder to rake down and it can become very slick if too wet. In order to make maintenance of the mound easier and quicker it is best to use 2 different types of clay product at this location. The majority of the mound should be constructed of a clay product that contains a greater amount of sand; which makes repairs and maintenance easier. In order to improve mound performance it is best to use a clay product that contains less sand, such as "Blue Gumbo", this would be used in the critical areas located in front of the pitching rubber and in the landing area. This product when mixed and installed properly is very gummy, and resists being dug out by pitchers during games.

BASE AREAS

Whether the fields you are working on consists of base cutouts or a full dirt infield the base areas should be constructed with a material that has a high content of sand approximately 60% and lower amount of Clay 20% and silt 20%.

Sand based fields are easier to repair and maintain and most importantly sand based fields will allow water to percolate much easier and faster, reducing the instances of standing water. Keep in mind, some clay content is required because it binds the field and allows for a firm footing. If you have too much sand in your field composition it will be too loose which could result in players losing their footing while rounding bases.

HOME PLATE

At home plate, similar to the mound you have 2 areas that you should treat differently, the area that makes up the bulk of the playing area you want to be constructed of a high sand product similar to the base areas, and in the areas where the batters stand you want to use a product with a high clay content.

MAKING THE MIX (preparing clay products to be used to repair holes)

As with many jobs advanced preparation makes the difference between an ok finished product and a 'great' finished product. For best results you should prepare your clay products in advance so that they are ready to go when needed. Rarely can you use clay products directly from the bag, most of the time you will need to complete the following steps to

prepare the clay so that you have a good “mix” (the correct ratio of material and water).

One of the most difficult products we work with is the “Grey” or “Blue Gumbo” clay, because it comes in 50lb bags, it is typically dry and in golf ball size pieces. You want your finished product to be moist and approximately the size of large raisins. Below is a step by step process for making a quality mix.

Step by Step: 1

1. Prepare a space for making your mix. This can be a smooth concrete surface, a sheet of plywood or a concrete mixing trough.
2. Make sure the surface is free of foreign material
3. Open the bag and dump it onto the surface
4. Using a small steel rake sift out the larger material from the smaller finer material, push fine material off to the side.
5. There are two options depending on condition of the material
 - a. First condition, the material is dry. If this is the case then you can use a hand tamper to pound the dirt and break it up into smaller pieces, sometimes even into a powder. As you break the material frequently stop and sift out the clumps, pushing the finer material to the side. Then continue breaking down the larger material.
 - b. Second condition, the material is moist. If this is the case then you can use a straight edge shovel to chop the larger pieces into smaller usable pieces of clay. Similar to the step above; using a steel rake, sift out the larger material, pushing the finer material to the side. Then continue until you have one full pile of fine material.
6. Push all the fine material to the top corner of your mixing board, using a water hose on mist or flat setting lightly wet the mixing area. Now using a steel rake pull the dry material over the damp spot spreading it out into a thin even layer (approximately ½” deep).
7. Using a fan or mist setting on the hose lightly spray the surface of the clay and let stand for a minute.
8. Then using the rake, gently rake through the material mixing the moist surface layer with the dryer layers below.
9. Repeat, spreading out material to a thin layer, lightly water, and then using a steel rake gently mix through.
10. After you have raked it through a couple times use a shovel to turn over the mix which helps get the dry clay that settles to the bottom brought to the top
11. After you have done this a couple times use the steel rake to sift through the pile pulling the moist clay to one side, leaving behind the finer dry material. You know the clay is mixed properly when you can squeeze a handful of material into a clump but when you push your thumb through it the clump easily breaks apart.
12. Move the good mix that you separated into a bucket and continue the process until the entire pile is mixed through.
13. After all the mix is in the bucket; cover it with an empty clay bag making sure the plastic contacts the clay, and then put the lid on the bucket.
14. For best results make your mix at least one day before it is needed. This allows time for the moisture to evenly absorb into all the material. Having pockets of dry material in the clay will make for bad repairs.



The steps listed above can be used for most materials. Products with a high sand content are much easier to mix, most of the time they can be used straight from the bag.

USING THE MIX FOR REPAIRS OR CONSTRUCTION

You have a quality mix ready to go; now you need to prepare your surface for repairs. Below are step by step instructions to ensure you produce a quality repair.

1. Start by lightly raking the surface that you need to repair to loosen up the top layer and knock down any built up or high spots.
2. Next, sweep off all loose material making sure to expose more than just the hole that is being repaired. Push the top dressing approximately 2 feet away from the edge of the hole and when possible expose the entire area (i.e. clear batter's box, both left and right side. On the mound clear the entire slope and table).
3. Next, lightly water the area where the clay is to be added. This is best done with a hose on mist setting, or a squirt bottle spray setting; you can use a watering can if that is all that is available. You want to control how much water you add, sweeping out any puddles left behind.
 - a. NOTE: Clay will not stick to a dry surface, and if the surface is too wet the clay will become muddy and not set.
4. Add mix to the deepest part of the hole first, initially pushing the material in with the heel of your foot. You can also use a sledge hammer to assist with this step.
5. Keep adding layers following the above steps until you are level with the surface you are repairing. Finish by pounding in clay with a hand tamper.
6. For best results fill the centre of the repair above the surface area being repaired, packing in the mix as tight as possible. Then rake the material back down to meet the surface area. This ensures you have a tight repair improving the durability.



