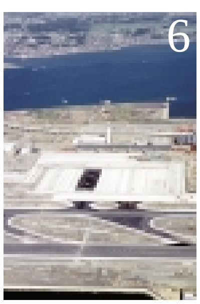
Vol. 32, No. 1

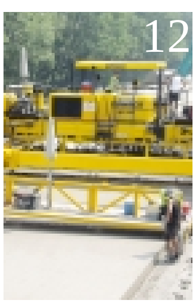
GOMACO WORLD

Special: International Edition

Vol. 32, No. 1

GOMACO WORLD





Please visit our Web site at http://www.gomaco.com
GOMACO World magazine at http://www.gomaco.com/gomacoworld
GOMACO World Editor Kelly Krueger at kkrueger@gomaco.com

Address all communications to *GOMACO World* Editor. If you do not receive *GOMACO World*, and would like a complimentary subscription, please contact GOMACO Corporation, PO Box 151, Ida Grove, IA, 51445, USA, 712-364-3347 or e-mail bwonder@gomaco.com.

One of the First Concrete Projects in Baja Paves with a First of Its Kind Paver

Photos by Kelly Krueger HW-120312 D16

The project is only 7.5 miles (12 km) of a total of 37 miles (60 km) of new concrete roadway in Baja California, Mexico. The road is one of the main thoroughfares through Baja and carries an estimated load of 1800 cars and trucks per day. By most standards, that size of a project wouldn't be drawing the amount of attention this new roadway is attracting.

Perhaps the real attraction is this project is one of the first concrete roadways to be paved in Baja California. And it's not just any slipform paver doing the work, it's a new generation GHP-2800 four-track paver and it's the first of its kind in the country of Mexico.

It's part of Mexican President Vincente Fox's plan to bring the roadways of his country to the same level of quality as those just across the border in the United States. The President is watching the project so closely that he even plans on visiting the job site himself to see the new paver and the product it produces.

The new generation GHP-2800 is co-owned by two companies, Alta Ingeniería 2000 and Constructora Gallego Ingeniería, located in Mexicali, Mexico.

"I saw a GOMACO paver at work on Highway 111 in Calexico, California, and I was in love with the machine," Alberto Woolfolk, director general of Alta Ingeniería, said. "Our government is very interested in concrete projects and right now seemed like a good time to buy a paver. We want to do a very good job here so we can bring in more concrete projects to Baja California."

They have an ambitious goal. Most of their crew has never worked around concrete and never even seen a slipform paver. Woolfolk knew that he needed a manufacturer that could not

HW-120312 D5

The first new generation GHP-2800 and a T/C-400 in Mexico are at work on a new concrete highway project in Baja California.

only provide him with a state-of-the-art paver, but also the training and on-site personnel necessary to teach his crew the basics of slipform paving.

"A lot of people here in Mexico said I was a little crazy, but I didn't let them stop me," he explained. "I saw the new generation GHP-2800 at work and I liked it. I visited GOMACO's factory in Ida Grove, Iowa, USA, and I was impressed with the people I met there and the machines they produced. I feel that the machine I bought has the best technology of any on the market today. Plus, GOMACO has a service department to train my people."

Three weeks before paving was scheduled to begin, GOMACO sent serviceman Tom Phillips down to Mexicali to assist with paver setup and training. On December 9, 2003, the new generation GHP-2800 and its crew paved for the first time.

Concrete is delivered to the job site by 12 end-dump trucks carrying 13 yard^3 (10 m^3) loads of concrete. The batch plant is owned by Alta Ingeniería and is located approximately 6.2 miles (10 km) from the job site.

"I like having our own batch plant because I feel that we have more control over the concrete mix design and its consistency," Woolfolk said. "We know that the quality of the concrete being delivered to the paver is very good."

The subbase is 6.7 inches (170 mm) thick of cement-treated soil with an asphalt layer on top. The GHP-2800 is paving 24.6 feet (7.5 m) wide and 11 inches (280 mm) thick. Dowel baskets are set by hand every 14.8 feet (4.5 m) in front of the paver for transverse joints. A front-mounted bar inserter on the paver places dowel bars into the slab for the longitudinal joints.

An Auto-Float® mounted on the back of the paver helps finish and seal the final slab.

"Our men are very happy with the machine," Julio Mejilla, project superintendent, said. "The machine does all of the work for them and puts a very good finish on the concrete. All the men have to do is cut the joints in and the paver does the rest."

A T/C-400 texture/cure machine follows behind the paver applying a transverse tine finish and curing compound.

The rideability of the new roadway hasn't been checked yet with a profilometer, but Woolfolk is confident they'll have smooth results.

"The government is looking at the specifications right now," he explained. "They are offering a five percent smoothness bonus if we build this road to their standards. I'm confident we'll earn the full five percent."

Production in the first week of paving averaged 1969 feet (600 m) per day. As the crew grew more confident with the machine and their concrete paving abilities, production increased to 3281 feet (1000 m) per day.

HW-120312 D10

A T/C-400 follows the paver applying a transverse tine finish and spray cure to the new roadway.

HW-120307 D17

The new generation GHP-2800 four-track is equipped with smart steering cylinders that aid in paver setup and operation.

HW-120309 D30

The three-position pivoting ladder can be positioned tight against the paver or tilted out for easier climbing to the platform.

HW-120309 D21

> “I saw a GOMACO paver at work on Highway 111 in Calexico, California, and I was in love with the machine,” Woolfolk said. “Our government is very interested in concrete projects and right now seemed like a good time to buy a paver...”

“Most of my men are familiar with hydraulic machines, not pavers, but they know how a hydraulic machine works in general,” Woolfolk said. “The paver, with the G21 control system, is very easy to use and very operator friendly. All of the controls are labeled in Spanish so that makes it very easy for us to understand. Tom, a GOMACO service representative, has been a very good teacher, too.”

The G21 is just one of the many new features Alta Ingeniería is enjoying on the new generation GHP-2800 paver. The low-profile engine shroud gives the operator a complete view of the entire paving operation. Vibrator controls are located on the front of the paver, in line with the vibrators for easy control and access. The ladders to the operator’s platform have a new three-position pivoting system. They can be vertically positioned tight to the paver for minimum-clearance conditions or tilted out for easier climbing and access to the platform.

It is equipped with a powerful Tier II Caterpillar C9, 8.8 liter engine with 335 HP (250 kW). A revolutionary cooling package module incorporates a centrifugal fan for added cooling capacity and noise reduction. The operator, standing on top of the paver on the operator’s platform, can easily have a conversation with members of the ground crew.

Their GHP-2800 is also equipped with a lighting package. They’re mostly used at the end of the paving day when the machine still needs to be cleaned for the next day. Depending on their paving schedule, they may be doing some night pours to keep their project on track for its March 17, 2004, completion deadline.

“The paver is working very good and we love having it,” Woolfolk added. “If you are thinking about starting concrete paving, you need to just collect all the information you can on pavers, then contact GOMACO and buy it. They will teach you how to operate it and be successful with it. If we’re concrete paving in Mexico, then I think you can do it in any part of the world.”

HW-120311 D9

Production for the first-time slipformers has averaged 3281 feet (1000 m) per day.

HW-120310 D36

The new generation GHP-2800 is paving 24.6 feet (7.5 m) wide and 11 inches (280 mm) thick.

