Special mix, fast test speed building job

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Special mix, fast test speed building job

By Correspondent Robert L. Hubler

A specially designed fast-set/early-high-strength concrete mix—combined with a new system for quickly testing the compressive strength of in-place concrete—is expected to speed up occupancy by five months and to yield substantial dollar savings on a 15-storey apartment building in Mississauga, Ont.

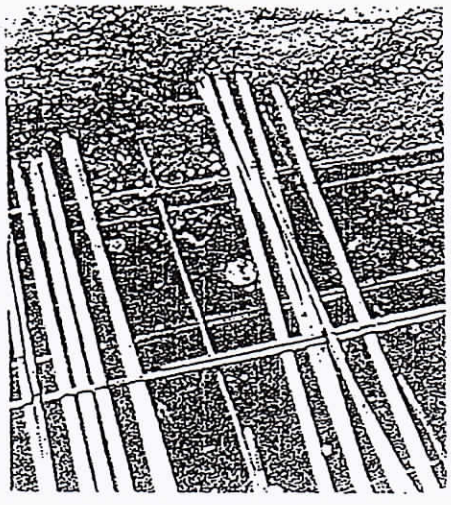
John Bassel, president of the Dunwarden Corp. of Toronto, developer and builder of the $8-million Winston Churchill apartment building on Battleford Rd., says earlier occupancy of the 210-suite building will generate a substantial revenue bonus. An additional $25 000 will be saved by a reduction in direct construction costs and other collateral benefits.

The major advantage of the new concreting system is its ability to permit the safe stripping of formwork in as little as 24 hours under anticipated weather conditions.

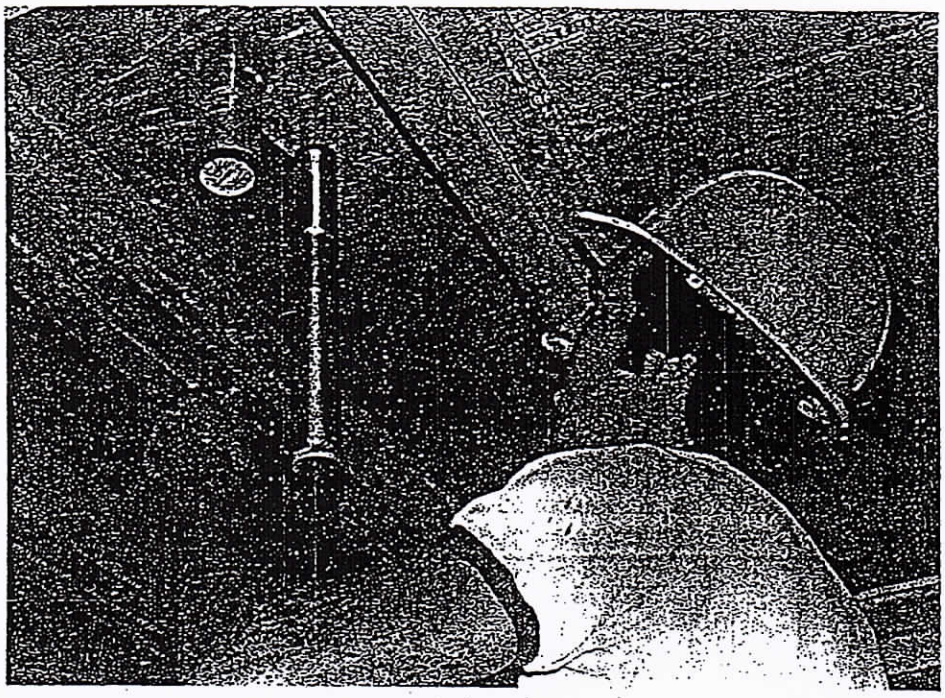
Jointly developed by Dufferin Concrete Products and the Trow Group Ltd., both of Toronto, the system combines Dufferin's Super-Stripper concrete mix with Trow's Lok-Test method for non-destructive testing of in-place concrete. While being introduced on a shear wall framed building, it could have wide application on a variety of concrete structures where time and money savings are key considerations.

Herbert McGroarty, marketing manager for Dufferin, says Super-Stripper is one of a family of advanced concrete technology systems (ACTS) being developed by the firm to help solve problems encountered in various types of concrete construction. Dufferin, a highly technically oriented ready-mix firm, was one of the first to use 56 MPa (8000-psi) concrete in Toronto and to include fly ash and superplasticizers as standard materials in concrete mix designs.