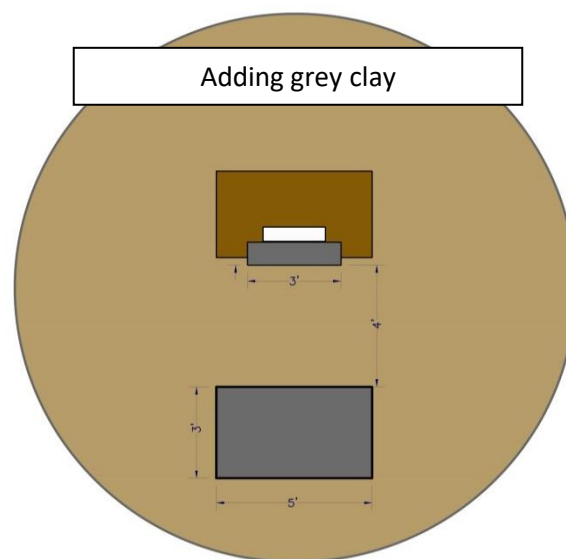
Improving Mound Performance

There are two main areas of the pitching mound that receives the most abuse; in front of the pitching rubber and where the pitchers lead foot lands. To improve the wear characteristics of the mound you should replace the material in these areas with a product that has a greater amount of clay content e.g. Grey Clay.

Assuming that the bulk of the mound is made of a good wear resistant material you can get away with installing the harder clay in a relatively small portion of the mound

Replacing clay

1. First map out the area where the clay is going to be replaced.
2. A good minimum is a 3' X 9" rectangle in front of the pitching rubber and a 5' x 3' rectangle starting 4' in front of that (See Diagram No. 5).
3. Next cut out the existing material to the desired depth of at least 4".
4. Rake deep grooves into base material.
5. Mix a little of the base material with the new material to be added. This is typically referred to as the bonding layer. Pack layer in, rake the surface and lightly water.
6. Repeat process until level with existing material.



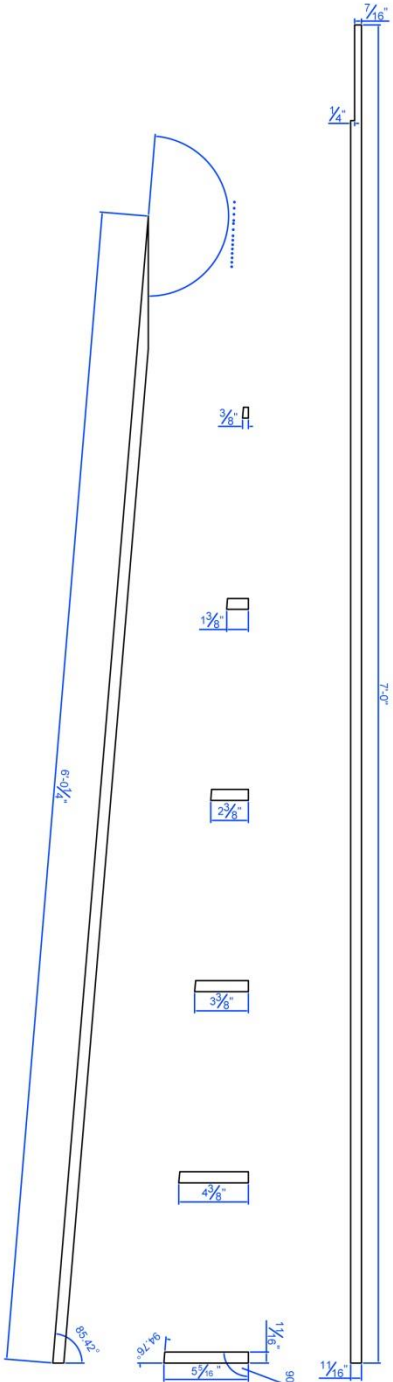
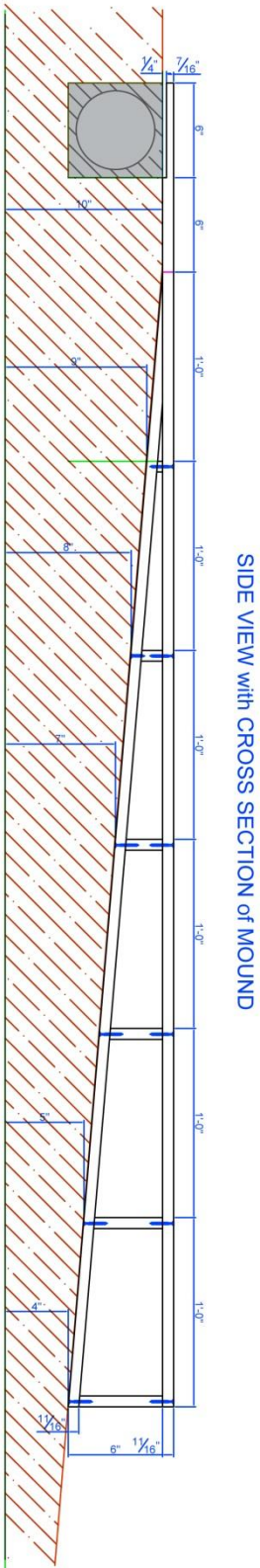
Slope Board (See Diagram No. 4)

A slope board is a jig or gauge that can be used to help quickly determine whether or not the slope of the mound is accurate. Using a slope board during routine maintenance will help to maintain an accurate mound.

1. The slope board is orientated on the mound with the narrow end placed on the pitching rubber and the wide end placed towards home plate.
2. Next place a level on the top of the board checking for level.
3. If the bubble is too close to the rubber then the material needs to be removed and if the bubble is too close to home plate then material will need to be added to the slope,
4. Once the overall degree of slope is confirmed now look at the slope board from the side and look for gaps between the base of the board and the mound's surface. Mark these valleys with a sharp tool.

Final step, fill all the valleys until the surface is flat (not to be mistaken with level).

Slope Board



General Notes
1. Drawing is in imperial.
2. Please verify all dimensions.
3. Only use the latest revised drawing.

MATERIALS
1. 3/4" Plywood
1. 3/4" Wood Screws
1. 3/4" Plywood

| | | |
|-------------|--|-----------------------|
| TITLE | | N/A |
| DESCRIPTION | | Full View |
| PROJECT | | Mound-Level-Final.dwg |
| DESIGNED BY | | TOM FARRELL |
| DATE | | 14 FEB 2015 |
| SCALE | | N / A |

TOP DRESSING

Top dressing is the loose top layer that creates the barrier between the base mix and the player's cleats, it is the material that the players slide on. Using the proper material on this layer can make the difference between a safe playable surface and a wet slick surface.

