# Grading with 3DMC-GPS

With the base station up and running, the machine configuration complete, the GPS localization performed and the System V Control box properly configured, you are ready to start grading ! Double-click on the 3DMC icon on the computer.

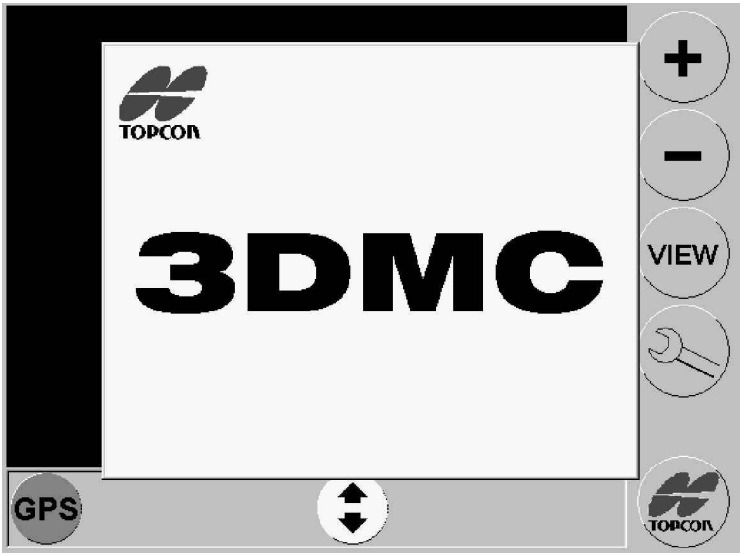



Fig 6.00

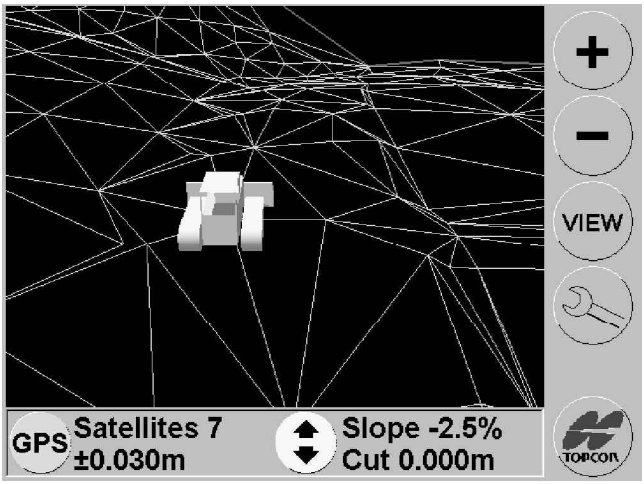



Fig 6.01

The main screen displays a graphical view of the design surface and machine along with several function buttons and status information. The right hand side of the screen has buttons for zooming in and out and changing the perspective view of the surface and machine. The wrench button takes you to a configuration screen where you can change surfaces, machines and current project. The "Topcon" button allows you to check the software version or quit the program.

At the bottom of the screen there are two buttons and status information. The "GPS" button can be pressed to get more detailed position information. The yellow "grade control" button at bottom allows you to raise or lower the site grade manually.



The status area at bottom shows summary information about GPS position quality and, when the machine is within the design area, current cut/fill and slope information.

The main window (black background and machine image) represents the design area and machine. If your machine

type is Bulldozer then this is what you will see on the display. When the machine is physically located on the design surface the machine will appear superimposed onto a red and green surface image. Green lines represent edges of triangle surfaces that are joined together to form the whole TIN surface (Triangular Irregular Network). Red lines represent grade-break or boundary lines or any other specific feature line-work that has been added to the TIN model.

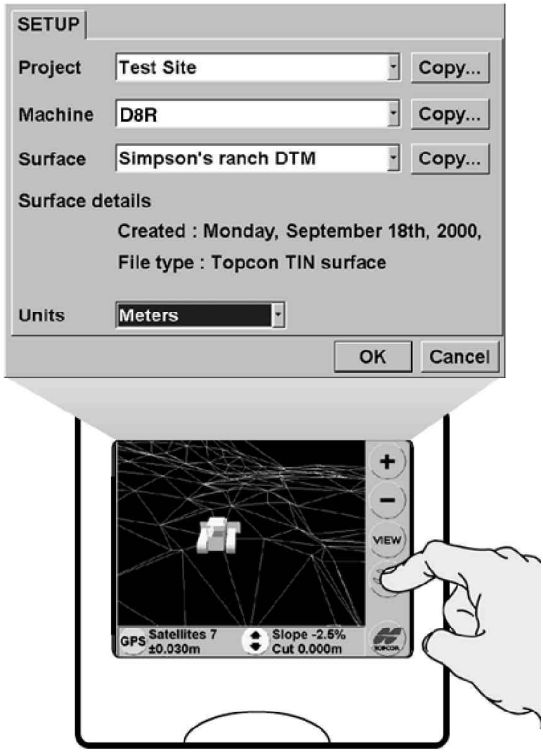



Fig 6.02

I nsure that the correct project, surface and machine files are selected. The “Copy” buttons allow you to copy new files from the PC card slot on the right hand side of the computer or from a floppy-disk drive connected to the large parallel-port connector on the rear of the computer. Typically the project and machine configuration files will be created on the computer and the surface file will be created in the office by the design engineer. If the correct surface file is not already on the computer, use the “Copy” button adjacent to the “Surface” entry to load it onto the computer. Once the file is copied, the PC card or floppy-disk drive can be removed.