The Super-Stripper mix was designed to swer a construction industry need for a ncrete that could be stripped safely at an rlier-than-normal date. The material has no untried ingredients but is a fast-setting, early-high-strength concrete containing a proprietary combination of several proven additives, including fly ash. All materials comply with Canadian Standards Association standard A23.1.



PULL-OUT BOLT (centre of photo) is key Lok-Test concrete testing.



LOK-TEST method uses calibrated jack attached to pull-out bolts in concrete.

Use of the special concrete on the Mississauga apartment building permits the stripping of a single set of flying forms in 24 hours, by which time a better than seven-day strength level has been achieved. Original projections had indicated that strength would be reached in 36 hours.

There are two separate Super-Stripper mix designs for warm- and cold-weather concreting. Both will attain minimum strippable strength within 24 hours provided standard weather protection is used on winter work.

McGroarty says that, while fast-setting concretes have been developed before, they often set too fast in the summer and too slow in the winter, and they have been inconsistent in meeting stripping strength requirements.

To adequately monitor the performance of a highly technical concrete design such as Super-Stripper, a reliable testing method is essential to quickly determine the in-place strength of the concrete. The Lok-Test method being used on the Mississauga project meets this requirement.

John Bickley, vice-president of the Trow Group, says the Lok-Test method differs from several other pull-out and non-destructive concrete tests in that it is as accurate as current cylinder tests made on stationary compression machines.

The method can be used for taking non-destructive control measurements to determine whether the concrete has reached the strength for which it is being tested. It can also be used to measure actual concrete strength, in which case a slight circular crack ring may appear, as a small concrete cone is slightly dislodged.

The Lok-Test method measures the Lok (pull-out) strength of the concrete which is then easily converted to compressive strength. Pull-out strength is measured using a special jack, which applies a pull load perpendicular to the concrete surface. The jack is attached to special pull bolts secured to the inside faces of the forms before the concrete is poured. Holes are bored through the forms to enable the jack to be attached to the bolts.

On the Mississauga apartment project, the test bolts are being inserted at the minimum ratio of one bolt for each 10 m^3 of concrete, but on larger pours fewer bolts could be used. Concrete for the Mississauga project generally is placed in the afternoon, with testing being done early the following morning.

Conversion of pull-out test readings to concrete compressive strengths is calculated in the field and telephoned to the Trow offices for computer verification. There, the decision is taken as to when the forms can be stripped safely.

A leader in promoting new methods of testing concrete in place, Bickley contends that 28-day concrete cylinder tests are not appropriate for today's construction requirements. While they are being used on the Mississauga project to determine concrete strength, test results are slow and the contractor needs data as soon as possible. At an economical price, the Lok-Test method gives him that information.

In-place testing now is encouraged in CSA 23.1-77, and Committee C-9 of the American Society for Testing & Materials has approved a standard draft allowing the use of the Lok-Test method. A recent 2½-year field research program by the National Research Council showed pull-out testing to be one of the most promising test methods for the future.

In explaining why developer-builder Dunwarden chose the new concreting system, Bassel says the firm's original plan was to start construction in May, enclose the structure by late fall and complete the project by spring 1979. However, because of zoning and site problems, the start was delayed by two months.

Delays in a spring construction start get the entire building cycle out of phase, Bassel says. If the structure isn't topped out and enclosed by winter, added expenses pile up. These include costs for winterizing and heating the structure and the concrete, labour inefficiency, and delays in mechanical work.

The most critical factor, however, is that the building may miss the prime spring rental season and not be ready for occupancy until summer, traditionally a slow rental period. As a result, a significant rental level may not be reached until September—five months later than expected.

The main reason for Dunwarden's speeded-up construction program, therefore, was the opportunity to generate income sooner than was projected for a late start. With full occupancy revenue estimated at $60 000 a month, earlier occupancy is to the obvious advantage of the developer.

Recapping his firm's direct construction economies, Bassel says the largest saving (about $50 000 in interest payments) will result from a three-month reduction in the duration of his construction loan. About $15 000 will be saved by eliminating the cost of heating and winterizing the building, while savings in the temporary reduction in the rate of the Ontario retail sales tax will net an additional $5000.

Against this gross saving of $75 000, $50 000 in additional charges must be deducted for the cost of Dufferin's premium-priced Super-Stripper concrete mix and Trow's Lok-Test services. Even so, Bassel says the net saving of $25 000 was sufficient to justify going to the new system, even if there weren't any other benefits, which there are.