There are many different products available for use as top dressing, including but not limited to vitrified clay and calcined clay which are also called field conditioners. At first glance some of these products look like cat litter, but don't let that fool you because they are very different. Calcined and vitrified clays are naturally occurring particles that have been heated to extreme temperatures (1400 F / 2000 F respectively), this process changes the physical structure of the particles making them where they will no longer breakdown with moisture. Calcined clay has better moisture absorbing characteristics, where vitrified clay allows water to flow around it more easily. Both are very effective at keeping a field playable after it has been watered.

These products allow field crews the opportunity to heavily water a field before a game in order to keep it soft throughout the game, without the concern of a player's feet sticking to a muddy surface.

I am partial to calcined clay for its water absorption characteristics. The particles of calcined clay are small but each particle has a relatively large surface area due to the fact that it is very porous; these pores are essentially little chambers that hold microscopic water molecules. When dry, calcined clay absorbs water into these pores, but as the ground around it dries out it will release moisture back into the ground.

Calcined clay is beneficial for many reasons; using it as a soil conditioner helps to improve drainage of the playing surface by drawing moisture into the ground. It helps to prevent compaction of your top dressing because it does not stick to itself. This is useful on hot days because it allows the opportunity to add a lot of water to the field in an effort to keep it soft, without fear of the surface becoming muddy and sticking to player's cleats.

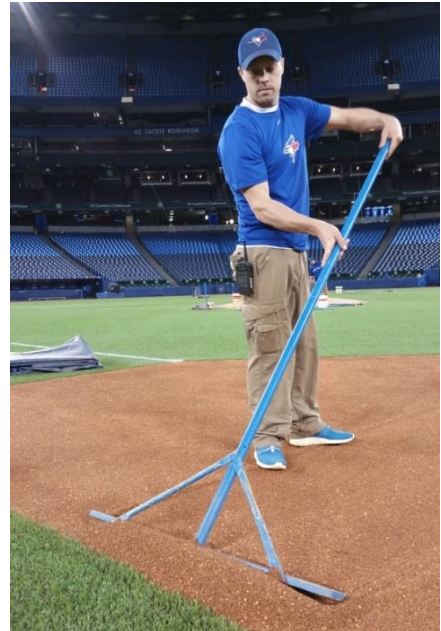
It should be noted that there is a saturation point at which the calcined clay cannot absorb any more water and adding too much water after this could result in a muddy field. If there happens to be too much water you will need to allow time for evaporation or if you need to use the field immediately you can add fresh dry materials to absorb the excess water.

The other advantage is to help make a field that has experienced heavy rain playable again. By adding bags of dry calcined clay and raking it into the surface you can quickly speed up the recovery time for a field following heavy rains. There are also products containing fine particles that are even better at drying out puddles.

How to apply Calcined Clay

1. Place unopened bags evenly throughout the infield areas (Approximately 1 ton for a field with base pits, and 5 to 7 tons for an all dirt infield).
2. Next open the bags and place in piles, removing all the empty bags from the field.

3. Using a landscape rake knock down the piles spreading the calcined clay around the infield area
4. When working on base pits you can now loop the calcined clay spreading it out evenly and smooth in one step
5. When working on an all dirt infield you will use a steel mat to spread the material evenly around the infield using care not to get any material onto the turf/.
 - a. If available you may want to use a coca mat to put a finishing touch on your field. The mat will smooth out any lines and give you a nice finish
 - b. A broom or looper will need to be used down the base paths, making sure you run the length of the path.
6. If material accidentally gets onto grass or turf sweep or rake it off immediately, excess material in the grass/turf will develop into a lip