GHP-2800 Passes the Test for Japanese Airport

Photos courtesy of Toa Doro Kogyo Company, Ltd., and Taisei Rotec Corporation HW-120302 D17

Japan's new Central International Airport covers 1161 acres (470 ha) and will feature an 11,483 foot (3500 m) long runway. It is the first commercial airport in Japan to feature slipform concrete paving. Two GOMACO GHP-2800s are at work on the project.

A new $6.4 billion international airport is currently being built out of the Pacific Ocean on the eastern coast of central Japan. It's being built on a reclaimed island in Ise Bay, 22 miles (35 km) south of Nagoya.

> Toa Doro Kogyo Company, Ltd., and Taisei Rotec Corporation would be the first contractors to slipform on a Japanese commercial airport.

The new Central Japan International Airport, nicknamed Centrair, extends across 1161 acres (470 ha) and will feature an 11,483 foot (3500 m) long runway that is 197 feet (60 m) wide. Centrair will operate 24 hours a day and will handle international flights from all over the world, including the eastern seaboard of the United States, southern Europe and northern Africa. It's also expected to handle a large volume of commercial cargo. The central region is home to many of Japan's leading manufacturers, including the automobile industry.

Ise Bay's shallow waters and solid sea bed made it an ideal location. Water depths ranged from 9.8 feet (3 m) at its most shallow to 32.8 feet (10 m) at the deepest point. The solid sea bed provided a strong base for the island and eliminates the chance of land settlement occurring.

Land reclamation began in 2000. The work was carried out strategically. Certain areas or subdivisions were completed first so construction could begin earlier on airport features like the passenger terminal.

A major part of the project is paving Centrair's concrete runway and apron areas, an area of approximately 8,611,410 $feet^2$ (800,000 m^2). Three consortiums, each made up of three Japanese contractors, divided the concrete work and agreed to supply their paving equipment. Two out of the three consortiums are using GOMACO GHP-2800 pavers for slipforming.

True concrete slipform paving has never been done before on a Japanese commercial airport. Officials were initially concerned that a slipform paver would not be able to hold the edge that the strict standards called for. A test pour was conducted in February 2003 on site in front of over 50 visitors from 17 different companies, the Japan Slipform Association and the Central Japan International Airport Company.

"All present were in agreement that the tests were extremely successful and 'true' slipforming with the GOMACO GHP-2800 was given the green light for the airport," Tim Nash, GOMACO International Regional Manager - Asia Pacific, said.

Toa Doro Kogyo Company, Ltd., and Taisei Rotec Corporation would be the first contractors to slipform on a Japanese commercial airport.

Concrete paving started in March 2003. Paving passes were 24.6 feet (7.5 m) wide and thickness varied between 16.5 to 18.1 inches (420 to 460 mm). Concrete was supplied by a batch plant on the island just 1.2 miles (2 km) away from the paving site. The concrete mix contained a blast furnace slag powder at a ratio of 9.9 lb/ft^3 (158 kg/m^3). Slump averaged 1.4 inches (35 mm).

Each consortium is using a different placer/spreader. The

HW-120317 D10

Toa's GHP-2800 slipforms on the new runway. They're paving 24.6 feet (7.5 m) wide and thickness varied between 16.5 to 18.1 inches (420 to 460 mm).

HW-120301 D12

Taisei purchased the GHP-2800 paver specifically for this project. They wanted a paver that could meet the strict specifications on this first commercial airport slipforming project.

HW-120316 D28

A T/C-400 follows behind the paver applying a transverse tine to the new runway.

Taisei Rotec's machine operators take a moment to pose for a group photo at Centrair.

Toa / Gaeart / Maeda Road joint venture is utilizing Toa Road's PS-2600. The Taisei Rotec / Obayashi Road / Nippo Joint venture is utilizing Taisei's PS-60.

Placing the concrete is accomplished by utilizing two placer / spreaders per paving pass. Concrete is dumped in front of the placer / spreader by dump trucks carrying 7.8 yard^3 (6 m^3) loads. Toa's PS-2600 spreads the concrete to a thickness of 11.6 inches (295 mm). A mesh cart follows behind and mesh is manually laid on top of the first layer of concrete. A second placer / spreader follows the mesh cart adding an additional 4.9 inches (125 mm) to the thickness of the slab.

Toa's GHP-2800 paver consolidates and finishes the concrete with the "GOMACO edge" the airport specifications requires. A T / C-400 texture / cure completes the paving train, applying a transverse tine to the new runway.

Taisei's paving train is similar. They're using their PS-60 to place concrete. The first layer is spread to a thickness of 12.2 to 12.6 inches (310 to 320 mm). Mesh is laid on top of the layer and the second placer / spreader applies another 6.3 to 6.7 inch (160 to 170 mm) thick layer of concrete on top of the mesh. It's followed by Taisei's new GHP-2800 paver with AutoFloat®.

"Taisei purchased the GHP-2800 specifically for this job," Nash explained. "They decided to purchase a GOMACO because they had serious concerns about meeting the criteria on this extremely important 'first ever' slipform construction on a civil aviation airport."

A third paver on the project could not meet the strict edge specifications and is paving with forms.

"We pay special attention to the

Toa's machine operators pose in front of their GHP-2800 paver at the Japanese airport.

HW-120301 D14

The international airport will open in February 2005. Once open, it will operate 24 hours a day, seven days a week.

HW-120302 D23

HW-120317 D18

Quality concrete is the key to maintaining the "GOMACO edge," said Ryuyi Izawa, Toa's equipment manager.

HW-120301 D1

quality of the concrete to ensure a sharp edge on our product," Ryuji Izawa, machinery manager for Toa Road, said.

A straight edge is just one of the specifications, the consortiums have smoothness specifications, too. Extra steps were taken by both contractors to ensure the smoothest slab possible.

"Your concrete mix design has to be consistent," Tomonori Fujisawa, machinery manager for Taisei Rotec, said. "Delivery of the concrete must also be consistent. We were able to continuously pave without stopping the paver and creating bumps."

Paving is scheduled to be completed in April 2004. Centrair airport will open its doors in February 2005 and Japanese travelers and shipments will have a new gateway.

"We're very proud that the Central Japan International Airport is the first in Japan where the slipforming method has been introduced and applied to," Fujisawa said. "We invite you to please visit us and this airport to confirm it with your own eyes!"

Editor's Note: Special thanks to Toa Doro and Taisei Rotec for sharing photos of their project with *GOMACO World*. We would also like to thank Isao Nakamura, who works with our distributor, Arayama Corporation, in Japan. Isao's help and translating skills made this article possible.

HW-120315 D30

Concrete is spread to a thickness of 11.6 inches (295 mm), mesh is laid on top and a second placer/spreader adds another 4.9 inch (125 mm) thick layer.

First Time Slipforming in Australia

Bolte Civil Proprietary Limited is a company based out of Wyong, New South Wales, on the eastern coast of Australia. The company has been in business for 11 years, specializing in residential subdivisions and civil works. Until last year, all the curb and gutter and concrete roadway on their projects was subcontracted. It was an arrangement that was causing Neil Bolte, managing director of Bolte Civil, some frustration.

"We started looking at a curb and gutter machine to do slipforming ourselves and we ended up with the GT-3600," Bolte explained. "We do some concrete roads and the GT-3600 had the versatility to slipform the roads and other applications."

With a new machine ready to break in, Bolte had to get his crew trained and teach the concrete suppliers what he needed to make a good, slipformable mix design. It was a challenging time for Bolte before they finally developed a good, consistent mix design.

