National Concrete Pavement Technology Center

Stringless Paving

tech transfer summary

Stringless paving has the potential to reduce construction costs and decrease traffic delays during roadwork.

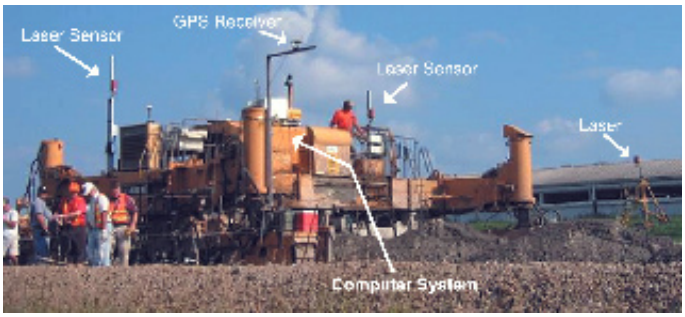
Objective

Recent research evaluated the potential of new stringless paving control methods. Stringless paving control using a global positioning system (GPS) was compared with the conventional string-line method of paving control for the following characteristics:

- vertical and horizontal alignment
- concrete yield quantity
- pavement thickness/depth
- subgrade and pavement surface elevations
- pavement profile
- pavement smoothness

Problem Statement

Conventional concrete pavement construction uses a string line on one or both sides of the paving train to ensure proper pavement thickness and alignment. This approach requires space on each side of the paving machine to set the string line. The placement and verification of the string line is time intensive and limits access to the area in front of the slip-form paver. Stringless control has the potential to provide the required guidance without the need for string lines.



Slip-form paver with GPS equipment attached

Technology Description

Several companies have developed stringless equipment control and guidance systems using technologies such as robotic total stations and GPS with laser positioning. These stringless technologies have been successfully implemented on construction earthmoving and grading projects. This research tested this technology in a new area—concrete paving.

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RESEARCH PROJECT TITLE
Stringless Portland Cement Concrete Paving (TR-490)

SPONSORS
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The mission of the National Concrete Pavement Technology Center is to unite key transportation stakeholders around the central goal of advancing concrete pavement technology through research, tech transfer, and technology implementation.

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Technology Description (continued)

The research evaluated a GPS system developed by GeoLogic Computer Systems and installed on CMI Terex Corporation slip-form paving train equipment. The research findings should be applicable to similar equipment from other manufacturers, but other brands may require minor modifications such as the addition of proportional hydraulic control valves.

The system evaluated uses GPS accompanied by lasers to control and guide paving equipment such as trimmers, slip-form pavers, and texture/cure machines. A GPS receiver is mounted over the front right track of the slip-form paving machine and two laser sensors are mounted on separate laser masts located on opposite sides of the paver. The lasers improve the elevation accuracy of the GPS control but are not essential to the system.

A computer on the paver runs the system. The computer requires a three-dimensional (3D) digital design of the construction project. A land survey may be required to convert some data to 3D GPS coordinates.

Key Findings

- Stringless GPS control can successfully guide the slip-form paver and adequately control the concrete yield quantity, pavement depth, and surface elevations.
- The GPS receiver location on the slip-form paver is critical to coordination with the 3D design program and proper machine control.
- Paving equipment hydraulic controls and computer software must be modified to allow for uniform changes in elevation as the equipment moves forward to meet profile specification requirements.
- GPS control can provide a reasonably smooth riding pavement surface. However, additional software development is required to uniformly produce surface profiles smooth enough to meet Iowa DOT specification requirements for incentive payments.

Implementation Benefits

Stringless paving eliminates the need for string lines. This carries many advantages:

- Avoid project delays caused by time-intensive staking of string lines.
- Reduce contractors' move in and move out times.
- Have shorter construction periods that disrupt traffic.
- Reduce labor costs of placing and removing string lines.
- Increase the amount of traffic access along the road, especially on county roads where the shoulders are limited.
- Reduce the need to set string lines in hazardous areas.
- Experience greater work access to the slip-form paver and surrounding area.
- Eliminate the need for string-line sensors on paving machines.
- Decrease the overall width of paving machines by eliminating need for sensors, making it easier and faster to cross bridges and other tight spots.

Laser height gages

GPS installed on the all-terrain vehicle for staking and other survey work

Sample screen from stringless paving control computer

Stringless paving train