# GPS Status


The “GPS” button at the bottom-left of the display will be either be colored red or green. When red, the position quality is not suitable for grading and no automated control will be possible. When green, the position quality will support automated control. Adjacent to this button you will see indication of position quality. When the button is red there will usually be some status message indicating why the position quality is poor. This message can be...

(1) Waiting for satellites...this is displayed when less then 5 satellites are tracked by the GPS receiver. This message will normally persist only for a few seconds after the receiver is turned on. Refer to the troubleshooting guide if this message persists.

(2) Waiting for radio link...this is displayed when the GPS receiver on the machine is not receiving a radio signal from the base station. Normally this message will persist only for a few seconds after the receiver is turned on or when the machine is out of radio range of the base station. Refer to the troubleshooting guide if this message persists.

Normally the position status will indicate number of satellites tracked and estimated position tolerance.

For more detailed information on GPS status and position press the “GPS” button.

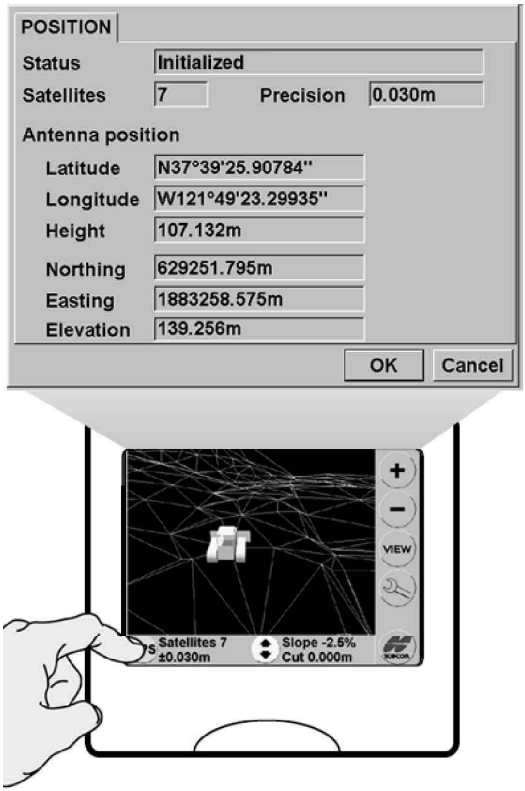



Fig 6.03

The GPS position screen shows “Status” of the GPS receiver to be in one of several states...

(1) Waiting for satellites...less than 5 satellites tracked as per the status on the main screen. This actually indicates the number of satellites that are tracked simultaneously by the base station and machine’s GPS receivers. Refer to the troubleshooting guide if this state persists.

(2) Waiting for radio link...no link established between base and machine GPS radios. If this message persists and the machine is reasonably close to the base station then it is likely that there is some configuration issue either at the base station or the machine. Refer to the troubleshooting guide if this “Waiting for radio...” state persists.

(3) Waiting for initialization...the GPS receiver takes some time after it is first switched on to produce centimeter-level positions. The state during which the GPS receiver is trying to produce these precise positions is referred to as “initilization” and can last from just a few seconds to several minutes. Sometimes the GPS receiver on the machine will “lose” initialization and have to “re-initialize” itself. This can happen if the GPS antenna is subject to very severe movement or if it somehow loses track of several satellites. Refer to the troubleshooting guide if this “Waiting for initialization” state persists.

# Blade Control

The yellow Blade Control at the bottom of the main screen displays a dialog where you can raise or lower the effective design surface by a set amount. If, for example, the design surface is for finished grade and you wish to cut to sub-grade then, this number can be entered in as an extra cut. If you want to allow for compaction an additional fill value may be added.

You can change the additional cut/fill values by...

(1) Pressing the box that displays the additional value and entering a number on the numeric pop-up keypad.

(2) Raising or lowering the cut/fill in increments of 1cm (or 5/100' if using feet) using the "Up" or "Down" buttons.

(3) Pressing the "Match" button to set grade to be current blade position. This will be possible only when the GPS system is connected and when the machine is inside the design surface.