"We run a slump of 1.2 inches (30 mm)," Bolte explained. "We avoid using water reducers because they make the concrete like jelly. You touch it and it runs all over the place."

It's just one of the many tricks that Bolte Civil has learned about slipforming in the few months they've operated their machine.

"Our biggest problem is a lack of trained personnel that are familiar with slipforming, and getting the concrete plants to supply what we want," Bolte said.

So far they've slipformed curb and gutter, roll curb, roadway and also a channel with curb, a 4.9 to 9.8 feet (1.5 to 3 m) wide flow path for drainage with a curb on one side. The amount of finishing work applied to each application is something Bolte is still working on with the local officials.

"People aren't used to things not being steel-trowel finished, but we're trying to get them used to the idea," Bolte said. "The GT-3600 is putting a consistent finish on our product out the back of the machine and we're not having to touch it much."

Two finishers work behind the machine

Photos by Paul McLarnon CG-090306 D17

Bolte Civil undermounts a 9.8 foot (3 m) wide mold to their GT-3600 to slipform this section of roadway on a project in New South Wales, Australia.

CG-090304 D20

Bolte Civil sidemounts their mold to slipform 4.9 feet (1.5 m) wide flow path with integral curb.

CG-090305 D9

The GT-3600's All-Track Positioning allows Bolte Civil to position the legs in the necessary alignment to pave this section of new roadway.

"We started looking at a curb and gutter machine to do slipforming ourselves and we ended up with the GT-3600. We do some concrete roads and the GT-3600 had the versatility to slipform the roads and other applications," Bolte said.

CG-090305 D7

A majority of Bolte Civil's projects are slipformed over continuous steel reinforcing.

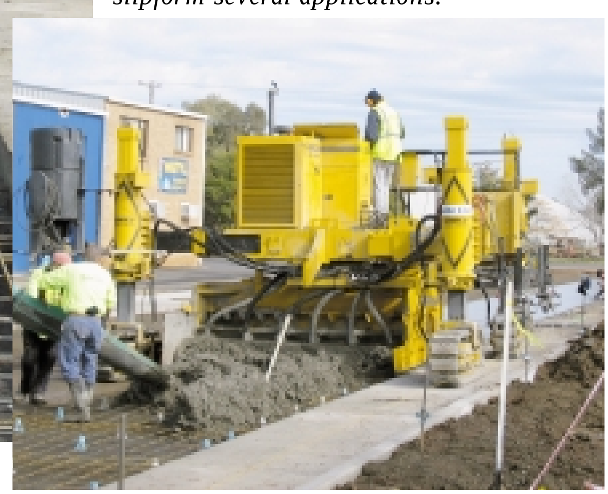
doing some handwork and inserting contraction joints and gutter outlets. Contraction joints are every 9.8 feet (3 m).

"We're not up to measuring thousands of feet per day and that sort of thing yet," Bolte said. "We're happy if we can run about 4.9 feet (1.5 m) per minute. We just try to average that with whatever we're doing and it gives us a nice result."

So far, the first time slipformers have tackled radius work down to 9.8 feet (3 m) on one of their projects, and are hoping to tackle some tighter ones on upcoming projects.

Bolte Civil is looking forward to the future and more projects with their GT-3600, both in Wyong and also Dubbo, where the company has a satellite office. They're currently slipforming 161,464 feet^2 (15,000 m^2) of new roadway on a subdivision development in Wyong.

The versatility of the three tracks on the GT-3600 (below) allows Bolte Civil to slipform several applications.



CG-090305 D5

The World's *Quietest* F
Slipforms A *Quiet* New R

– Betonac nv slipforms noise-reducing concrete in Belgium with their new generation

Paver
oadway

GHP-2800 four-track paver –

Photos courtesy of GOMACO International Ltd. HW-100304 D6

HW-100308 D25

Betonac is slipforming 10.3 miles (16.6 km) of continuously reinforced concrete pavement on the E40/A10 freeway connecting Brussels to Ostend.

Betonac nv has been slipforming with GOMACO equipment for 25 years. The company is based out of Sint-Truiden, Belgium, and their inventory of equipment has included GP-2500 pavers, Commander IIIs, and most recently, a new generation GHP-2800 paver.

They are a general contractor specializing in tunnel, bridge and highway work. They've completed several challenging projects with a number of difficult build aspects during those 25 years.

One of their recent projects may have proven to be the most difficult. The E40/A10 freeway runs from Brussels, the capital city of Belgium, to Ostend. It is one of the country's busiest highways and carries up to 57,000 vehicles per day.

Project specifications required the 10.3 miles (16.6 km) of new roadway be completed in 150 calendar days. Betonac stepped forward and committed to completing the project in just 126 days and faced penalties of $50,000 per day for every day they might exceed the agreed upon completion date. Adding to the overall difficulty of the project was the unheard of high temperatures in Belgium at the time.

They had to contend with tight-clearance working conditions to maintain a haul road for themselves, while keeping three lanes of traffic open to the public on both sides of the highway. With such tight working conditions, there was no room to set stringline. Betonac turned to GOMACO International Ltd., their distributor Oswald De Bruycker nv, and Leica Geosystems for suggestions. Their answer, the Leica LMGS-S 3D stringless guidance system to help them work within the project's tight constraints and allow them to pave both night and day, 24-7.

The project also required the removal and replacement of the existing barrier wall. Betonac used their new three-track

HW-100304 D15

Commander III to slipform 25,098 feet (7650 m) of New Jersey-style barrier wall. The wall was 31.5 inches (800 mm) wide at the bottom, 15.7 inches (400 mm) across the top and 50.4 inches (1280 mm) tall.

It was slipformed with reinforcing steel cables and a very dry concrete mix design with a slump averaging only 0.4 to 0.8 of an inch (10 to 20 mm). The low-slump concrete created problems with the ready-mix trucks when it came time to unload. The concrete would stick inside the mixer and because of the problem, production was slowed down and 12-hour days became 16-hour days. Production averaged 131 feet (40 m) per hour.

"We wanted the stringless technology not only because of our space limitations but also the promise of better rideability. We are more than satisfied with the system and our GOMACO paver," Boulez said.

"We've been working with Commander IIIs for 25 years and we find it to be a very compact and versatile machine," Felix Boulez, CEO of Betonac, said. "It's a state-of-the-art machine and we've had excellent support from GOMACO and their distributor Oswald De Bruycker nv."

With the barrier in place, work could be carried out on the roadway itself. The decision had already been made to slipform the project using the stringless guidance system.

Betonac hired a third-party surveying company to provide a survey crew to prepare the job-site data, operate the Leica total stations and do the as-built control checks during the paving operation. This allowed them to concentrate on the paving aspect of the project while also learning how to operate the 3D system.

"Traditionally, when contractors are setting stringline, the surveyor has coordinates and levels and he stakes out points, drives the pins in, and sets the levels and stringline. It's a costly, time-consuming and error-prone process," Karl Soar, Service and Support Manager, Machine Automation for Leica Geosystems, said. "That exact same data can be used for the 3D system. It's just a matter of reformatting that information into a file that we can use on our controller on the paver.

"We then only need a list of the survey control or reference points around the site. These control points allow us to accurately position the total stations within the project."

The paver is then equipped with front and rear slope sensors to measure the machine's position and any cross slope in the slab. Prisms are also mounted to the paver and used by the total stations for tracking purposes. Leica's computer, loaded with the project coordinates, is positioned next to the G21 controller on the paver and the two are interfaced.

