SOMERO ENTERPRISES
A DOVER COMPANY

SOMERO SITESHAPE™ SYSTEM

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The Somero SiteShape™ System allows for grade shaping automatically using your motor grader, dozer, or other grading machine. This highly accurate Somero SiteShape System, until now restricted to Laser Screed® application, is available to meet the demands of real three-dimensional grade shaping.

The SiteShape System is ideal for use on parking lots, loading dock areas, service ramps, and driveways. It can also be used on roadways, runways, taxiways, or any multi sloped surface. Slope and elevation changes are now simple, practical and cost-effective to achieve.

The SiteShape System is compatible with most makes and models of grade cutting machines.

The SiteShape System adds *automatic* control of the *height* of the blade cutting edge to a Blade Control System equipped machine. A Geodimeter Automatic Tracking System (ATS) is used to accurately measure and communicate Blade Location and Elevation, to a mobile computer that calculates what the proper elevation for the blade should be at that location. The computer then generates a command to adjust the blade elevation accordingly six times per second. Therefore, an area of contours and complicated shapes that would normally require the use of feathers and hubs can be graded just as easily as a flat surface.

To obtain a better understanding of how the SiteShape System works, let's take a brief look at how the system works.

First using the ATS and remote target, a Site Survey is performed to record the layout of the job site on a mobile computer. This survey takes approximately one hour depending on the job. Walking the site and entering points and elevation breaks is all that is required. Each point becomes part of the map with one click of the laptop. When the survey has been completed the Somero Profile Maker is used to create a surface map of the layout. This surface map is used to create the computer generated surface mesh that is used to control the blade.

To Shape the Site, the remote target is installed on a mast on one side of the blade. The ATS tracks and follows this target. The position of this target, including its elevation, is measured and the data is communicated via radio signal to the computer.

The computer then determines the proper blade elevation for the specific target position within the mesh of the job site and then through the Control System, adjusts the blade control cylinder to raise or lower the target side of the blade.

A sonic sensor is used to control the opposite side of the blade. The sonic sensor monitors the distance between the sensor and the previously graded surface. It tells the blade control cylinder to raise or lower so sonic sensor side of the blade will match up with the previously graded surface.

To better understand how this is done let's look at the components that make up the SiteShape™ System.

Automatic Tracking System

The 1/8th inch accuracy achieved with the site shape system would not be possible to obtain without the use of an Automatic Tracking System such as the Geodimeter ATS 600 that comes with each full package SiteShape System. The ATS 600 is an enhanced robotic version of the Trimble 5600 Total Station that allows for high performance machine tracking.

The ATS uses servomotors to rotate left or right and tilt up or down to locate and track the Remote Target infrared signature. Once the target has been located, the ATS will lock onto the target and continue its automatic motion to follow it. The ATS uses a laser to measure the horizontal angle, vertical angle, and slope distance from itself to the target. This distance can be measured very accurately up to ½ mile away. This information is communicated via the ATS radio to the 3D computer.

To maintain accuracy electronics inside the ATS compensate automatically to correct both horizontal and vertical angles for any deviations of level and plumb, and adjust for any shift in laser measurements due to environmental factors.

The ATS is installed on top of a tripod high enough where it is not likely to be blocked by people or equipment. It is recommended that this device be powered by using a 12V car or deep cycle marine battery to ensure full power for an entire day's work.

If the ATS ever loses track of where the target is, it will automatically search for it. If it cannot find the target quickly, it will perform an even larger sweep until the target is located.

Tracker Target

The Remote Target is what the ATS uses to measure location. It consists of two parts: the lower part uses a battery to emit an infrared signature. The upper part is a prism that reflects the laser back to the ATS. The target used as part of this system is a full 360-degree device that does not have to be oriented in any special fashion for proper operation.

The target is used whenever measurements must be taken. In the SiteShape application, it will be used during the Site Survey and Grade Shaping. During the Site Survey the target is attached to a survey rod on a base and is powered by a small battery via a cable. This can easily be carried around and set down on any location on the job site. When grading, this target is attached to a mast, which is attached to the blade and then operates using power from the machine.

On the base of the RMT 600 is an infrared frequency adjustment knob. This adjustment is available to allow multiple ATS 600's to operate on the same site simultaneously.

