

ANOTHER

# SLAG

## SUCCESS STORY

THE  
ALL-PURPOSE  
CONSTRUCTION  
AGGREGATE

### SCOTIA PLAZA - A UNIQUE SLAG PROJECT

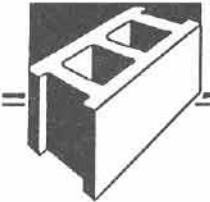
The new \$450 million, 69-floor Scotia Plaza Office Tower in Toronto's financial district is a modern slag building. The largest building component after natural sand and stone aggregate is the 36,000 tonnes (40,000 tons) of slag supplied from Hamilton, Ontario.

#### Ready-Mixed Concrete



- over 74,000 m<sup>3</sup> (96,800 yd<sup>3</sup>) of concrete in the foundation, six below-grade levels, inner elevator shaft, outer structural tube, and floor systems;
- design specifications 20 to 70 MPa (3,000 - 10,000 psi);

- 14 classes of concrete include slag cement at a minimum 20% and as much as 30% of the total cementitious materials.



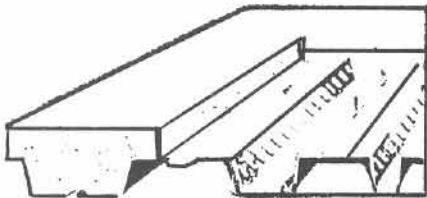
#### Lightweight Concrete Block

- about 1,000,000 140 mm (6 in.) slag blocks, 75% solid, which were selected for
  - a) lower weight for ease of handling both in the construction hoists and for the mason

b) + 2 hour fire rating

c) high-quality appearance in exposed locations

d) solid back-up for heavy granite facings on elevator fronts and lobby areas.



#### Composite Floors

- 150,000 m<sup>2</sup> (1,600,000 ft<sup>2</sup>) of composite floor system uses semi-lightweight slag concrete averaging 1,975 kg/m<sup>3</sup> (126.5 pcf);

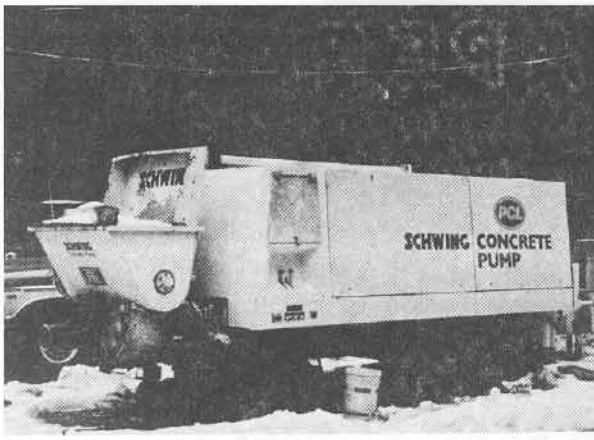
- slag concrete yields very high-quality floor finish;

- floor system reduces design weight;

- two-hour Underwriters Laboratories Canada approved design requires no sprayed-on fireproofing;

- slag concrete shows reduced shrinkage cracking.



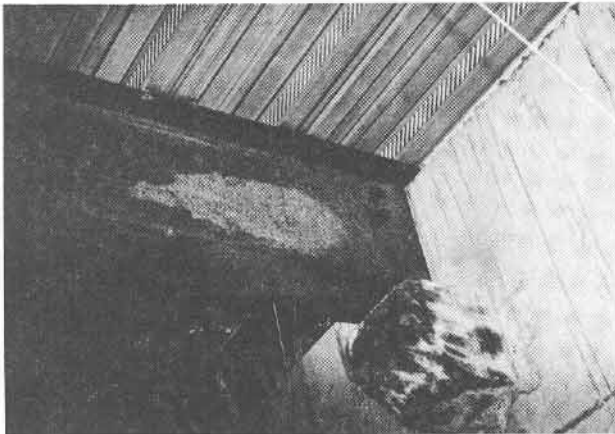
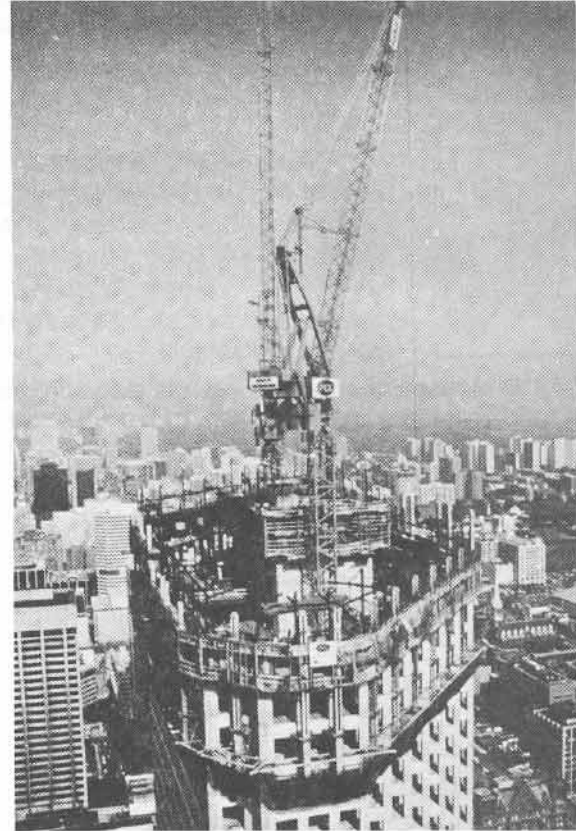


### Concrete Pumping

The majority of the semi-lightweight and normal-weight concrete was pumped from street level in a single lift by a Schwing 5000 concrete pump. Concrete for the highest levels was pumped nearly 300 m (1,000 ft) straight up. Hydraulic pressures up to 27 MPa (4,000 psi) were developed with imposed pressures up to 20 MPa (2,800 psi) on the concrete. Super-plasticizers were not required below the 25th floor. Quality checks on lightweight concrete comparing pumped with bucket lifted showed little difference in entrained air and unit weight. The pumped concrete appeared more homogeneous and exhibited less tendency to bleed. Loss of slump after pumping was about 200 mm (8 in.) for the semi-lightweight concrete. Normal-weight concrete slump loss ranged from 150 mm (6 in.) to 175 mm (7 in.).

### Jump Form Systems

A high-tech jump form system was used for the exterior tube. The jacking schedule was three days per floor. The mix used normal portland cement, slag cement and silica fume and was designed to achieve 10 MPa (1,500 psi) in 10 to 12 hours. The absence of shrinkage cracks, particularly at the cold joints, is credited to the slag cement because it lowers the water/cement ratio, while maintaining fluidity necessary for pumping under pressure.



### Hybrid Design

The Scotia Plaza Office Tower is designed as a hybrid building because it uses both structural concrete and structural steel. The inner tube was placed by slip-forming, the outer tube used jump forms. Mix designs incorporated slag cement and silica fume and achieved strengths up to 104 MPa (15,000 psi). The floor structures incorporated steel floor joists supported on corbels cast in place in the wall and shaft structures. The floor plate is semi-lightweight concrete cast on a steel deck composition incorporating slag concrete with average density of 1,975 kg/m<sup>3</sup> (126.5 pcf) slag concrete. It has a ULC rating of two hours without sprayed-on fireproof coating.