"It's remarkable," Soar said. "All we do is plug in one cable that lets our computer talk to the G21 controller and that's all the interfacing to the paver that needs to be done. Once the G21 is set to the Leica mode, it ignores any signals coming in from the wand sensors and listens for the Leica messages coming over the CAN bus."

HW-100304 D1

The roadway is sprayed with a sugar and water mix retarder and covered with biodegradable plastic as part of the curing process.

HW-100305 D13

Betonac was also responsible for slipforming the New Jersey barrier wall on the project. They used their new generation Commander III to slipform the 50.4 inch (1280 mm) tall wall.

Photo courtesy of Jim Coffman HW-100310 D1

Two Compactor batch plants were on-site providing concrete for the project. Since paving was carried out 24/7, each plant operated in 12 hour shifts. GOMACO International Ltd. is an agent for Compactor batch plants in the UK.

HW-100305 D17

The new generation GHP-2800 is equipped with GOMACO's exclusive G21 control system.

The new generation GHP-2800, with the Leica components installed, was ready to start paving. The paver was moved into position and the total stations were set up and orientated to their positions by taking measurements off the predetermined reference points. The total stations were then aimed at the prisms on the GHP-2800 and started the tracking process. The Leica computer could immediately see whether the paver was positioned correctly. The G21 was set to the Leica steering and elevation modes and the paver brought itself on line and to level.

Betonac utilized three total stations on their project. Two of them measured the two prisms on the paver, six times per second, and sent those measurements to the Leica computer.

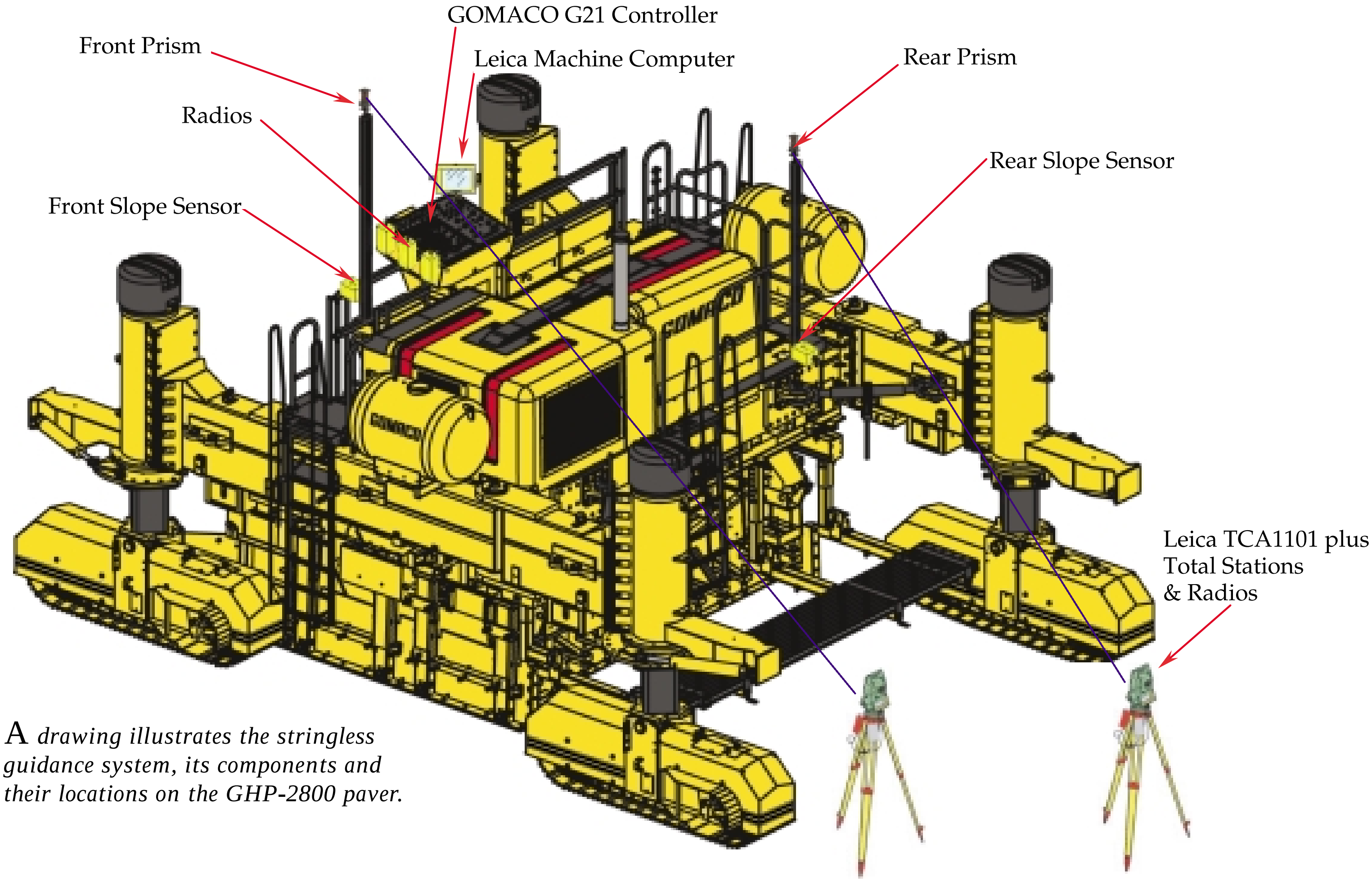
The third total station was conducting as-built checks behind the paver. The as-built checks measure the line and level of the new concrete roadway and provide instant feedback regarding the accuracy of the new slab. The third instrument is also used for leap frogging.

"Between 400 to 500 feet (120 to 150 m) you need to leap frog your total station," Soar explained. "You take that third instrument, move it to where it's suitable for the next part of paving, set it up level and take some shots to the reference points to bring it into the coordinates system again. When it's time to make the switch, you press a button on the Leica computer and it tells that third instrument to lock onto one of the prisms and start measuring.

"The total station that was previously looking at the machine now becomes your redundant instrument for doing your as-built checks and for leap-frogging again at another convenient time."

Safety measures are built into the system, too. If a problem arises, for instance, someone parks a truck in front of one of the total stations and the instrument can't see the prism on the paver, it will instantly send an error signal to the computer and the measurement process stops. The computer receives the error signal and sends a stop signal to the G21. The G21 puts the paver into stand-by mode, shutting off the vibrators, tampers and augers until the problem is corrected.

"There's no danger that the machine will pave incorrectly or pave out of tolerance," Soar said. "It's similar to a job using stringline. If the stringline is accidentally broken, the wand sensors go into the extremes of their measurement mode and the controller picks that up and



A *drawing illustrates the stringless guidance system, its components and their locations on the GHP-2800 paver.*

puts the paver in stand by.

"One of the myths surrounding 3D control is that it's a 'black-box' - a new, and difficult-to-grasp technology, when in fact it's a very similar concept to running on stringline. There are checks and balances to stop the paver in case of errors or problems."

One of the main advantages of the stringless system, on this project, was its ability to work within the project's tight clearances. Six live lanes to carry heavy traffic had to be left open, a haul road had to be maintained, and the paver needed room to operate. Betonac had originally hoped to sensor off the new barrier wall, but decided that just wouldn't work in this situation. Clearances were so tight even the tripods that held the total stations had to be modified to fit.

