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Building Toyota's Test Track in Woodstock

SMOOTH SAILING



BUILDING TOYOTA'S TEST TRACK IN WOODSTOCK

Toyota's reputation for quality and excellence has made it the world's largest automobile manufacturer. And as Capital Paving discovered Toyota's philosophy of continuous improvement and its relentless pursuit to make things better applies to asphalt paving as well.



In the fall of 2008 at a time when other automobile manufacturers are faltering, Toyota is heading in the other direction, opening a new manufacturing plant in Woodstock Ontario. Built on 1,000 acres in the north east part of the town at a cost of more than a billion dollars, the plant will manufacture Toyota's RAV4 sport utility vehicle. Toyota expects to produce about 75,000 vehicles in the first year of operation with plans to eventually boost production to 150,000 vehicles a year. And to make sure that the vehicles meet all of Toyota's quality and performance standards, the first time that the rubber will meet the road for some of the RAV4s coming off the production line will be on the test track adjacent to the plant. Designed by Nippo USA, which has designed Toyota's test tracks around the world, the track is arguably the smoothest stretch of pavement in Ontario.

ZERO TOLERANCE

When Capital Paving received the tender document for the new test track, the general reaction was one of astonishment.

"We had never seen such tight tolerances for an asphalt pavement before," recalls Mark Latyn, Capital Paving's manager of quality control. "The hot mix specifications were relatively standard, but what they wanted you to achieve was anything but standard. The test track had to be very smooth and the consequence for not meeting the smoothness criteria was severe."

The centerline elevation of the track itself was perfectly flat with superelevated loops at either end of the track with an extremely tight crossfall tolerance.

But it was the surface tolerances that really caught Capital Paving's attention with each of the three pavement lifts designed to be smoother than the next. While the foundation and binder course, as measured with a three metre straight edge, were similar to typical OPSS standards, smoothness tolerances on the surface course were extraordinarily tight.

Nor did the design allow for any second chances. There was, Latyn notes, no flexibility for going outside the tolerances.

"You couldn't do any patching. Get it wrong and you would have to remove and replace the entire section of pavement."

Putting together the proposal was as novel a process as the project itself, says Larry Wilson, Capital Paving's vice president.

"While our past successes with MTO work gave us the confidence that we had the crews, the quality control, and the ability to do the job, obviously the price had to reflect the risks inherent in the project. But pricing was only one aspect of the bid process. We had to sell ourselves as well."

Capital Paving put together a team to develop an execution plan and assemble the project specification binder that would form part of the tender submission package, after which Nippo USA, the track designer and general contractor, interviewed the management team and inspected Capital's asphalt plant and construction equipment.

"It was like going for a job interview," Wilson recalls.

The interview must have gone well. In March 2007, Nippo USA awarded Capital Paving the contract.

TRACK AND FIELD

Nippo Corporation, Japan's largest paving contractor, provides advanced engineering and construction techniques for automobile proving grounds around the world.

"The demanding nature of the testing programs on these tracks requires levels of precision well beyond those of normal construction," says Daijiro Meguro, Nippo USA's project engineer. "Nippo USA engineers worked closely with Capital Paving to develop the construction means and methods that would meet Toyota's exacting standards."

In June 2007, Capital Paving started work on the sub-grade for the track.

"If we were going to meet the tolerances for this project, we couldn't leave anything to chance," says project supervisor, Wayne Murphy. "Deviations accumulate so we decided we had to beat the specifications right from the start. Our goal was to get our elevations at plus or minus 10 millimetres."

Backgrounder

Toyota Test Track

Owner: Toyota Canada

Location: Woodstock, Ontario

Timing: June 2007 to July 2008

Asphalt Mixes

Foundation course – MDBC

Binder course – HL 3 HS

Wearing course – HL 1

Asphalt cement - PGAC 58-28

Contractors

Design and general contractor – Nippo USA

Sub-contractor - Capital Paving

Geotechnical engineering – Trow Associates

Field surveying - Contract Survey Consultants

Mix design - John Emery Geotechnical

Material Suppliers

Granular - Dufferin Aggregates

Hot mix aggregates – Lafarge

Hot mix – Capital Paving

Asphalt cement – Canadian Asphalt

Editorial note:

Due to the confidentiality of Toyota's testing program, specific track design parameters cannot be disclosed.