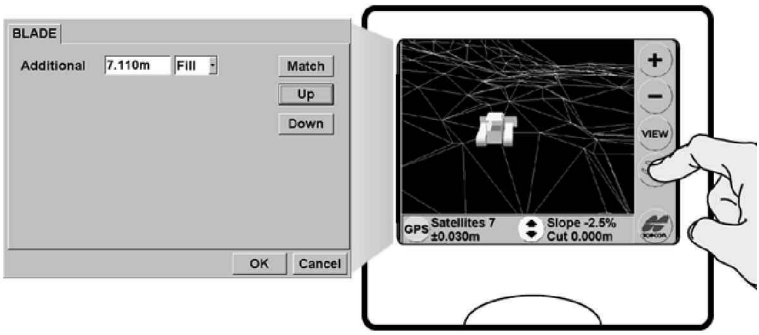
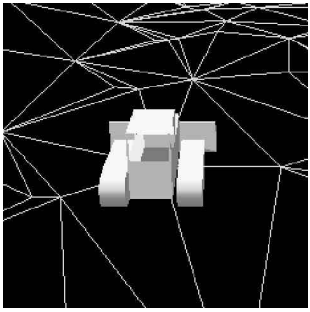



Fig 6.04

# Changing View


The “View” button allows you to change the way you look at the machine on the site plot.



Right edge of blade

Fig 6.05

Left edge of blade

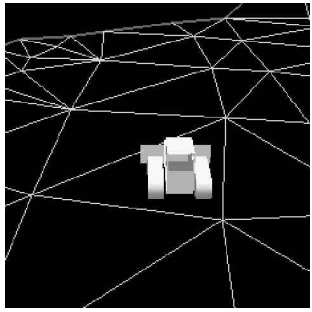
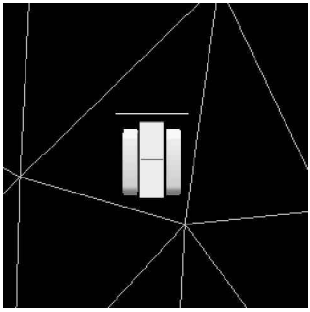


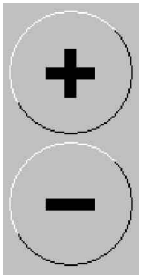
Fig 6.06



Plan View

Fig 6.07

# Scale and Zooming



Use the “Zoom In” and “Zoom Out” buttons to change the scale of the machine on the display. An operator can zoom out to get an accurate representation of the machine’s whereabouts on the design surface or zoom in to the corner of the blade to help follow a break line.

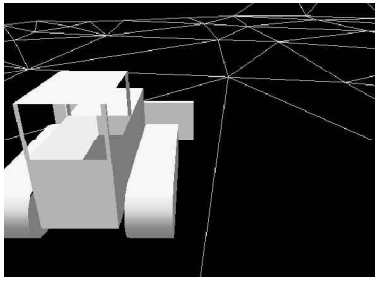


Fig 6.08

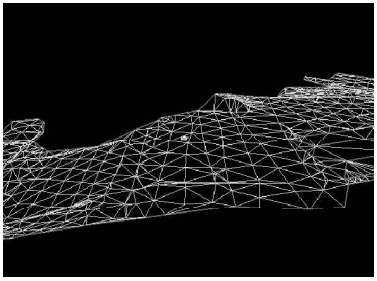


Fig 6.09

# Automated Grading

When the configuration has been checked, the System V control box is operational and the GPS button is colored green you are ready to begin automatic grading. The 3DMC program will calculate cut/fill and cross-slope values to send to control the hydraulics. These values are calculated based on machine position and orientation. The slope of a surface will differ depending on the orientation of the blade and machine. The 3DMC program determines orientation solely by monitoring the direction that the machine is moving. Thus it is always best to get the machine in motion before switching to automatic control. It takes only a few meters/feet for the system to determine the correct orientation and therefore correct cross-slope. This is especially important on steep slopes where an error in machine orientation results in significant slope error.

When grading areas with significant cut or fill an operator should grade manually, using the cut/fill displayed on the 3DMC display and on the control box lights as reference. For safety reasons the System V control box limits the amount of vertical movement possible while in automatic control mode. The maximum cut/fill movement for automatic elevation control is about 10mm (3/10'). It is necessary to manually move the blade to within this "control window" before the system will take over control of the blade. When the grade is within the control window, the operator can start automatic control. The operator can also raise or lower the site as described earlier to allow the system to work in automatic.

The 3DMC program does not limit the direction the grade is cut. When starting a pass, get the machine moving and wait a second or two for the 3DMC program to determine the true direction of the machine. Lower the blade into the working window (the control box auto-lights will begin to

flash) and switch into automatic mode with the auto/manual switch/knobs on the blade lever. When the pass is complete, switch back to manual mode before lifting the blade.