"We maximized the amount of available space around the paver without compromising safety and also maintained an access route for the trucks to bring the concrete in. The logistics were pretty nightmarish," Soar said. "We had to develop this unusual-looking tripod that props itself up on the barrier. It was the perfect place for them. There were no line-of-sight interruptions and being perched on the barrier meant they had a rock solid foundation."

HW-100305 D16

A *Leica computer is mounted next to the G21 controller. Information from the sensors and paver logistics are displayed on the monitor.*

A *total station sends measurements to the Leica computer six times per second.*

HW-100305 D12

HW-100305 D11

T*wo total stations work behind the paver sending measurements while the third measures the accuracy of the slab.*

Betonac brought in two mobile batch plants to produce concrete for the project. The Compactor-brand batch plants are each capable of producing 157 yard^3 (120 m^3) of concrete per hour. The plants are computer assisted, operated by remote control and capable of adding six different types of additives to the mix design. Each plant was equipped with a tank that holds up to 39,626 gallons (150,000 l) of water.

The plants operated in 12-hour rotating shifts producing the noise-reducing concrete. The special mix design included a minimum cement content of 25 lb / ft^3 (400 kg / m^3), entrained air, a high percentage of sand, and aggregate no larger than 0.4 inch (10 mm). Slump averaged 0.8 to 1.18 inches (20 to 30 mm).

Concrete was delivered to the paver by semi-trucks with open beds hauling 10.5 yard^3 (8 m^3) loads. There wasn't enough room for a placer / spreader and the trucks couldn't drive on the grade, so the concrete was dumped into a holding container. An excavator then placed it in front of the GHP-2800.

The new concrete was slipformed on the milled down existing asphalt with continuous steel reinforcing placed on top. The project was paved in four 10.3 mile (16.6 km) passes. The width varied between 23.8 and 25.8 feet (7.25 and 7.85 m) and had a thickness of 9.25 inches (235 mm).

During a 24-hour shift, Betonac's production averaged 107,643 feet^2 (10,000 m^2). Their highest production on the project was 9150 feet^2 (850 m^2) in one hour.

HW-100306 D11

An exposed aggregate finish makes this new roadway extremely quiet to drive on.

Finishing the noise-reducing concrete was an extended process. First of all, an Auto-Float® mounted to the back of the GHP-2800 helped seal and finish the new roadway. Behind the paver, another machine sprayed the concrete with a sugar and water mix retarder before it was covered with a special, biodegradable plastic. The plastic was left on between five to eight hours before it was removed. The concrete was then washed and brushed out with another machine to produce the exposed aggregate finish associated with noise-reducing roads.

Throughout the paving process, rideability and final smoothness of the finished roadway was a concern. The project specifications required a ride of only 0.24 of an inch per 9.8 feet (6 mm per 3 m). Betonac's ride came in under the spec by half. They averaged only 0.12 of an inch (3 mm).

"We were checking the concrete immediately behind the paver with the Leica prisms," Boulez said. "We wanted the stringless technology not only because of our space limitations but also the promise of better rideability. We are more than satisfied with the system and our GOMACO paver."

They especially like the digital G21 controller on the GHP-2800.

"It's a state-of-the-art controller that is open for future evolution, too," Boulez explained. "Our four-track paver has smart cylinders that allow us to steer our machine a lot more precisely, within millimeters. Selective steering makes it easier to maneuver.

"It is very easy to move and load for transport. The lower profile helps with that, and the operator can see more around him because of it. It's a quiet machine, too. People can easily talk to one another while working around it. The whole crew is in love with this machine and the 3D system."

Even with the aggressive completion schedule Betonac set for themselves, they finished the E40 / A10 project four days early and earned a $25,000 bonus for each day they finished ahead of schedule.

In just 122 days, Betonac placed 25,098 feet (7650 m) of safety barrier and 4,090,420 feet^2 (380,000 m^2) of noise-reducing concrete roadway. A total of 28,000 tons of cement and 4310 tons of steel reinforcement was used on the project.

Editor's Note: *Special thanks to Pascale Van Huffel, who works with our distributor, Oswald De Bruycker nv, in Belgium. Pascale's assistance and translation skills made this article possible.*

HW-100308 D10

Project specifications required a ride of only 0.24 of an inch per 9.8 feet (6 mm/3 m). Betonac averaged 0.12 of an inch (3 mm).

HW-100304 D23

There was no room for a haul road, so concrete was first dumped into a holding container before an excavator placed it in front of the paver.

A "Green" and

After the slopes are finished, they're sprayed with a seed mixture that grows in the porous concrete and roots in the soil below.

The River Law is the governing rule which all contractors must follow while working on flood control and water utilization projects in the country of Japan. In 1997, that law was amended to not only include the work on the projects, but also to include the preservation of the environment.

Until just last year, the usual method of making environmentally-friendly flood control slopes involved placing precast concrete panels along the bank of the slope. Native grasses and plants could then grow up through the openings in the precast panels.

The problem was, though, that plants rarely grew in thick enough to cover the panel. It wasn't the aesthetically pleasing look most people were hoping for. The process of laying the panels is also time consuming and expensive for contractors. A different method needed to be developed that was less labor intensive, easier to accomplish and, ultimately, had the finished look that people wanted while preserving the environment in case of flooding.

One Japanese contractor, Sato Road Company Ltd., is taking the lead in building these new, environmentally-friendly "green" flood control projects. They're using their GOMACO RC Conveyor and SL-450 slope finisher as part of the process.

Sato Road developed the perfect solution. They created a new type of concrete mix design with coarse aggregates, cement paste, mortar and a 25 percent air-void content. The no-fines mix could then be placed on any slope with their SL-450 finisher. The new concrete slope would be porous enough to allow plants and grasses to grow root systems into the earth below. In the event of a flood, the plants could hold firm to the soil below and the result would be less erosion and damage due to the flood waters within the canal.

The idea was embraced by officials and the first project was built. Sato Road introduced the "Eco-Based Construction Method" to the country of Japan for the first time on a project

Sato's RC Conveyor places the no-fines concrete mix on the flood control slope.

Photos courtesy of Nikkie Business SL-010401 S2

Easy Solution for Flood Control Problems

reconstructing the bank of the Akishino River in the Nara Prefecture.

The rebuilt river canal is 210 feet (64 m) long, finished at a width of 13 feet (4 m) and had a total work area of 2917 feet^2 (271 m^2). The canal had a 26.5 degree slope and would have a finished thickness of 7.9 inches (200 mm). The project would take just two days to complete.

SL-010401 S1

Ready-mix trucks hauled the no-fines concrete mix to the job site. They discharged directly into the hopper on Sato Road's RC Conveyor. The RC Conveyor placed the concrete uniformly across the width of the canal.

An SL-450 slope finisher followed behind the conveyor and finished the porous concrete to the required specifications.

"Backhoes, or small compacting machines, are sometimes used to place the concrete on projects," Yoichi Noguchi, technical division manager at Sato Road, said. "Under such methods, however, the rolling pressure cannot be kept constant, thus resulting in variations in quality in the concrete. The cylinder finisher is designed to compact the concrete with rollers, applying a predetermined pressure to the concrete, which assures a uniform concrete placement."

During the first day of production they finished approximately 1830 feet^2 (170 m^2) of canal. The second day they finished the project by completing the remaining 1076 feet^2 (100 m^2) of canal. Production averaged between 807 to 1076 feet^2 (75 to 100 m^2) per hour on both days of the pour.