For instance, the accelerated construction schedule enabled the developer to make maximum use of a capital cost allowance for work done in 1978. Up to 30% more could be claimed this year as a result of the faster construction pace, it is estimated.

While Bassel is enthusiastic about the benefits of the new concreting method, he warns that, like other high-performance systems, its requirements are more demanding than those of conventional forming and pouring. He says there must be good site supervision, reliable concrete quality control and testing methods, a responsible forming contractor with a good set of forms, and proper co-ordination with mechanical contractors.

Bassel adds that the system is not a cure-all for all concrete construction problems and says it wouldn't have been needed if the Mississauga project had been started on time. Since the building is long and rambling, one set of forms would have been adequate. But he adds quickly that, even with a single set of forms instead of the usual two, the system is ideal for a tower building where the entire floor is cast in a single pour.

Designer of the apartment building is the Toronto architectural firm of Martin Mendelow & Partners, with Alex Tobias & Associates of Toronto as the consulting engineers. Steve Szalwinski, project engineer for Tobias, says he is pleased with the new concrete system; the Super-Stripper enables the contractor to strip quickly, and the Lok-Test method gives the engineer the control he needs to ensure adequate concrete strength.

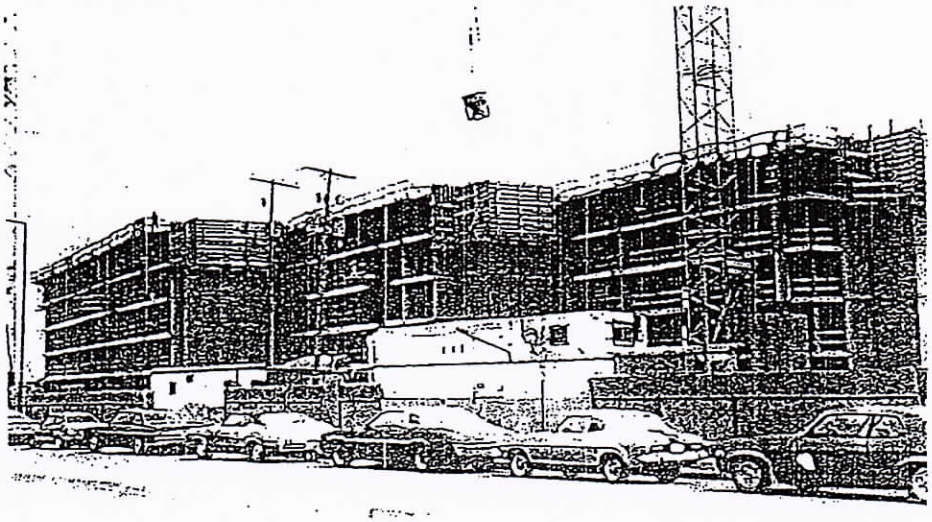
Measuring about 96 m long (315 ft) and 16.7 m wide (55 ft), the apartment building is framed in three different directions, with their heights stepping down from 15 floors on the east section to 11 floors on the west. The principal floor slabs span from 5.6 m (18½ ft) to 6.1 m (20 ft), with slab thicknesses of 165 mm (6½ in.) and 178 mm (7 in.), supported on 6-in.-wide shear walls. The concrete design strength is 21 MPa (3000 psi), with an allowable minimum form-stripping strength of 14 MPa (2000 psi).

Each floor, covering 1627 m² (17 500 sq ft), contains about 270 m³ of concrete plus 100 m³ in the shear walls.

Vern Peterson, construction superintendent for Dunwarden, says the original concreting schedule, using conventional material, called for placement in four separate pours. With the switch to Super-Stripper and Lok-Test testing, the number of pours per floor was reduced to three, with an average placement schedule of two floors every five working days.

Concrete placement is being done at a rate of about 45 m³/hr. Originally, the mix was placed with a 76 mm (3 in.) slump but, because of summer heat and wind, it was gradually increased to 114 mm (4½ in.). During weekdays, a one-day strippable concrete is used, but a two-day mix is placed if it is intended to set over a weekend. Dufferin provides on-site quality control supervision when concrete is being placed.

Arrigo Fogliato, president of Rigo Forming Ltd. of Toronto, the forming contractor on the project, says the new concreting system is working well.



TWO FLOORS are cast in five days using Super-Stripper mix, Lok-Test method.