INFIELD SKIN GROOMING

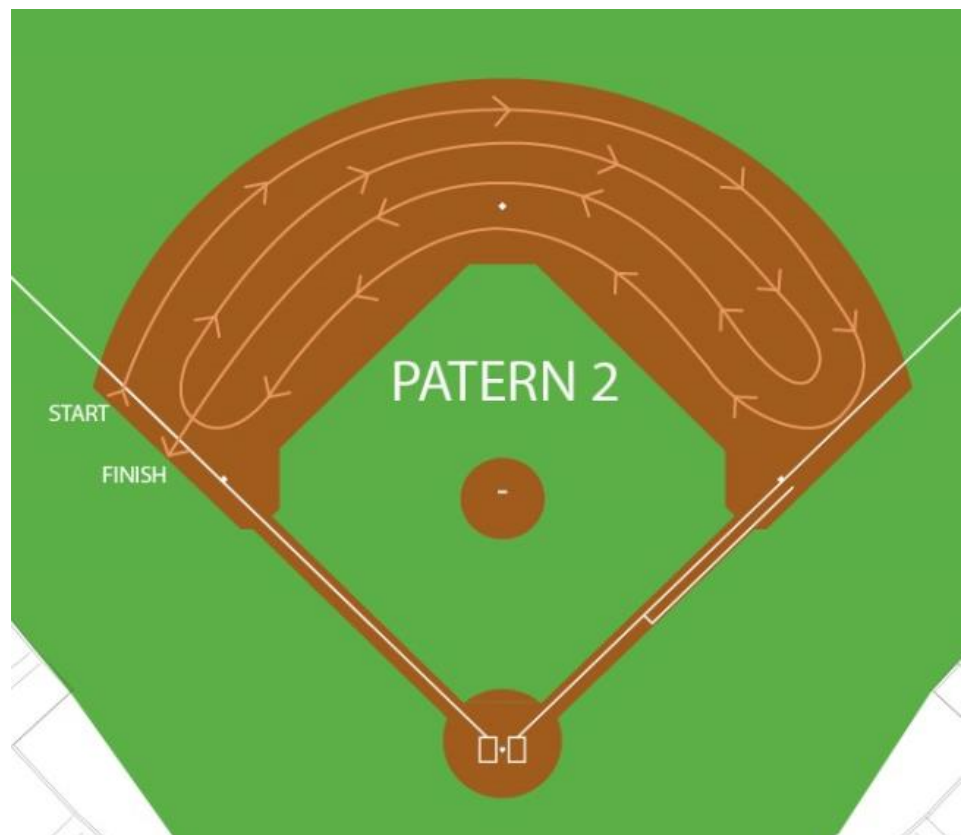
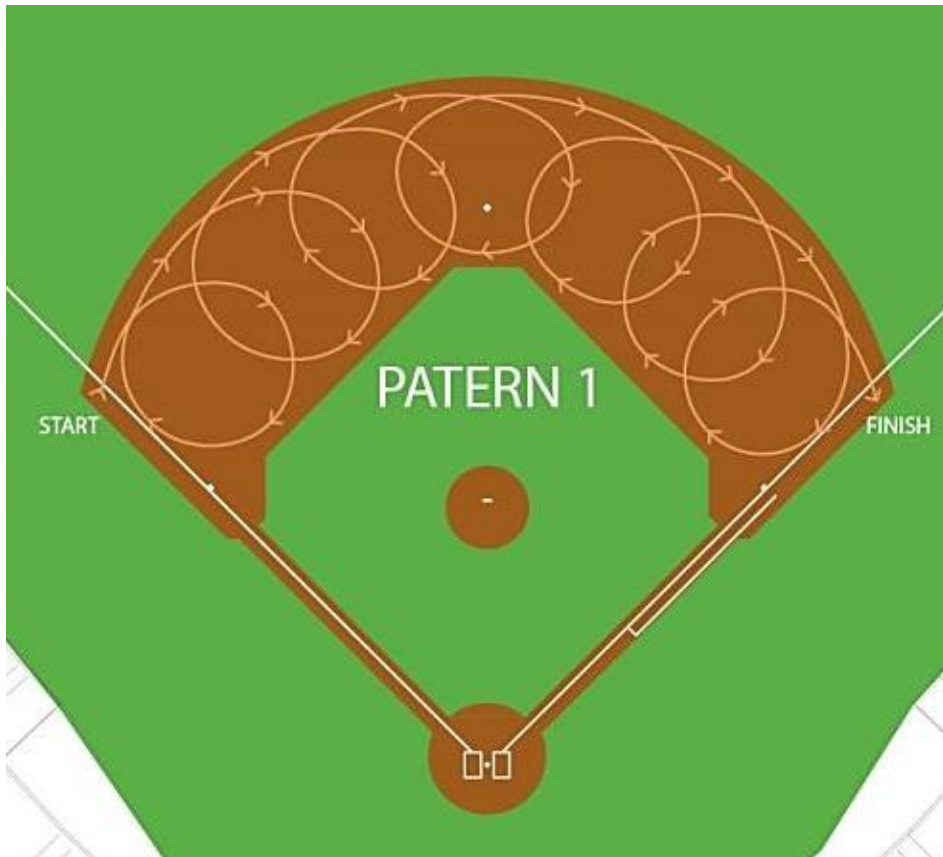
When working on a full infield skin you will need to use a nail drag, steel drag and a cocoa drag mat to maintain the playing surface.

- Nail drag – Used after the dirt has been watered, purpose is to break up compaction of the top dressing, loosen top dressing, rake out small cleat marks, and knock down high spots. They come in many sizes from large ones pulled behind a vehicle to small ones pulled by hand. Small hand pulled one is typically used up the base paths.
- Steel drag – Used to level out and spread top dressing, will pull material helping to fill small dips and help to level out high spots. It will also pick up seeds and small clumps of dirt that will need to be pick up with a shovel after removing the steel drag.
- Cocoa mat – Used to finish the infield and give the surface a smooth texture. Again, will also help to level out and high spots or ridges