"If we had placed precast concrete units by manual labor, we would have completed an area of only approximately 538 feet^2 (50 m^2) per day," Noguchi explained. "The new method can carry out the work at a two to three times faster pace compared to those conventional methods."

Not only is the new method faster than the conventional precast concrete panel method, it is also more economical. Noguchi estimates the average savings per project is approximately 20 percent.

A third advantage of Sato Road's new porous concrete method is that it accomplishes both environmental preservation and flood control for the canal, two major objectives in Japan's River Law.

"There are other various advantages, too," Yoshio Adagawa, chief researcher for Japan's Advanced Construction Technology Center, said. "For example, you can control the kind of plants that will root inside the concrete to give it a natural look. For all of these reasons, I believe the use of porous concrete will continue to increase in the future."

Sato Road also believes in the future of "green" flood control slopes. After completing their first project with the new method, its parent company, Sato Kogyo Company Ltd., has made Sato Road its own independent company. In this sense, the "Eco-Based Construction Method" will serve as a new kind of business for Sato Road. They have even formed a new association to promote their "green" ecologically-friendly paving, called the Eco Base Association.

SL-010401 S25

The SL-450 assures uniform concrete placement and slope thickness and finishes the slopes at a much faster rate than placing preformed concrete panels.

SL-010401 S24

Sato Road introduced the "Eco-Based Construction Method" to Japan on this flood-control project.

GOMACO's Non-Contact Profile Device – The GSI®

A GOMACO World interview with Kevin Klein, research and development manager, and Mark Brenner, research and development controls design engineer

EG-110304 D16

Both sonic and slope sensors mounted to the GSI's frame take readings simultaneously to determine pavement smoothness.

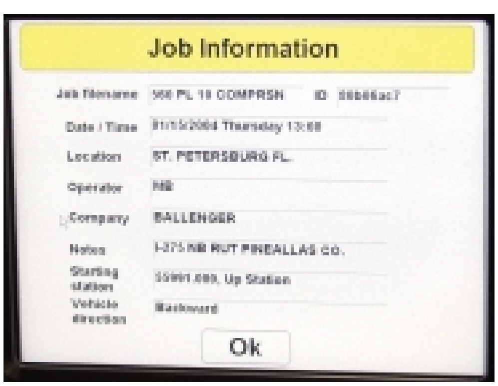
What is the GOMACO Smoothness Indicator (GSI)?
Klein: It's a non-contact profile device which can be used to develop profilographs for several different types of road surfaces. Actually, there are several ways to use it, some that we don't even know about right now.

How do you set up and operate the GSI?
Klein: Every step of the way we've tried to make it easy to operate and user friendly. Most of the technology is in the software. All of the machine components are "off the shelf items," but the software is unique. As far as set up, at the beginning of the project, the sensors and components have to be mounted onto the GSI machine or on the paver itself. It's not necessary to have the GSI printer on board at all times because you can collect data and print it out at a later time. There are a couple of calibration steps that need to be done for initial setup to calibrate the encoders or the pulse pickups in the motors. This calibrates the distance measuring devices that are on the machine. You drive the machine a known distance and then enter that distance into the GSI computer.
Brenner: You push start on the touch screen, run your machine the specified distance, stop, and then enter the exact length that you traveled. The distance traveled doesn't matter. If you went 105 feet (32 m) and overshot your 100 feet (30.5 m) line, you don't have to start over. You simply type in 105 feet (32 m) and it will calibrate to that measurement.
Klein: The next thing in setup is to enter the job-site information into the computer: highway number, direction of travel, job, contractor, city, state, etc. Then you're ready to run.

How do the sensors know where they are on the frame and what they're measuring? Do they refer back to the left wheel track?
Brenner: Actually the sensors don't need to know, the GSI computer needs to know where the sensors are located in relationship to the wheels on each end of the frame. You have to input a measurement that is the distance between the two wheels because there's an encoder or PPU mounted at each end on the wheel. You then input distance measurements for each set of instruments from your left wheel. The GSI computer then knows where each sensor is, based on these recorded measurements. For example on a radius... the sensor on the inside radius will have a shorter distance of travel than the one on the outside radius. It all refers back to the left wheel track.

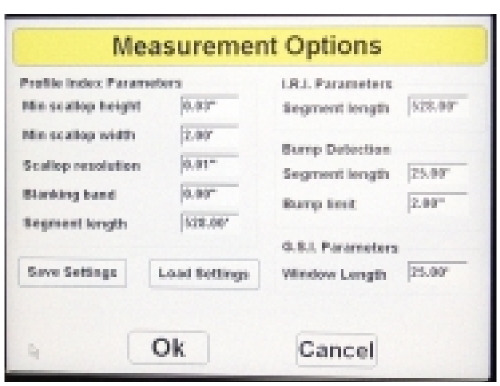
Are you measuring the slab in the wheel path all the time?
Klein: No, sometimes specifications call for quarter traces, but to our understanding, measuring the wheel trace is the most common. It all depends on the state's specifications.

What is the minimum amount of equipment involved?
Klein: To do a single trace, you would



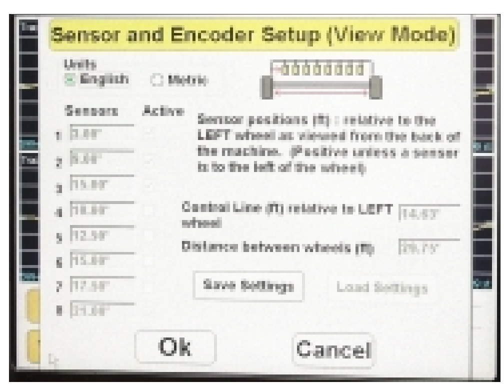
EG-010410 D8

Part of calibrating the system is entering job-site information into the GSI's computer.



EG-010410 D10

The GSI provides ride numbers for three different indexes with this set-up screen.



EG-010410 D2

Sensor positioning has to be measured out so the GSI computer knows what it's measuring.

need what we are considering a single trace GSI unit. The unit includes the GSI computer, two sonic sensors, a slope sensor, and all the mounting hardware and cables. If you are mounting on a paver, you're also going to need two encoders, one for each side.
Brenner: There's also a CAN Gateway.
Klein: In fact, on the GSI machine, there are actually two CAN Networks, one for the GSI and one for the machine control. They're both on the same machine, but they don't communicate with each other.

Can it be mounted to an ATV?
Klein: Correct, assuming that you can get the ATV to travel at steady speeds less than 80 fpm (24.4 mpm).

What kind of reports can you output from the information you collect from the GSI?
Brenner: There are three indexes being calculated continually as the machine collects data. The GSI index, PI or profile index, which is based on the California profilograph and the IRI (International Roughness Index). You can also export an .erd file, which is currently used for IRI traces.
Klein: They are all derived from the true profile of the surface, determined by the data we are collecting. Those three happen all the time, the way the system is set up now.
Brenner: External of the system, we can export the file and use it to analyze all other types of indexes off the true profile. If you can create a true profile, you can create any index required.

How do you identify where your bumps are located?
Klein: Both through the printed report or by calling up the run on the GSI computer monitor. Each shows the

GOMACO's GSI is designed for anyone who needs to measure the smoothness of a surface.

