Slipforming On Route PJK

Following a specification change by Transit NZ, contractor ***Smithbridge*** proposed slipforming as the most appropriate solution for median barrier construction on a section of highway on the outskirts of Tauranga.

A new section of State Highway 2, jointly funded by Transit NZ and the Tauranga District Council, has recently been completed by joint venture contractors Smithbridge, a heavy civil engineering, bridge and marine works specialist, and Fulton Hogan.

Transit changed its specification for median barriers on the route to test a new height requirement (1100mm rather than the usual 830mm). It also specified that "the barrier be continuous for 60m with cast-in-situ footings at each end."

While it was originally intended this would be precast with infill joints every six metres, having examined the options Smithbridge proposed slipforming as an alternative. The slipform detail uses four 12.7mm strands within the cross section, one each within the toe area on each side and two on the centreline in the top of the cross section. (The upper strands are to prevent large blocks from entering the opposite lane should an impact be severe enough to break the barrier.)

A slipforming machine, the "Gomaco" Commander III, manufactured in United States, was bought secondhand in Britain and imported to New Zealand by Smithbridge for the project. This is a versatile machine that can be configured in a variety of ways to suit the required operation - from barriers or kerbing and drainage channels, through to six metre wide concrete paving.

Slipforming Operation

During operation, the median barrier mould is mounted solidly to the Gomaco frame, with the height and orientation of both adjusted by hydraulic legs that connect the tracks to the frame. Control is provided by a microprocessor with sensors on a string line, at points before and after the mould.

Concrete for these median barriers, supplied by Allied, was a 30 MPa mix with polypropylene fibres added. Slump, which is the essential consideration, has to be low and consistent, at about 20mm. It is essential to have one experienced person checking the slump at the plant, to try to get the best consistency possible. Too wet will result in the barrier collapsing and too dry will result in 'tearing' of the barrier as it exits the mould.

During the slipforming operation, concrete is delivered to the Gomaco machine by agitators, which discharge onto a conveyor. This conveyor then feeds the mould feed hopper. The concrete is vibrated within the feed hopper and shaped over the length of the mould form section. The resultant shape will vary from the mould dimensions depending on the 'slump' of the concrete. Because of the batch process of mixing concrete, small changes in slump can occur between loads, and even within loads, which can result in variations of up to 10mm in height and cross section from the mould.

Production speed is entirely dependent on the concrete's properties. Generally speeds vary between 0.6 – 1.0 m/min, with daily production limited first by concrete supply and second by manpower for finishing. It is not an option to hold material within the mould and stop everything for lunch. As there were specified discontinuity joints every 60m, average production was 120m per day. 180m per day was achieved, but this did not leave enough time to set up for the next day's production and start within a reasonable time the following day. Finishing manpower was also stretched trying to work 180m/day consecutively.

Finishing

Hand finishing follows the slipforming, with one person working on the top of the barrier and generally two people each side. Only steel trowels are used on the side finishes.

Although this was not specified, all advice was to cut contraction joints into the barrier. This was done at 4m spacing, with concrete saws used to make cuts 30-70mm deep. This is enough to promote shrinkage cracking in a controlled fashion; however, it must be remembered that cutting too deep can cut the strands. Joints are finished with a grooving trowel. Contraction joints were not used on bridge parapet because of the amount of reinforcing steel

Thanks to Alan Bell of Smithbridge for this article.