OCCDC
case study
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Ontario Cast-In-Place Concrete Development Council

1 King West

Standing as the tallest residential building in Canada[1], 1 King West opened for occupancy in July 2005. Located at the south west corner of King Street and Yonge Street in downtown Toronto, it is professed to be the world's most slender building as defined by its height-to-width ratio. It is a fifty-one-storey hotel and condominium tower, containing 576 residential suites and 102 parking spaces. The $100 million tower measures 190 m above its base and is 14.25 m wide at its broadest, covering 47,800 m^2.

The tower footprint encompasses part of the historic sixteen-storey Dominion Bank Building located on the eastern side of the site. The client was determined that this building and all of its prominent features be retained intact within the new development.

There were significant challenges that were presented to the design and construction teams. One was the evident heritage Dominion Bank Building located on the site's east side. It occupied most of the building site and it was essential that this building remain intact. The remaining portion of the property is long and has a narrow street frontage. As such, the slender tower extends over and down through part of the existing heritage building.

Due to its slender vertical aspect ratio as well as its elongated plan (50.99 m x 14.25 m) the tower required a strong lateral system from both strength and serviceability points of view. The obvious structural material for the lateral system was reinforced concrete. A series of reinforced shear walls in the east-west direction, which provide as demising walls, with hammerheads at the north and south end of these walls are the foundation of the building's lateral system. The tower's lateral system was also required to sustain wind and seismic forces from the existing bank building, which relies on the new tower structure for its lateral stability.

Strength design based on wind and seismic loading went hand in hand and almost equally governed the final design parameters in terms of reinforcing of these walls. Serviceability design of the lateral system, however, required the consideration of building wind-induced horizontal displacements and top floor accelerations.

The introduction of a "sloshing" liquid damper located at top of the building

Owner:	Stinson Properties Inc.
Architect:	Stanford Downey Architect Inc.
Engineer:	Yolles
General Contractor:	EllisDon Corporation
Concrete Supplier:	Innocon
Post Tensioning Subcontractor:	Harris PT
Reinforcing Steel:	Harris Rebar
Formwork Contractor:	Resform Construction Ltd.
Precast Supplier:	RES Precast Inc.
Formwork Supplier:	Peri Formwork Systems Inc.

Additional Participants:

- Universal Workers Local 183
- Ironworkers Local 721

Project Facts:

- Open for occupancy in July 2005
- Total gross construction area is 47,800 m^2
- $100 million construction cost
- 3 years construction time
- 190m above its base and 14.25m wide at its broadest
- 576 residential suites, 102 parking spaces

1 As of 2005

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(Continued from Page 1)

was to alleviate wind accelerations. This simple device successfully reduced building top floor acceleration from a one in ten year wind down to acceptable limits. The rooftop damper system, constructed in concrete, consists of 10 water tanks containing a total of approximately one half million litres.

Several gravity load schemes were investigated from the standpoint of structural efficiency and overall value. The schemes finally adopted comprised reinforced concrete slabs spanning between east-west walls. The north and south elevations of the building are supported on discrete columns to maximize views and space planning flexibility. On the base of the south facade, columns are supported on storey deep girders over the loading dock. The south side restaurant entrance allowed for a much shallower girder, which was prestressed to further reduce its depth and maximize clearances.

Above Level 14, construction was simplified by excluding spandrel beams from the east and west faces of the building. These floor slabs were designed to support loads from two-storey deep pre-cast units. Upper level shear walls on the north and south sides of the tower were curtailed as the building transforms into an elliptical shape towards the top of the building.

In conclusion, reinforced concrete was seen as the only practical option for the structure of 1 King West for a number of reasons. These include the lateral stiffness reinforced concrete can achieve, the shallow depth of flat plate floor slabs, its inherent fire rating, its inherent stiffness, and sound insulation between floor slabs, etc. The construction of 1 King West demonstrates the diversity and versatility of concrete when used as a building material.

2005 Ontario Concrete Award winning project for Structural Design Innovation

In 2000, the Ontario Cast-In-Place Concrete Development Council (OCCDC) was formed to aid the owner/developer, architect/engineer and design-build contractor in the decision-making process of choosing the best construction material for the framing system of new cast-in-place structures.

OCCDC promotes the benefits of reinforced concrete as the construction material of choice based upon the following advantages:

- *fast-track construction*
- *costs savings*
- *structural advantages*
- *environmental considerations*
- *local economy benefits*

The Members of the OCCDC incude (alphabetical order):

Aluma Systems Inc.
Carpenters District Council of Ontario
Concrete Forming Association of Ontario
Ironworkers District Council of Ontario
LIUNA–Ontario Provincial District Council
Ontario Formwork Association
PERI Formwork Systems Inc.
Ready Mixed Concrete Association of Ontario
Reinforcing Steel Institute of Ontario

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