The next time a defensive safety for the Edmonton Eskimos football team smacks down an opposing wide receiver at Commonwealth Stadium, both of them will land on a very well-prepared piece of real estate.

That’s because the field at Commonwealth Stadium, the home of the Edmonton Eskimos professional football team, recently received a renovation to the tune of about $2 million. The former field was natural grass, and it was the last stadium in the Canadian Football League to convert to artificial turf. The old field had become expensive to maintain properly. And the Grey Cup game will be played at Commonwealth Stadium this year. The stage needed to be re-set.

The renovation was extensive. It required total removal of the existing growing medium and subgrade materials to a depth of 1.2 m. And precision was the order of the day. The project’s Edmonton-based subcontractor, Wilco Contractors Northwest Inc., finished the subgrade to near-perfect planarity, or flatness—a tolerance of 3 mm over a 3-m length.

To achieve this precision, Wilco used a Leica PowerGrade...
GPS/GNSS Machine Automation system. One of the company’s Volvo G-960 motor graders were fitted with the GPS receiver, and Wilco set up a Redline GPS/GNSS Base Station. A second grader, a G-930, was controlled by a Redline Power Tracker Robotic Total Station. That grader could achieve sub-centimetre accuracy.

WISE INVESTMENT

“We probably have a quarter-million dollars invested with Leica Geosystems,” says Wilco president Art Maat. “The machine control equipment pays for itself on an annual basis. And that equipment gives us the ability to construct projects to tolerances that others cannot, even though they have the same big iron capabilities we do.

“Wilco was selected to work with the Edmonton Eskimos solely based on our experience with projects like this and because of our surveying abilities and machine control systems,” explains Maat.

The stadium project began this spring with snow removal. Then large excavators and dump trucks excavated the existing soil mixes, drainage rock and the subgrade clay. Maat says one Caterpillar D6N dozer and the two Volvo motor graders graded the subgrade to a 0.5 per cent slope on both sides of the field’s centre spine—a longitudinal centreline between the goal posts.

That’s not all; a running track encircles the football field and runs behind the goal posts. So the excavation and grading process extended to the D-shaped zone behind each goal post. The centre, or radius, point of each half-circle was very close to the goal posts. And the slope of the field from the half-circle’s radius point down to the track edge must be constant.

“So the problem was how do you grade that half-circle?” asks Maat. “From a grader perspective, grader operators and surveyors want to grade in straight lines or on rectangular grids.

“So we used the robotic total station, to control the grader blade, three dimensionally. It is one step more accurate than a GPS system.”
Using the robotic total station involves entering a digital terrain model, which Maat calls a “TIN-file,” into the computer on-board the grader. The grader is also fitted with a mast and prism, which has a fixed relation to the grader blade. The robotic total station can “see” the prism, read its 3D location and communicate that location back to the grader.

The on-board computer then processes the differences between the actual blade location and the digital terrain model. Knowing those differences, the computer controls the grader blade.

The two motor graders divided grading chores for the final subgrade. The GPS-equipped grader did the rough grading and the prism-equipped grader handled the fine grading. “Both systems are fundamentally the same except for the receiving unit on the grader and some minor hardware inside the grader cab,” explains Maat. “The Leica Power Grade 3D system gave us sub-centimetre accuracy with the robotic total station, and about 20-mm accuracy with the GPS-equipped motor grader.”

With the final subgrade complete, Wilco installed a drainage system in the floor of the excavation. The contractor dug eight trenches running the length of the field, then placed 8-in.-diameter perforated pipe, surrounded by washed rock, into each trench. The perforated pipes feed into a collector system to drain the field. Next, all of the drain trenches and subgrade were covered with a geotextile.

Then, working in four lifts of 300 mm each. The contractor filled in the excavation with a product called coal bottom ash. “It’s like playground sand, but it’s very gritty,” says
Maat. “We use it because we get 100 per cent compaction without much effort. We get incredible compaction and incredible vertical drainage. And it insulates against frost very well.”

When the coal bottom ash had to be placed, Wilco could not access the field with trucks due to other conflicting contractors’ schedules working on the building facility. So the contractor used a series of electric conveyors to move the ash. “We dumped it up near the top of the bleachers at street level and brought the material down onto the field with conveyors,” says Maat.

When the dozer and the two motor graders spread the coal bottom ash, the ease of using the machine automation systems made it quite simple to get the 300-mm lifts, says Maat. “We simply take the TIN file (terrain model) and offset the elevation by 300 mm at a time.” Two HyPac smooth double-drum vibratory rollers handled compaction, and the ash required a steady application of water to achieve the required density. While there was no need for sub-centimetre accuracy in spreading the material in the lower lifts it was critical that compaction tests for each layer be performed on 300 mm—no more and no less. “And because of the Leica systems we did not have to go out there and do any staking with a survey crew,” says Matt. “We were able to spread it in just 300-mm lifts and the consultants were quite happy with that.”

SAVINGS ON SURVEYING
Maat said the machine control equipment saved $15,000 to $20,000 on surveying. He’s figuring that cost more than 100 hours at $150 an hour for a surveying crew. “And the machine control systems probably make our equipment 25 per cent more efficient on low-tolerance sites such as fields and running tracks where the grades are very critical.”

To test the planarity of the coal ash fill, Wilco stretched a stringline over a 3-m distance at many points on the field. If you could fit a couple of loonies under the string, you’ve got a low spot. If you can’t, then the tolerance of 3 mm has been met. Once ready for inspection, engineers test the grade using a 20-m string with more difficult tolerances. Our feedback from the consultants was that they had never seen a field prepared this well with very little adjustment required.

“In our case, the consultant’s stringline testing proved the grading we did was absolutely perfect,” says Maat. The slope of the field had to be 0.25 per cent from the centreline spine down to the sides of the field, at the track. And the slope of the D-shaped areas behind the goal posts was exactly the same. In three dimensions, each D-shaped area formed an inverted shallow cone.

Atop the bottom ash, crews placed a 23-mm-thick shock pad (similar to a carpet underlayment, but firmer). Next the turf goes in like long shag carpeting. Granulated rubber and sand are swept into the shag threads with large power brooms. “At the end you have about a quarter to a half-inch of carpet, or thread, showing at the surface,” says Maat. “So it walks and feels like real grass.”