(pictures courtesy of Nippo USA)



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By the end of the 2007 construction season, Capital had completed the excavation of the existing sub-grade, placed all the Granular B, and a good portion of the Granular A, leaving the remaining 100 mm for fine grading in the spring. Nippo USA closely monitored each operation to ensure that the sub-grade and granulars were adequately compacted and stable – a key component to constructing a long-lasting pavement.

With paving scheduled to start in the spring, Capital Paving decided to take advantage of the hiatus.

“In order to get the paving tolerances that we needed, we had to pave with a string line,” notes Murphy. “It is not a new technique but it’s not used on a regular basis and our crews had never paved using a string line before, so we set up our own training facility. We built a small test section with a straightaway and a banked curve at our asphalt plant and held our own practice runs. We even brought-up a Roadtec specialist from Chattanooga to provide some additional training to our crews.”

Meanwhile, Mark Latyn working in conjunction with John Emery Geotechnical designed three mixes that would resist shoving under rollers and provide a dense, uniformly graded mat and Capital Paving held some test trials to verify the mixes field performance before they were used on the project. The

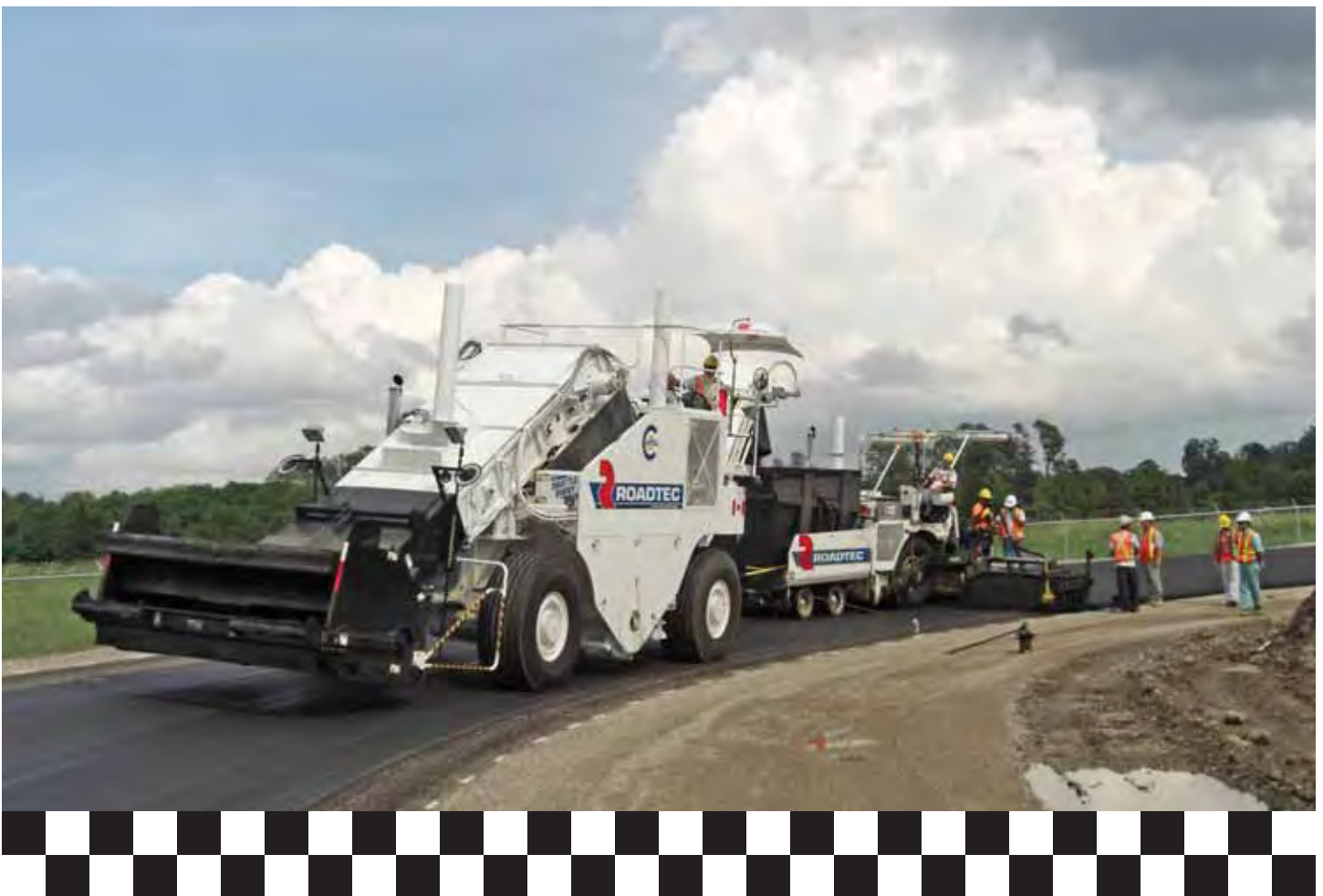
mix designs were submitted to Nippo USA and sent to a Japanese pavement engineer (who subsequently came to the test track at Woodstock for two weeks while Capital did the paving) who reviewed the designs and gave them his stamp of approval. In May 2008, Capital Paving was back at the Toyota plant to complete the fine grading in preparation for paving.

