Project: Villeneuve Aggregate Pit Box Culverts

Location: Villeneuve, Alberta

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Inland Aggregates Edmonton required 140 meters of precast concrete box section with a 3.0m span and a 2.4m rise to replace two existing conveyor systems each contained within an 1800mm corrugated steel pipe. The two 70m long tunnels are used to feed raw aggregate to a wash plant; both are aligned 30 degree offset from the wash plant conveyor. The existing CSP was rusted, punctured, and at the end of its service life. Furthermore, it was a safety hazard which no longer complied with current OHS regulation. An ancillary benefit of the project allowed for an increase in the plant's live material stockpile capacity.

Figure 1: Previous CSP culvert

Figure 2: Wash plant conveyor

Each tunnel has a designed dead load for 16.5 meters of aggregate overburden with a density of 15.8kN/m^3 and a CSA CL-625 live load. Due to the excessive loading conditions, a direct design approach was needed to create these custom box sections. Inland's internal engineering department was able to generate the production drawings using BOXCAR software. The design assumed a CHBDC Type B1 installation and a welded wire reinforcement yield strength of 480MPa. High sulfate resistance concrete was used with a compressive strength of 45MPa.

Figure 3 (left) & 4 (below): Steel reinforcement for each box section.

Both tunnels contained three evenly spaced steel bunkers; each of these bunkers house a mechanical hopper to enable aggregate to be conveyed at intermediate points along the tunnel. The bunkers have steel studs welded to the joints to mechanically bind to a grouted connection with the concrete box sections.

Figure 5: Tunnel with steel bunkers installed.

Figure 6: Welded studs to bind with concrete box sections.

Installation was conducted by JDB Venture Ltd over the month of November, 2014. During this time in Northern Alberta, temperatures dropped below minus 30 degrees Celsius. This added a great level of difficulty to curing the joints, welding the bunkers, and achieving an optimal final grade. Under these extreme environmental conditions, use of pre-cast concrete was the only viable option compared to a cast-in-place option or the use of any other material.

Figure 7: A site welder continues to work in frigid temperatures. This particular day was -28 degrees Celsius before wind-chill.

Figure 8: Precise grading was essential to ensure each joint gap was within an acceptable limit. Frozen ground conditions and continuous snowfall offered routine difficulties.

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