

Fundamentals of Laser Grading

By Sean Connell

Laser grading is a term in the athletic field construction industry used to describe the process of moving soil with a grading mechanism equipped with an automated control. Laser guided controls can be mounted on any machinery including track hoes, trenchers, motor graders, bulldozers, tractors and infield groomers. In fact, anything with a motor and hydraulic supply can be mounted with an automated laser control system. The fundamental reason to use laser guided equipment is that it creates the most accurate and consistent grade and ultimately improves the drainage, usability, safety, and overall appearance of a sports field.

One of the biggest myths about laser grading is that some fields cannot be laser graded because of the elevations of land or fences that directly encase the field. This is usually untrue. A field can often be laser graded without moving the surrounding topography. In order to do this, you must do the following procedure.

First, grid the field on 40' or 50' centers, then shoot all grades and record on a scale drawing. (Note: most fields have some type of original blueprint so that scale drawings can be made very easily by tracing). After you have a drawing with grades shot, you can evaluate which way the water is going. After determining where the water can drain the most efficiently, you will then determine how much slope you will laser grade. One tenth of an inch in 10 linear feet is 1% of slope, so 1' of fall in 100 linear feet equals 1% slope.

After compiling your information, you need to measure the length of slope to determine your slope %. For example, if you have 4' feet of fall over 200 linear feet, you automatically know that is 2% of slope ($4/200=0.02$). Now you can determine if there are any problems between the points such as a big mound of soil which is holding the water back from draining or a big dip that is holding water. This process identifies problems and helps you determine how much to cut or fill. The automated laser guarantees the 2 points (from high to low) will have continual slope with no holes or high spots to get through. The lowest point is your bench mark so you know you will get positive drainage.

Now that you have a plan, you need to make sure have the right type of equipment to complete the job. For instance, laser grading variances are 1" to 2"; that means 1" to 2" is all the soil you will be able to move with a laser box in a reasonable amount of time. So, given that information, you know you have to make other arrangements to move larger quantities of soil. A farm tractor equipped with a box blade with ripper teeth can loosen the soil from 4" to 6" depths at a reasonable rate. Using larger equipment such as a bulldozer is good, but keep in mind that any equipment you use needs to complement the laser grading.

The sloped laser that is used to control the laser box blade is set in a central location on the field. You point the axis in the direction that you want to laser grade. It is accurate to the thousandths

of a percent. After setting the height of the instrument, you will set the receiver to the relative grade of the soil you're going to grade. The most frequently used type of equipment to laser grade athletic fields is a tow-type box blade. It has a hitch receiver to the draw bar of a tractor and an axle of wheels behind the box blade. It makes it independent of the tractor and provides the most consistent grade. There is also a mast that holds the laser receiver which receives the signal from the sloped laser and sends it in to a control box. The control box sends the signal back into an electric hydraulic valve that controls the box blade that is grading. The signal is instant and in real time. As the tractor moves across the field, the box is making cuts and fills leveling soil giving you the safest playing surface and best drainage. In addition to the tow-type box blade, there are also 3-point hitch versions of the laser guided systems available. Unfortunately, they are more sensitive to the tractor movement. For instance, the front wheel goes into a hole and moves the box blade faster than the system can respond requiring the operator to have more responsibility on the finished surface.

The field is laser graded. All the soil is in-place and you balanced the soil so you do not have to export or import any fill to complete your job. As completion of the field is near, you are going to install your irrigation (always tamp ditches and make contractor fix settling for up to a year, this is a safety issue and is a standard for professional contractors). After irrigation and soil amendments, you will need to prepare the soil for grassing by loosening the top 2" to 3" of soil. To remove all stones, trash, sticks etc. for a clean surface, use a harrow or soil pulverizer to loosen the soil; then smooth with a box blade, preferably with the laser box. After completion, you are ready to seed or sod your field; remember, the biggest chance of damage or slow drainage is when a field is being grassed.

In summary, automated laser grading guarantees safety and improved drainage which are the biggest issues on any field. Understanding the method and how it directly impacts the finished result on any playing field should make it a mandatory trade to be included on any field renovation or construction. You do not let plumbers do electrical work, so why would you let a site contractor grade a field when there are sports turf specific contractors with properly sized equipment and specialize in field construction? Site contractors move soil and install the utilities more efficiently and cost effectively. The same logic should go to the Architect / Engineers by specifying laser grading as a trade and including them on all field construction projects. When renovating and constructing fields, properly sized equipment and trained operators make the difference.

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