Laser guides blade operator

By using a laser to guide the operator of a motor grader, a Bay Area contractor can fine grade large building pads to plus or minus ½ in. in one-third the time normally required.

ANOTHER TECHNIQUE has been added to the growing list of construction applications of the laser by Redgwick and Banke, Inc., excavating and paving contractor of Hayward, Calif. It speeds up the process of fine grading by using a laser beam as an elevation reference for motor grader operators.

How the method works

The laser is set up at a convenient location outside the area to be graded and its brilliant beam of coherent red light is focused on a translucent target attached to the grader's blade in front of the operator. By noting the location of the laser beam on the target, the operator knows the exact elevation of his blade. By keeping the beam within the reference lines on the target as he drives toward the laser, the operator can produce a graded surface within the indicated tolerance.

The method does away with blue tops, and the annoyance of having them torn up or covered by the blade, and it provides constant control over the entire area rather than the eyeballed grade between the blue tops. It's fast, too. Grading can be done in about one-third the time normally required.

Redgwick and Banke developed the technique for its building pad subcontract for Eastman Kodak's $5 million office and warehouse installation in San Ramon, located about 13 mi. east of San Francisco Bay.

Laser mounts on transit

Redgwick and Banke selected a University Laboratories' laser that mounts on most transits and projects its beam through the transit optics. It is powered by a portable power pack connected to a truck or automobile's 12-v. battery, or a University Laboratories' battery pack can be used. The special battery pack will run the laser for one shift and its built-in recharger, when plugged into 115 v. AC, will rejuvenate the battery overnight.

The target is a piece of translucent plexiglass held in position on the grader by angles welded to the blade's circle. The position of the pencil-size laser beam on the target indicates the blade elevation. A Slope Meter on the top of the target shows when the blade is level.

Only two men needed

The method needs only two men, one to handle the laser and the other to operate the grader. The instrument man levels the transit and directs the laser beam on to the target. The motor grader operator keeps the laser spot in proper position by his blade controls as he grades the surface.

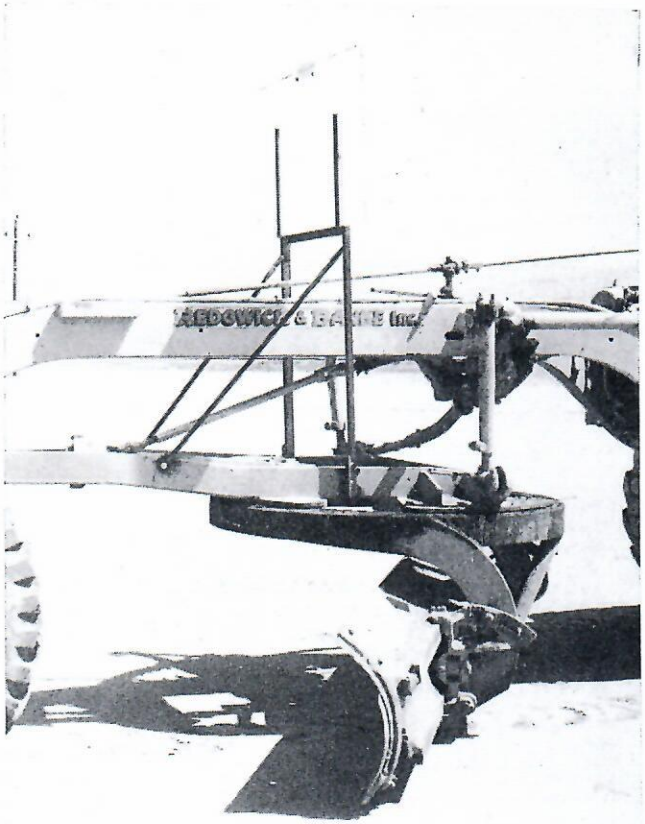
Even though the laser can operate unattended, a man is still needed at the instrument to direct its beam on to the target. It is almost impossible for the grader operator to find the beam by maneuvering his machine. However, once the beam is on target, it is easy for him to keep it there.

To obtain the correct initial elevation for the laser control method, surveyors must first set a hub which is accessible to the grader. The blade is positioned over the hub, which is set to proper elevation or to a known distance above or below grade, thus determining the exact elevation of the blade. The laser beam is directed on to the target and, using a carpenter's level, a horizontal line is

LASER beam projected through transit optics provides elevation reference for grader blade.

GRADER operator watches the target and adjusts blade to keep the laser beam between reference marks.

POSTS under truck bed stabilize it to provide a solid platform for the laser. Power supply is truck battery.



TARGET is a piece of plexiglass, sanded to make it translucent, in a frame that moves with the blade.

penciled through the spot on the target.

With the laser beam level, the grader operator knows that if his blade is at proper elevation, the spot will be on the penciled line. Parallel lines are then drawn above and below the grade elevation line to show allowable deviation from grade. On the Kodak job, the tolerance was ½ in. above and below.

When the grader has finished the sector covered by the laser, the instrument is moved to another convenient location. The transit is leveled and the laser beam is projected through it to the target on the grader which is again positioned over the hub. Since the laser is at a new elevation, the old reference line is erased and a new one penciled in before the grader tackles the new sector.

Target discovered by accident

When the method was first tried, the target was a sheet of aluminum, a common target material for laser use in tunnels, and the beam was projected from behind the operator to the target in front of him. The operator viewed the reflected spot of the laser beam. However, in daylight there was not enough contrast between the laser spot and the bright target, so other materials were tried.

One of the trial targets was made from plexiglass, sanded on one side to make the spot reflect. It was discovered, while standing in front of the grader while the laser beam was being projected from behind the target, that the spot was easier to see when viewed through the translucent plexiglass. The direction of the grader was changed from moving away from the laser to moving toward it so the operator could look at the spot projected through the target instead of its not so easy to see reflection.

Easy to check grade

The method produced an easy way to check grade. A target is mounted on the front of the grader so that the laser beam can be used to show the elevation of the front wheels. Then, as the grader moves over the area, the operator can quickly determine high and low points by noting the deviation of the laser spot from the reference line. A truck was also used to carry a target over the area but it was found that its shorter wheel base and softer suspension caused too much bounce for accurate checking.

Kodak's distribution center project, where the laser blade control was first used, consists of a warehouse and office building which required a total graded area of about 190,000 sq. ft. about 110,000 tons of imported material, obtained from a pit operated by Redgwick and Banke. An additional 130,000 tons of fill was used on the site outside the building area.

Imported material was loaded by a Caterpillar 988 rubbed-tired loader and hauled in bottom-dump trucks to the site where it was spread by a Cat DW20 pulling a Bee Gee 16-ft. industrial drag scraper. Two Cat No. 14 graders were used to windrow oversize rock out of the fill.

The structure will be built with cast-in-place and precast concrete. Completion is scheduled for May 1969.

Key men and firms

The laser blade control method was developed by Don Redgwick, vice president and project manager for Redgwick and Banke, Inc., subcontractor to Underground Construction Company.

Eastman Kodak's distribution center for its Pacific Northwest region was designed by Kitchen & Hunt, architects. Norman W. Davis, project engineer, is Kodak's representative at the site.

John Marcott is superintendent for Swinerton & Walberg Company, the prime contractor. □