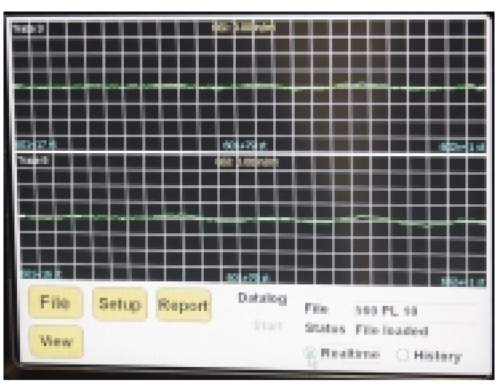
measured distance and where exactly the bump is located.
Is there any way to alter the data to take out a bump?
Klein: It's almost impossible. We're taking measurements every two inches (51 mm), even though we're getting readings 40 times per second, as the machine indexes forward. We're collecting large amounts of data to develop this profile. I don't think there's any way that the data could be altered. There are too many things that are related to the job site to accomplish that.

Is there an on-the-go bump alarm?
Klein: Yes, right now, a screen comes up with a warning window that says "bump" and you can go from there to look at where the bump is. We have an output for an external component like a buzzer or a light that we can drive from the computer.
Brenner: There are three bump alarm options. One is the external output, one is a pop-up screen and the other is an external warning without the window popping up on the computer screen.

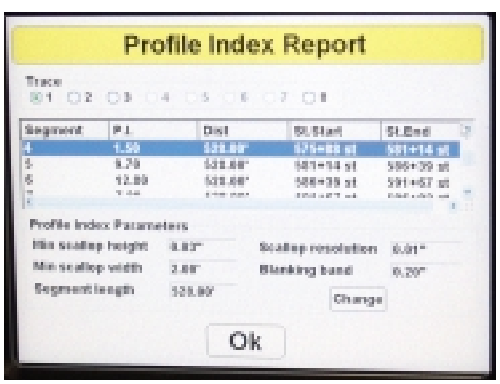
After you've fixed your bump and re-run your GSI over that area again, does it make a separate script so you can see the improvements you've made?
Brenner: It saves over the file that you've just previously done.
Klein: We're developing a way to store that original bump data someplace else. Right now, if the machine moves forward, it counts so many feet. It knows and keeps track of the distance it's traveled. If it starts backing up, it starts deducting from that number.

Has the GSI been tested for accuracy?
Brenner: We've tested against proven manual profilograph machines that are out there. We have good output or graphs compared to those machines that are qualified by different states. We also had very good repeatability.

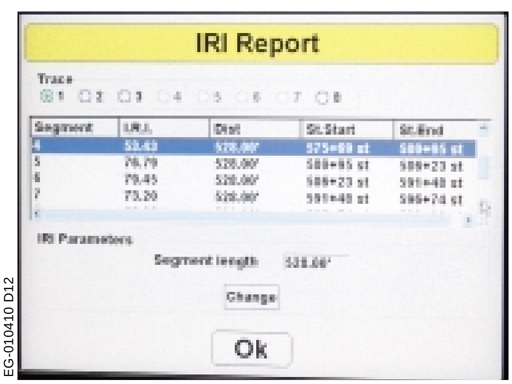
How do you justify the expense of the GSI to a contractor?
Klein: First of all, if it helps him improve his process where he can avoid expensive grinding, I think that's probably going to be a big selling feature or reason to buy. There are also the other applications the GSI makes possible to help his operation: reading the grade ahead of the paver, checking the stringline setup, checking the ride... We also had discussions about being able to develop or determine the volume of concrete it's going to take to do the job based on the grade that is already in place. It's a big issue for subcontractors where the prime contractor is getting the grade ready. If the subcontractor comes in and paves it and the prime has undercut the grade, it costs more for the concrete. We could develop a program where they'd be able to do a run first with the GSI machine, read the grade, and be able to determine what volume of concrete it will take to



Two different sensor traces can be displayed on the computer's screen at a time.



A trace shows how this section of roadway did using the two-tenths blanking band.



This stretch of roadway posted some good numbers on the IRI index.

bring it up to the right elevation for the slab. They could then go to the prime and say the GSI is showing a 10 percent overrun and be able to ask the prime if they want to fix the grade or go ahead and pave. They could make that decision from information supplied by the GSI.

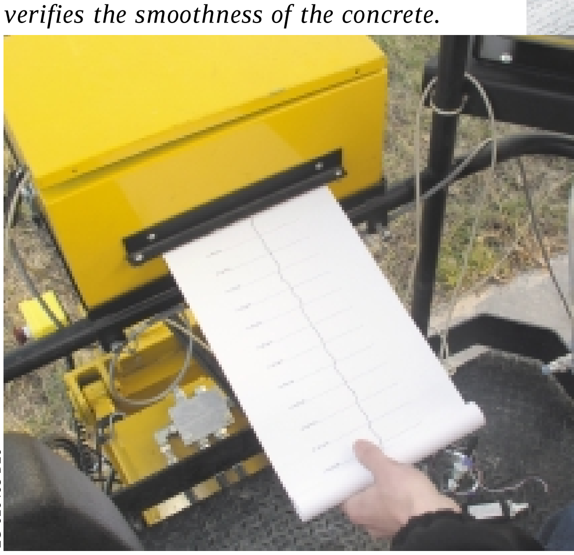
What does the future hold for the GSI? Do you see every mainline paving contractor owning one?
Klein: Absolutely. Not only is the market going to be targeted towards contractors, but there are a lot of other possibilities out there. There are engineering firms, Department of Transportations, Federal highway authorities, and others. We are anxious for the GSI to be certified for accuracy by the states. We believe that the GSI index could become a norm. Instead of having to convert all the information to a California profilograph or an IRI, it's a possibility that the GSI index would be all that's necessary. I think the GSI's future is looking bright with its non-contact versatility.

The GSI is very versatile. It's not just limited to concrete paving.
Klein: Exactly. You can read asphalt slabs, flooring, the stringline, you can read the grade, the pavement behind the paver, behind the finishers, behind the texture/cure machine, two days later... I still believe it's going to teach us a lot about different mix designs for concrete paving and how those mix designs cure and what their curing process does to the ride. It may be a great ride coming out of the paver, but two days later after it's all cured out, there might be bumps showing up because of the way that concrete cured. There may be some concrete mix designs that cure more favorably than others.

Is the accuracy of the machine affected by the fact that it runs on the grade and not on the finished slab?
Klein: The machine is designed to run on any surface, within reason. You can't travel over two foot (0.6 m) rocks or extreme grades. It will give you a trace without worrying about what the machine frame is doing. That was one of the goals or parameters that we set from the very beginning. We had to be able to get this trace with the GSI independent of what the machine was running over. We knew from the very beginning that we had to develop something that would measure everything electronically and establish an imaginary baseline through the software.
Brenner: The machine can go over a fairly rough terrain without interfering with the data that the GSI collects from the slab. The variations in the frame during travel are eliminated in the software by the "two sonic sensor and a slope sensor" unit.

So far, you've worked with a couple of contractors. What have their reactions been so far?
Klein: I think they'd say they're excited about the future possibilities and they're definitely very interested in the concept. They're intrigued by the non-contact concept and the time savings by doing up to eight traces in a single pass.

The GSI's on-board printer instantly verifies the smoothness of the concrete.