GROOMING PATTERNS

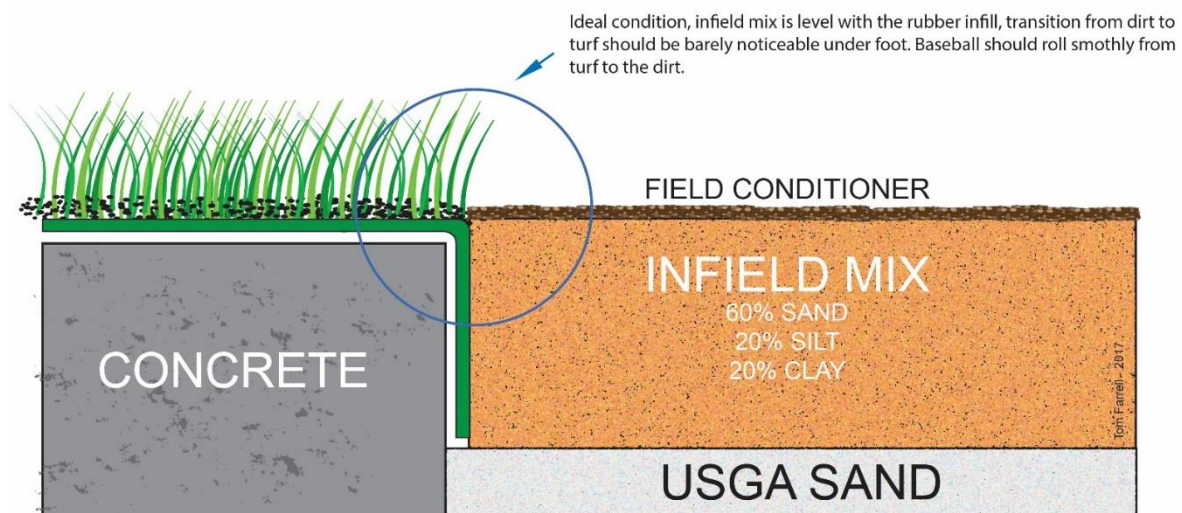
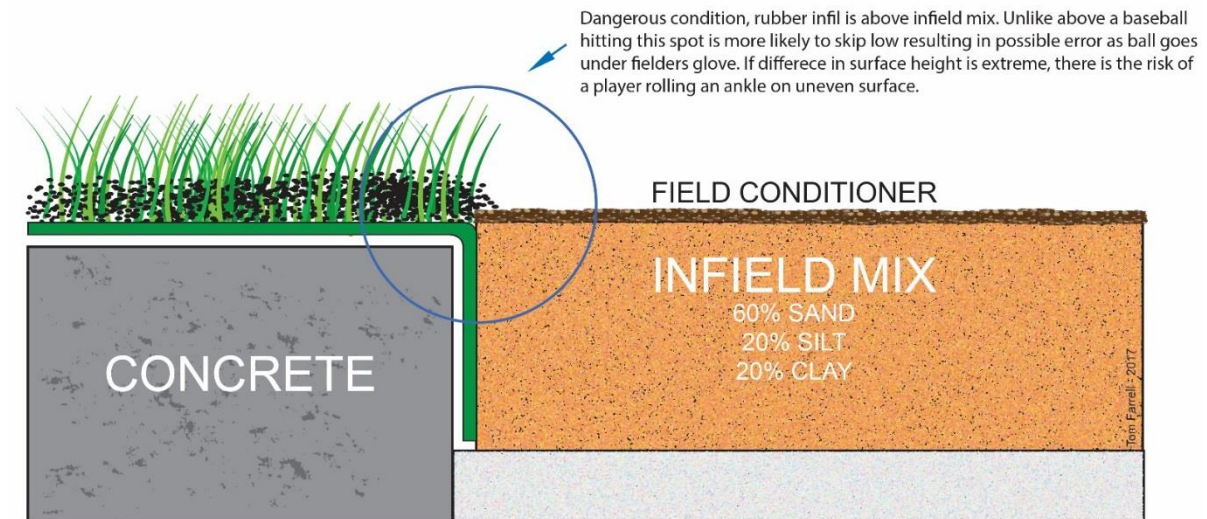
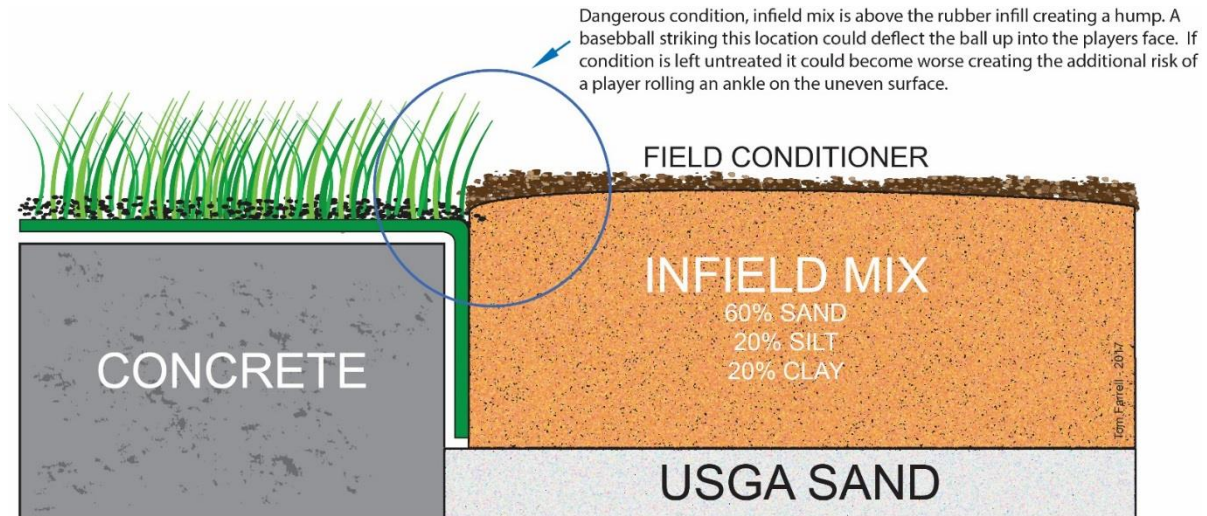
When grooming the infield skin it is important to change your drag patterns and directions. If you were to start and stop in the same spot every day you will end up creating a low spot where you start and a high spot where you finish. Also, if you run your drags in a line east to west each time you could start to develop groves that can affect ball roll/bounce. Remember to keep 6" away from the turf to prevent pushing infield material into the turf area. The areas near the turf should be done by hand with rakes and loopers.

Below are a couple patterns that you can use to help ensure you don't negatively affect you playing surface. In addition to changing patterns be sure to alternate the sides of the field you start and stop on.



INFIELD LIP

A lip can form where the turf meets the infield dirt, and can also occur around the mound, home plate and the warning track. It is caused by too much infield material getting mixed with the grass. Over a period of time this material will build up creating a lip that is dangerous to players because it can greatly impact the bounce of the ball.



The best way to control the buildup of a lip is by making every effort to prevent the infield dirt from getting onto the grass. When raking, looping or dragging the field, do not let the tool drag from the infield dirt onto the turf.

Having a good maintenance program will help prevent a lip from building up.

