Laser grading:
setting your sights on quality

As the demand for quality and playability on sports fields continues to grow, so does the demand for laser grading. Laser grading is establishing surface elevations within a given area using an automated blade control system.

To understand a little more laser grading, you first have to understand a few terms and principles. A basic understanding of the types of lasers also helps.

Laser transmitters come in a number of configurations from simple to more complex. The basic principles are all the same. As a laser transmitter rotates, it sends out a beam of light over an area that is picked up by a receiver. In the process of laser grading, the receiver is mounted on the grading equipment, attached to a mast or pole. The receiver picks up the signal from the transmitter and in turn sends the signal to a control box that simultaneously raises or lowers the grading blade to keep the cutting edge of the blade at a consistent elevation relative to the transmitter beam. Ultimately the established grade will mirror the laser transmitter beam.

The four main types of lasers are the level laser, single plane laser, dual plane laser and cone laser. The area of the laser beam emitted from the laser transmitter is called a plane. The plane is a two dimensional area. Picture a flat sheet of paper. Now picture that sheet of paper as being large enough to hover over the area to be graded. Maybe that's why it's called a plane? A plane has a Y axis and an X axis. The Y axis could be considered one edge of the paper and the X axis could be considered the edge perpendicular to the first.

LASER GRADING

"This is an article I wish was available when I started using a laser."
—Jim Hermann, CSFM

The most basic laser is the level laser. This laser is typically used to document existing relative elevations within an area. This laser is designed to send out a flat "level" beam of light. That is, the X axis and the Y axis are both level creating a level plane above the area being documented.

Example: The laser transmitter is set up in a location within view of the area to be documented. The laser has to be set up in "plane" sight, pun intended. Anyway, the operator uses a grade rod marked off in feet and inches or other measurement such as tenths, meters etc. The grade rod is equipped with a laser receiver. The operator can document the relative elevation at any location within the proposed area. First, he or she positions the grade rod perfectly vertical on that location. Then, by maneuvering the receiver up or down on the grade rod to intersect with the beam sent by the laser transmitter, the operator can read the corresponding measurement on the grade rod; the higher the corresponding measurement, the lower the actual elevation. By documenting the relative elevations over a grid work of locations the operator can chart the surface contours or topography of a given area. Once the operator has done this, he or she can develop a better understanding of water movement and use this information to develop an effective grading plan.

EVERYTHING IS RELATIVE

It is important to note that when documenting relative elevations, these elevation readings are only relative to the height or elevation of the laser transmitter at that time. If the transmitter is repositioned, the operator will come up with totally different readings on the grade pole. To allow for this, a benchmark is established at the time the elevations are documented. A benchmark is a location within plane site of the transmitter that is a permanent elevation such as a concrete pad, footing, or possibly the base of a fencepost. By establishing a benchmark, the operator can reposition the transmitter on a day to day or even year to year basis as long as the elevation of the benchmark doesn't change. By documenting the new reading for the benchmark, the operator can translate the new readings to correlate with those documented in the past.

The benchmark is used as the reference elevation when positioning the receiver on the mast above the laser grading equipment. First the laser transmitter is positioned, turned on and programmed to the desired slop. The cutting edge of the grading blade directly below the receiver is positioned on the benchmark elevation. The receiver is raised or lowered on the mast to intersect with the laser bean. The receiver will remain in this position as long as the transmitter is not repositioned. Whenever the laser transmitter is repositioned, the laser receiver must also be repositioned to correlate with the elevation of the new transmitter location. The same process is carried out to position the receiver correctly when a grade rod is used.

A single plane laser has the ability to slope the Y axis while the X axis always remains level. This creates a flat plane but not a level plane. It is important to note that the terms "flat" and "level" are many times used interchangeably. In reality they can

have totally different meanings.

The term "level" means that all points within a defined area are at the same elevation, such as the elevations of the water surface on a calm lake. Flat just means flat. A flat surface can extend uphill or downhill, side to side or both. I once made the mistake of saying that topdressing helps to level a soccer field. We all know a soccer field cannot be level. Smooth yes, flat yes, level no.

Many, if not all lasers have a sight, typically on the top of the laser. With it, you can sight along a straight line to establish the X axis. An example would be to set the transit up directly above the apex of home plate and site down a foul line to the foul pole. This line would typically be considered the X axis. With a single plane laser this line (axis) would have to be level. If you want a certain slope perpendicular to the foul line such as toward the dugouts, you could adjust the Y axis to whatever percent slope you want.

Since the laser beam travels 360 degrees in a complete circle, you could mark the proposed elevation at the front of the dugout and also mark an elevation for the pitching area as long as the same slope is desired in both directions. If a different degree of slope is desired, you could readjust the Y axis in either direction. The downhill side of the axis is negative (-)Y and the uphill side of the axis is positive (+)Y.

The only difference between a single plane laser and a dual plane laser is that with a single plane laser, only the Y axis is adjustable. With the dual plane laser, both the X axis and the Y axis are adjustable. So, in the example, if you want a 1% slope (downhill) from home plate to first base you can set the X axis at -1% and if you want a .75% slope (uphill) to the pitching area you can set the Y axis at +.75.

The cone laser creates a conical grade. This transmitter has the ability to bend the laser beam either up or down with the transmitter always being positioned at the center of the cone. A conical grade is used when an infield is graded from a central location between the bases out in all directions, typically creating a grading plan with all the bases at the same relative elevation. With many cone lasers adjusting the X and Y axis can tilt the cone forward, backward, left or right. Adjustments like this may be necessary to match existing perimeter grades.

Laser grading is a combination of technology and operator ability. Never take for granted that because an infield is laser graded that it is graded effectively.

One very important fact to keep in mind is that regardless of how accurately the operator can grade an infield, it is still at the operator's discretion how to set up the laser and how to tie into the existing elevations surrounding the infield. **Laser grading is a combination of technology and operator ability**. Never take for granted that because an infield is laser graded that it is graded effectively.

Of these four types of lasers, due to their versatility, only the dual plane laser or the cone laser is normally used in combination with automated blade control equipment.

Typical laser grading equipment can either be a single mast or dual mast system. A single mast system is the least expensive and has a single receiver typically mounted in the center of the blade. The receiver controls the blade by either lifting the entire blade or lowering the entire blade.

A dual mast system is more expensive and has two receivers with one receiver

mounted on either end of the blade. By controlling each end of the blade individually, a dual mast system can grade in any direction relative to the slope with equal efficiency and accuracy.

Using manual controls on a dual mast system, the operator can go from automatic to manual with either the left or right side of the blade and adjust the blade higher or lower than the elevation determined by the transmitter without leaving his seat. This comes in handy when multiple passes are necessary to reach the finished elevation or when it is necessary to make minor adjustments when matching existing perimeter elevations. Manual overrides are also provided on single mast systems.

A laser receiver can also be used simply as a visual reference when grading an area without the use of an automated blade control system; the receiver is mounted directly over the cutting edge of the skid steer bucket. The receiver has a series of flashing red and green lights that tell the operator if the bucket needs to be adjusted up or down or if the cutting edge is on grade.

Note: individual transmitter functions vary by model and manufacturer.

As they say in the golf industry, "the proof is in the putting." ■

Jim Hermann, CSFM, is president of Total Control Inc. Athletic Field Management, www.totalcontrolinfields.com.