Capital Paving made some final adjustments to the grading of the granular base using a Leica grade control system, which tracked the grader from a remote ground control monitoring station and allowed fine adjustments to be made as the grading proceeded.

After the elevations of the granular base had been verified and the base successfully proof rolled using a loaded tri-axle, Capital’s crew, working under the direction of Nippo USA, installed the string line supported by stakes placed every five metres and tightened using tension winches to ensure the smoothness tolerances could be met.

On June 20th the first load of MDBC arrived on-site from Capital Paving’s nearby hot mix plant in Guelph. A Roadtec SB-2500 material transfer vehicle supplied a constant flow of material to the Roadtec RP-190 rubber-tired paver. A CAT CB-534D vibratory steel drum roller, followed by a CAT 360-C pneumatic tire roller, and finally a CAT-534C static steel drum as the finish roller was used for compaction.

After each lift of asphalt, Capital measured and recorded the pavement elevations at every 10 metres along each wheel path, the pavement widths, and the surface smoothness using a California Profilograph longitudinally along the track and a three-metre straightedge transversely across the track.





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“It was the perfect quality control, quality assurance system,” says Mark Latyn. “We handled the quality control while Nippo had a dedicated staff of four to five people to administer the contract and carry out quality assurance. They verified everything that we did and nothing proceeded until we had their approval.”

FINAL INSPECTION

By the time the final load of hot mix was going down on the track, the sun had started to set and as the compaction train completed its now well established roller patterns, Latyn recalls, “you could see the sense of relief on the faces of all the people involved.”

“The grading and paving crews had given it their best and now the fate of the project was in the hands of Nippo USA and their client Toyota.”

Nippo checked the smoothness of every inch of the test track’s wheel path with a three metre straight edge and did not find any deviations that exceeded the specified tolerance. The average smoothness of each wheel path as measured by the profilograph ranged between 50 millimetres and 100 millimetres per kilometre (“I’ve seen a lot of profilograph results and I didn’t know you could get so low,” was Mark’s observation).

Although the track met all the tolerance requirements specified in the contract, there was one final test that Capital Paving had to pass. On July 23rd two test drivers, one from Japan and one from Toyota’s nearby plant in Cambridge, arrived to see just how well the track lived up to expectations. The drivers gave it the thumbs-up.

“I have to give the credit for the success of the project to all our crews,” concludes Larry Wilson. “We used standard hot mix. We used regular production equipment. It was the care with which we did the planning and the quality of the workmanship that went into the job that made all the difference.”

The final result was a track with a smoothness that measured an amazing 87 millimetres per kilometre profile index.

“We followed established best practices for constructing quality pavements to the letter,” was Larry Wilson’s response to the question of how such exceptional smoothness results could be achieved.

“We used a transfer vehicle to keep the paver moving at a constant speed, controlled the head of material in the auger chamber, monitored mix temperatures, and established an effective rolling pattern for each mix.”

“Having a guy with “duck boots” pound down the bumps left behind by the break-down roller is not an established best practice...and one I don’t expect to see many contractors doing on a typical project,” he added with a smile.

But this was not, of course, a typical project.

“Our industry builds exceptionally good roads in Ontario, some of the best in North America,” Wilson concludes “but this was something special.” ■