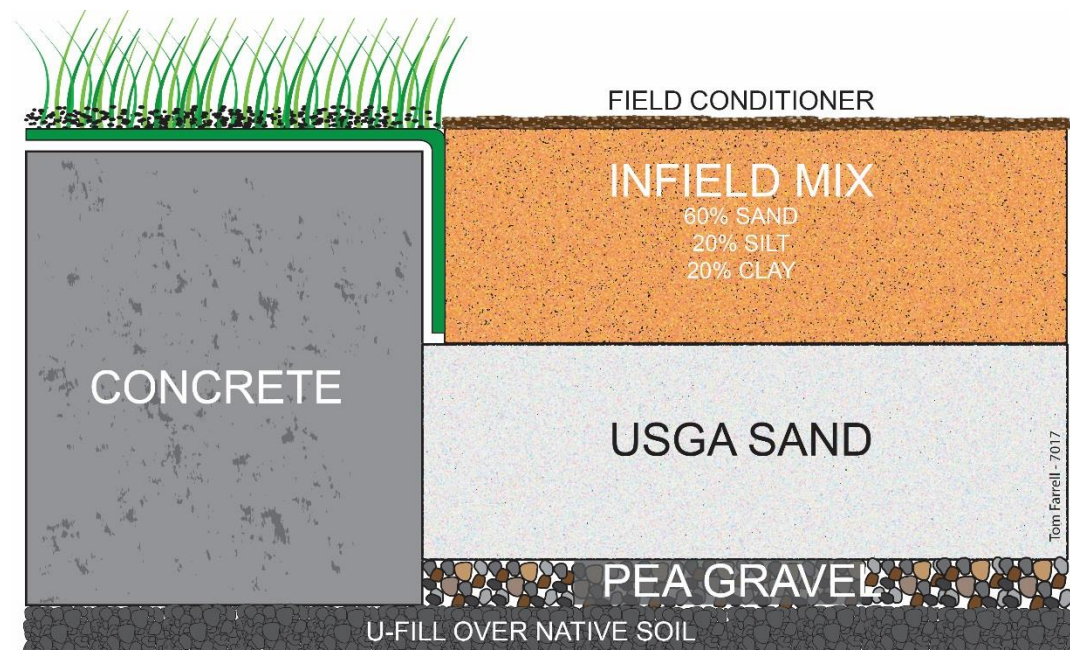
1. Following every game or practice use a leaf rake or stiff bristle broom to push any infield material that has made its way onto the grass, back onto the dirt areas. You can also use a blower pack to blow material back onto the dirt areas.
2. Use of a power brush comes in handy on an artificial turf field.
3. Frequent edging of the field will help maintain the separation between grass and infield. Be sure to use a line to ensure you have straight edges.
4. On a grass field if the lip starts to build up you can use a hose to pressure wash the dirt out of the lip and back onto the infield areas. Keep in mind that this will need to be done when there is a long break between games or practices so that the field can drain and dry out.
5. If the lip becomes too big you will need to use a sod cutter to remove the areas at the lip, grade the area and relay sod that was removed or re-sod with new turf.



MOISTURE MANAGEMENT

Having the right balance of moisture in your playing field is obviously important for healthy grass, but what some people don't realize is the importance of the moisture levels of your infield skin, mounds, and home plate areas. Too much moisture and your infield skin will be muddy, too little and it will be dusty and hard. The more the infield material dries out, the harder it becomes and the greater risk of player injury.

When building a field maintenance program it is very important to have a solid moisture management plan, and that starts with the materials that are used to construct the field. A quality baseball field will be sand based, and is typically constructed in multiple layers, starting with a native soil base on top of which will be pea gravel, followed by sand, next is the infield mix and topped with field conditioner.



THE LAYERS

Pea Gravel base creates a barrier between the native soil and the sand layer above it. Sand placed directly on the native soil can act like a sponge drawing unwanted moisture up into the infield profile through capillary action. The gaps between the gravel make it impossible for the adhesive and cohesive forces of the water molecule to overcome the force of gravity which is working against it. These gaps are what allow water to easily flow from the sand down into the native soil.

Sand layer is made up of a sub-angular clean sand such as USGA sand. You want to use a sub-angular sand because it creates a balance between stability and water penetration. Round sand would be unstable having too much movement, and angular sand would compact too much reducing the ability for water and nutrients to flow through.

it. You want clean sand, this removes fine particles that could negatively affect the flow of water, and it also removes contaminants that could be harmful to your grass.

Infield mix material is your next layer, this should consist of a quality engineered product that is made up of a mixture of Sand, Silt and Clay. For fields that do not have the maintenance budget you would want to go with a mix that is a little higher in sand because it is easier to maintain. Pro fields will have a mix around the 60% Sand, 20% Clay and 20% silt ratio because the additional clay/silt help provide stability. Keep in mind that these surfaces require more rigorous maintenance.

Field conditioners mentioned earlier in this guide makes up the final, top layer of your infield skin creating a barrier between the player's cleats and the infield mix below it.