EG-010408 D26

EG-110303 D31

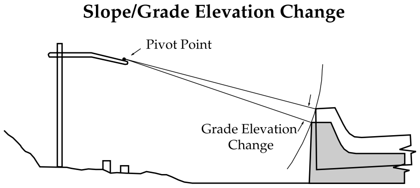
The GSI measures pavement smoothness behind the texture/cure machine on a project near Onawa, Iowa.

Positioning the Line for Cross Slope Changes

by Dennis Clausen,
Director of Training

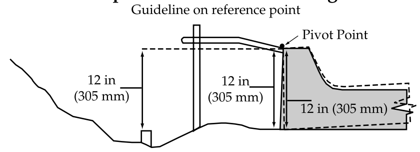
Have you ever wondered why the elevation of your product changes when you change the cross fall (slope)? It's because automated slipform pavers and trimmers pivot around the stringline. The stringline acts as a pivot point when cross slope is changed. As slope is increased or decreased, grade elevation is affected. The amount of elevation change is in relation to the offset and the percent of slope change. At those locations where slope changes are required, it is recommended that the stringline height be changed to compensate. When the stringline is on the left side of the machine and the amount of slope is increased, the stringline should be lowered, and the line should be raised as the amount of slope is decreased. When the stringline is set under the machine and the slope is increased, the line must be raised, and must be lowered when the slope is decreased. (See drawing below)

Slope/Grade Elevation Change



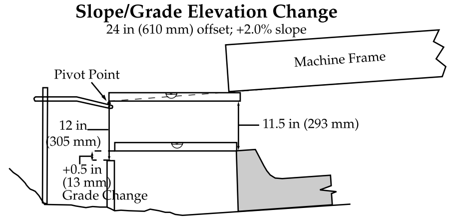
If the stringline guide is positioned even with and at the same elevation as the top back of curb (reference point), there will be no change in the vertical elevation of the curb when the cross slope of the machine is changed. Assume the stringline is positioned 12 in. (305 mm) above the top of the grade hub and the curb is positioned even with (no offset) the stringline. With 0.0% of slope, the top of the curb is positioned 12 in. (305 mm) above the grade hub. If the slope is changed to 2.0%, there will be no elevation change and the measurements will remain the same. *Note:* Positioning the stringline directly over the reference point is impossible in most cases as the trimmerhead, slipform mold hopper and various other protrusions are in the way. Also, with the stringline over the reference point, it would be very difficult for the finishers to do any repair to the product. (See next drawing)

Slope/Grade Elevation Change
Guideline on reference point



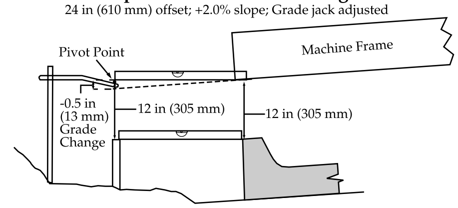
In this example, the slope of the machine was changed to +2.0% (right side higher than left). As the elevation of the right side increases, the machine pivots around the stringline (grade sensor(s) must remain electrically centered). With a 24 in. (610 mm) offset, the elevation of the curb will increase a proportional amount. To determine the elevation change, multiply the offset by the amount of slope change. In this example, multiply 24 in. (610 mm) (offset) by +2.0% (slope change). Therefore, 24 in. (610 mm) x +0.02 (decimal equivalent) = +0.5 in. (13 mm) of grade change on the product. The top of the curb would be +0.5 in. (13 mm) above the top of the grade hub. The measurement between the stringline and the top of the curb would be 11.5 in. (293 mm). The finished product would therefore be 0.5 in. (13 mm) too high. (See drawing below)

Slope/Grade Elevation Change
24 in (610 mm) offset; +2.0% slope



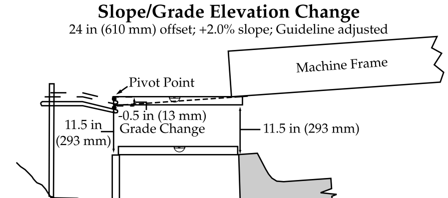
When the slope of the machine is changed to +2.0% with a 24 in. (610 mm) offset, the increase in elevation on the right side will cause the elevation of the curb to increase +0.5 in. (13 mm). To compensate for the increase in elevation, the curb must be lowered. One method used to change the elevation of the curb is to adjust the grade jack(s) (one turn = 0.12 in. (3 mm)). When making a transition from 0.0% slope to +2.0%, the grade jack(s) should be adjusted evenly over the entire transition distance. For example, if the transition distance is 100 ft. (30 m), the grade jack(s) should be adjusted one turn every 25 ft. (7.6 m). The measurement between the stringline and the hub will remain at 12 in. (305 mm) and the top of the curb will be even with the top of the grade hub. The measurement between the stringline and the top of the curb will remain 12 in. (305 mm). The bottom of the machine frame will be 0.5 in. (13 mm) lower. *Note:* This method of grade adjustment is not normally recommended as it relies on multiple people attempting to make the correct adjustments at the correct intervals. It also increases the chance of errors if the grade must be pre-trimmed prior to pouring. (See drawing below)

Slope/Grade Elevation Change
24 in (610 mm) offset; +2.0% slope; Grade jack adjusted



The best method used to change the elevation of the curb is to adjust the stringline. To determine the amount of stringline adjustment at each station (stringline holder), divide the transition distance by the number of stations in the transition. For example, if the transition distance is 100 ft. (30 m), and there are four stations, the stringline should be adjusted in 0.12 in. (3 mm) increments every 25 ft. (7.6 m). The line would be adjusted to the correct measurement at the beginning of the transition. At the first station, the line would be adjusted 0.12 in. (3 mm), adjusted 0.24 in. (6 mm) at the second station, 0.36 in. (9 mm) at the third station, etc. until adjusted the total amount. The distance between the stringline and the grade hub will be decreased by 0.5 to 11.5 in. (13 to 293 mm). The distance between the stringline and the top of the curb will also be decreased by 0.5 to 11.5 in. (13 to 293 mm). The top of the curb will be even with the grade hub. (See drawing below)

Slope/Grade Elevation Change
24 in (610 mm) offset; +2.0% slope; Guideline adjusted



HW-100309 D14

HW-050303 D4

Slipforming London Heathrow's T5 Project in England

A total GOMACO package is at work on London Heathrow's massive T5 runway project. A four-track GHP-2800 paver, equipped with the stringless 3D guidance package, is paving passes 21.7 inches (550 mm) thick with a female keyway in the side of the slab. A GOMACO T/C-400 follows the paver and applies a transverse texture and cure to the new slab in a single pass.

Concrete for the project is being produced by two Compactor batch plants, sold by GOMACO International Ltd. The two plants, synchronized to work together, are capable of producing 445 yard^3 (340 m^3) of concrete per hour.

The airport project has some very demanding specifications that are being met by AMEC with their GHP-2800.

Watch for a complete article on AMEC's work on London Heathrow's T5 project in a future edition of *GOMACO World* magazine.

Work is currently underway on the T5 project at London Heathrow Airport. A GHP-2800 is slipforming slabs 21.7 inches (550 mm) thick. Two Compactor-brand batch plants are providing concrete for the project.

GOMACO

GOMACO CORPORATION
POST OFFICE BOX 151
IDA GROVE IA USA 51445

www.gomaco.com

ADDRESS SERVICE REQUESTED
PRINTED IN USA

PRSRT STD
U.S. POSTAGE PAID
SIOUX FALLS, SD
PERMIT NO. 1209