Portable Radio (Georadio)

Information from the ATS is sent back to the computer, via a matched pair of radio modems. The first radio is built in to the ATS itself. The other half of the set is a hand-held unit. The radio receives the information from the ATS and converts it to a format that the computer can understand.

During the site survey the radio gets it's power from a rechargeable battery, when Shape Grading the SiteShape™ system cabling provides power to the radio from the machine or battery if needed.

Mobile Computer

This is a standard Windows-based computer. It has the necessary hardware and software installed to run the SiteShape software programs. The control of the blade is done through calculations made by this computer.

Whenever the 3-D Profiler™ software is functioning, this computer communicates to the ATS through the radio link via the COM port. It interprets the information received and performs the mathematical computations to correlate distance, etc.

While grading, the Mobile Computer determines the location of the blade and compares it to the desired elevation from a grid generated from the site survey. Then it determines whether to raise or lower the blade to achieve the desired grade.

Sonic Tracer

The Sonic Tracer operates on the same principal as SONAR used on ships and in fish locators. A high frequency sound wave is sent out and bounces back. The length of time is measured, and the distance is computed.

The sonic tracer is tuned so that it can be used to measure distance from forms, string lines, or the previously graded surface.

Since the sonic tracer is mounted opposite the tracker target you must always establish grade with the target side. The sonic tracer ensures that each new pass will match up with the previously graded surface.

Control System

The Control system used with the SiteShape system is the Trimble GCS-21.s. The system includes an operator interface Dual Control Box (DCB), and a Triple Remote Box (TRB). The GCS-21 uses CAN (Controller Area Network) data it receives from the SiteShape Mobile Computer and Sonic Sensor to send electrical signals to the Electro proportional valves mounted on the Grade Shaping machine.

Hydraulic System

The hydraulic system is Grade Shape machine specific; using Electro proportional valves sized to properly control the blade.

Brackets and Cabling

The SiteShape™ system will include all necessary brackets and cables. Each install will require some minimal customization.

Now that we know a little more about the components lets look at the SiteShape software.

The software package is comprised of two different programs. The first is the 3D Profiler™ Software, and the second is the Profile Maker Software.

3D Profiler

The 3D Profiler Software is used to perform the Site Survey and control the machine. The Site Survey is performed by measuring known points within and around the perimeter of the work area with the ATS. Each point measured is called a node. The node map is stored in a directory in the Mobile Computer for use with the Profile Maker software. Once the node map has been processed in the Profile Maker software, the 3D Profile Maker uses the information generated by the ATS to calculate the elevation of the blade in reference to its position in the created mesh map when grading. This software also has the functions necessary to establish the position of the ATS in relationship to the site.

Profile Maker

The Profile Maker software uses the node map that was recorded while surveying the site using the 3D Profiler software. The nodes are used to define surfaces that will be used to create a Surface Mesh. These surfaces use either 3 nodes (3 sided) or 4 nodes (4 sided) depending on the desired finished grade for that area of the node map. Once all of the nodes are used to create the surfaces, the Profile Maker automatically generates a Surface Mesh to define the grade of the area inside the site. This surface mesh is what is used by the 3D Profiler Software to calculate the proper elevation for the blade position in the site layout. The surface mesh can be viewed in Profile Maker to determine proper pitch directions. Surveyor northing, easting, and elevation data can also be used. The data is imported into the software in spreadsheet form to create a node map. This node map is used in the same way as a site survey node map to create a surface map and then the surface mesh. Any and all nodes can be edited and or deleted in the Profile Maker Software, and Site Surveyed nodes can be added to a surveyor data generated node map for optimum flexibility.

Once the surface mesh for a job has been loaded into the 3D Profiler Software, and the necessary equipment is mounted on the machine, Shape Grading can begin. To establish the finished grade elevation, the target side of the blade is lowered to a known elevation, be it a curb or hub. When working in an as-built condition with curbs already installed, the operator will establish the grade of the curb, through the 3D Profiler software. Then offset the blade elevation to the desired grade. When working in design conditions with a hub of proper elevation, no offset will be required. This means that you need to establish grade once for the entire job

Depending on the site conditions, grading is usually done starting with the target toward to outside of the job until grade is established for approximately one half of the blade width. Once this is done you can change directions and grade with the target toward the inside of the job and allow the sonic sensor to keep grade on the opposite side of the blade. The blade is angled so that loose material flows off the target side of the blade to ensure that the sonic sensor does not improperly adjust.