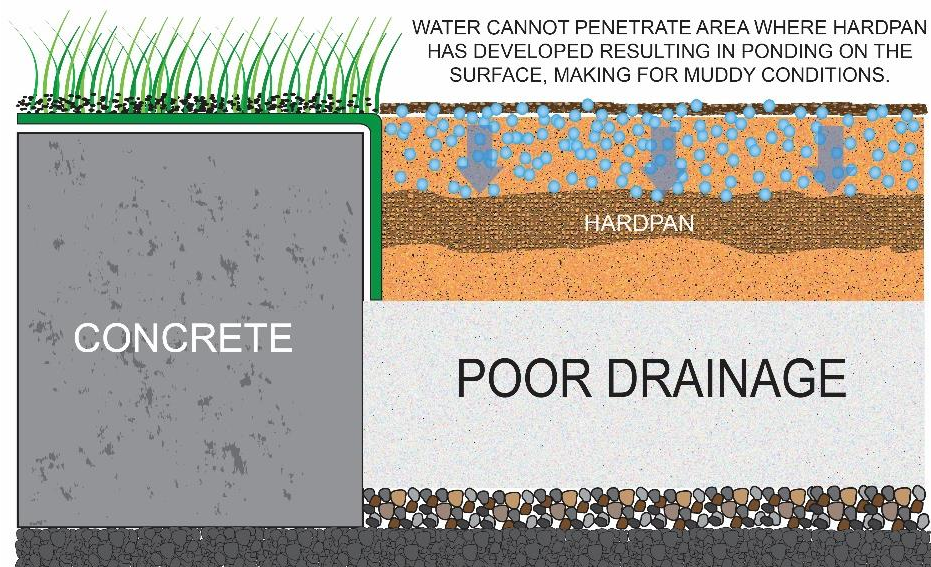
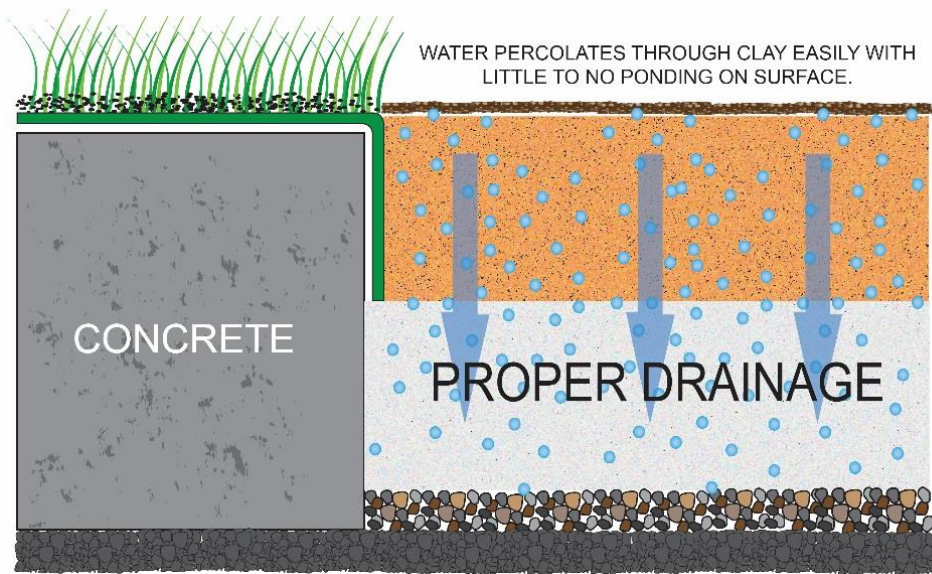
WORKING WITH EXISTING FIELD

Working on an existing field, don't worry, all is not lost. There are a number of companies out there that can provide you some assistance at a cost drastically less than what it would cost to do a complete field rebuild. There vendors not only specialize in new baseball field construction, they can also assist with the revitalization of existing fields. They will take a sample of your existing soil and have it analyzed to determine the existing structure of your field mix. Afterwards they will work with you to develop an amendment program that will help to improve your playing field. Your field is too sandy, they will add clay/silt as an amendment, too much clay they will add sand. Keep in mind that these products will need to be mixed in with the existing materials, so the field will be torn up and need to be re-graded and compacted. This is not a quick fix and must be planned out well in advance.

DON'T LOOSE YOUR FIELD

Make every effort to maintain moisture in your playing surface, allowing it to dry out too much will make it very difficult to get moisture back deep down into the profile of your mix. This is increasingly more difficult the greater the clay and silt content of your field. Allowing the mix to become excessively dry can also contribute to the development of hardpan.

Hardpan is caused by heavy traffic, or when clay below the surface becomes too dry, which results in a hard layer that becomes hydrophobic, and resists absorption of water (See illustration on next page). Signs of this can be seen when a large amount of water is applied to a dry field and instead of the water being absorbed into the field it ponds on the surface; potentially staying there until it evaporates instead of sinking in. When this occurs no amount of water will help resolve the issue, at this point you will need to resort to physical means to break up the hard layer. This can be done by tilling the field breaking up the hard pan and turning over the field mix. It is also possible to alleviate the problem using a deep tine aerator to penetrate through and crack the hard layer. This method is faster, less aggressive, and can allow for a quicker turnaround time between action taken and games being played.



TARPAULIN (TARPS)

Field coverings are an important part of the moisture management program. A full field tarp is great in order to protect the field from heavy rain that could cause the cancellation of game, however, they are heavy, expensive, and a lot of people are required in order to move one. Most likely you will not have one of these at your disposal and that is ok, however, you should invest in smaller tarps for covering the areas of your field that have high clay content such as mounds and batter's box. These tarps not only keep unwanted water off your field, they also contain wanted moisture in the profile of your clay. An uncovered clay mound will dry out in a couple hours, one covered with a proper weighted tarp can last day(s), depending on heat and humidity. The money spent on the tarps will be paid back

in the reduced labour that would be required to bring back a dried out mound, or batter's box. Invest in good quality tarps with grommets so that you can stake them to the ground. Tarps can become airborne very easily, you don't want to come to the field the next day and find your tarps stuck to the side of neighbouring condo.

PROTECTIVE SCREENS

There are many different types of protective screens available; the type used will depend on budget and type of practice to be held on the field. Below is a list of typical screens used at the major league level and their purpose.

1st Base Screen

Set up in front of the first base position, protecting the first baseman from being hit by batted balls while he fields throws from 3rd, SS or 2nd base positions.

2nd Base Screen

Set up in front of the base at second, protecting both the Short Stop and 2nd basemen from batted balls allowing them to practice turning double plays.

3rd Base Screen

Set in foul territory, perpendicular to the foul line in front of the base at 3rd. This protects base runners from being hit by batted balls when they are doing running drills during batting practice. It is set up in foul territory so that it does not interfere with the 3rd basemen fielding balls either hit by batsmen or by coach.

Centre Field Screen

Set up in centre field approximately 30 feet behind the infield arch. Used as a point to collect batted balls, and provides protection to the person collecting the balls.

Batting Cage or "Turtle"

Used behind home plate, it contains balls that would be hit foul, or balls that are missed by batter. By containing the balls it makes it easier to retrieve balls during batting practice; the screen also allows coaches to see the batter hit from a close proximity so that they can provide instant feedback and instruction.

L-Screen

This is the most critical screen; it protects the batting practice pitcher from being hit by batted balls. This is a critical piece of equipment because it allows the batting practice pitcher the comfort of being able to concentrate on pitching and not worry about being hit by a batted ball. It also allows the batting practice pitcher the ability to pitch from a position closer to the batter, a position that would be too dangerous to throw from if not for the protection of the screen. The L-Screen should be padded in order to help absorb the impact from batted balls; this will protect the screen from damage and prevent batted balls from ricocheting back and hitting the batter.

Soft toss screen

This screen can be set up anywhere; it typically has a loose fitting net or basket style net opening to help contain batted balls. A batter can use it on their own hitting off a tee, or with someone soft tossing balls to them. It is a good tool for a batter to practice the mechanics of their swing, and for a coach to observe a hitters swing giving the batter feedback with every swing.

NOTE: It is important to inspect all screens prior to use to ensure that there are no holes in

the net, and that the net is in good condition. Players and coaches will rely on these screens to provide them protection. If possible it is good to store nets out of direct sun light and rain. The effects of the environment will shorten the life span of the netting.



1ST AND 3RD BASE SCREENS



PITCHING L-SCREEN AND PITCHING PLATFORM



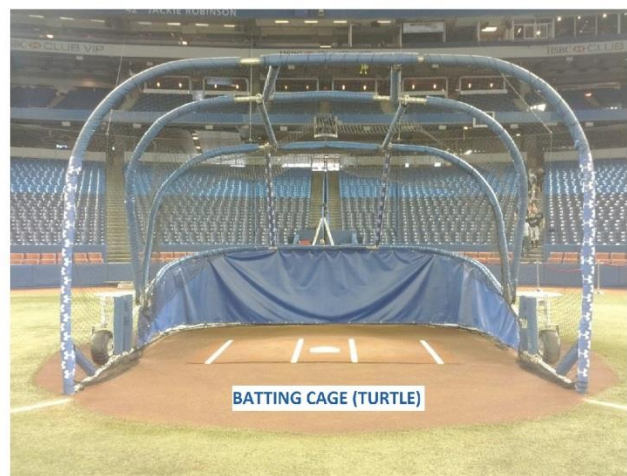
12' HIGH CENTRE FIELD SCREEN



2ND BASE SCREEN



BATTING CAGE (TURTLE) IN PARTIAL DOWN POSITION



BATTING CAGE (TURTLE)

EDUCATING PLAYERS

One way to assist in the maintenance of any field is to educate the player's on its proper use. Many amateur players step onto the mound or into the batter's box and immediately start to dig a hole. Many of them most likely do this because they watch their favourite professional player do it. What they may not realize is that the professional players are playing on a very firm surface, when they see them kicking at the dirt area the player is not digging out a deep hole but instead is shaping a shallow divot to best fit their foot. Due to the fact that the material they are playing on is firm it takes some effort to shape the well compacted clay and this may give the impression that they are digging a large hole.

Train players to practice in different areas of the field, throwing side sessions or hitting fungos from the same spot day in and day out will wear out those areas quickly. Move the team around; have them warm up from different spots every day. Coaches hitting to position players, if on the grass hit from different spots, to allow the grass to recover between games.

PLAY SAFE

A key component to any Health and Safety plan is the concept of IRS or the Internal Responsibility System, which basically means that everyone is responsible for their own safety and the safety of others. Whether you are on the Field Crew, a Maintenance worker, a Player, Umpire or, a Coach everyone should be actively looking to ensure the safety of all and not depend on others to make the place safe for them.

How to put this into action? If you see something that is unsafe don't ignore it, take action to correct it yourself or bring it to the attention of someone who can. For example if you are a player running the field and you step in a deep hole, tell your coach immediately, make them aware so that others can be warned of the danger and the coach can make the park manager aware so that the hole can be filled. If you are a coach walking the field and you find a screw, pick it up and check the area to ensure it's not the only one. If you are a Field worker and you find a broken bottle, section off the area and carefully remove all the glass being careful to remove the small pieces and not just the large easily noticeable pieces.

Playing sports has a certain amount of risk inherent in the activity; however, everyone must do their best to eliminate all the risks that can be controlled.

Below are some basic guidelines to help ensure you are maintaining the field in a safe manner.

- Follow safe work procedures
- Inspect work station and equipment for hazards at start of a shift or prior to working on the field
- Keep all work areas clean
- Stack & store items safely

- Store all work materials in designated areas
- Do not use broken or damaged equipment, instead, lock it out and report it to the appropriate people for repair.
- Use the correct equipment for the job (A folding chair is not a ladder)
- Report unsafe conditions or practices immediately
- Think safe; think about how your actions affect those around you and how their actions could affect you.

Falls in the work place

- Every year about 20 people die due to falls in Ontario workplaces. 80 Workers are injured every day.
- The following are some of the reasons:
 - Tripped over a hose on the floor
 - Fell off a loading dock
 - Fell off a stool, vehicle or ladder
- Take the time to do your job properly, don't take shortcuts.
- An untidy or poorly organized workplace can present a risk to your health. Put tools out of the way so you don't trip on them. Make sure rakes are set on the ground with teeth facing down so that in the event someone falls on it they don't get puncture wounds; same is especially true for a piece of equipment like a nail drag.
- The basic principle of housekeeping is put tools, equipment & supplies in their proper place

Inspect the field

- Best to inspect the field before the season starts so that if there are any major projects that need to be done they can be taken care of prior to the first game.
- Things to look for
 - Deep holes in the playing surface
 - Broken benches, both team and spectator
 - Broken fence
 - Expose chain link at top of fence in areas where players might field a ball. It is good to add padding or a fence cover at these locations
 - Lamp post that are close to the field of play where players could run into it. Protect with padding or warning track system.
- Prior to every game or practice the field should be walked to ensure nothing was dropped on the field that could present a hazard to the players. Even in a controlled environment like Rogers Centre we have found broken glass

FINAL COMMENTS

As with any project remember to plan ahead, be organized, make notes, create checklists, document situations and conditions so that you can repeat desired result and avoid repeating negative results.

Good luck!

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