A Construction Highlight for the International Commerce Centre at Kowloon Station, West Kowloon

Prepared by Raymond Wong
City University of Hong Kong
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Construction features of the ICC Tower

Height of tower structure – 490m
Average floor plate area – 3000m2
Total floor area – 280,000 m2

Key dates
Procession of site – June 2003
Obtaining of Temporary Occupation Permit – December 2007
Expected Full Occupation – February 2010
Opening of the hotel – end of 2010

Use of floor spaces (floor number is for reference only)
Office spaces from 8/F to 98/F.
Hotel apartment from 101/F to roof, total 14 floors.
Sky Lobby and Observation Deck located on 43/F and 99/F respectively.
Outrigger spaces are used as mechanical floors.
Construction/structural features

• A 76m diameter cofferdam lined with 1.5m-thick diaphragm wall panels was formed to facilitate the construction of the 9m-deep foundation raft and core wall structure of tower using bottom up arrangement.

• Basement in 2 levels is constructed using semi bottom-up arrangement due to limited space and the existence of the MTR tunnel tube crossing within 6m on the side of the tower foot-print.

• Grade 90 concrete is used up to 60/F. The other portion of tower structure uses mainly Grade 45 and Grade 60 concrete.

• Four sets of outrigger are provided at 6/F, 42/F, 78/F and 100/F. Except for the one on 6/F which is constructed in in-situ prestressed design, the upper ones are in fabricated structural steel with an inner frame embedded in the core wall.
• Two sets of jump-form were used (in stepped operating mode) for the construction of the core wall from 2/F up to 100/F with some dimension re-alignment at a few floor locations with the outrigger frame or where thickness of core wall reduced.

• Connecting joint between the outrigger and mega column is provided with design to cater for the differential deflection similar to the IFC2 project.

• General composite frame structure is used for the tower up to 100/F, with the central core, an external steel frame rested onto 8 mega columns which span about 16m.

• Hotel floors from 101/F upward are constructed in in-situ method using Grade 60 reinforced concrete and traditional large panel form, with a transfer structure at 101/F.

• Total amount of structural material consumed

• Concrete 240,000 m3, Reinforcing bar 98,000 tons, Structural steel 27,000 tons
Artistic view of the ICC tower and the Kowloon Station Development as seen from Hong Kong side
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Master Plan for the MTR Kowloon Station Development
Early stage of work as seen in 2002 showing the layout of site and the facilities that equipped for the forming of diaphragm wall panels which would be used as the lining of the 76m cofferdam.
Standard equipments for the construction of diaphragm wall as seen on site, including the desanding plant (in photo 3) for the removal of excavated spoil through the circulating bentonite slurry and the reverse circulation trench cutting machines (in photo 4).
Photo 5a – Commencement of excavation for the 76m-diameter cofferdam as seen in late 2003

Photo 5b – Completion of the foundation raft up to the third layer. The total depth of the raft is 9m. The concreting process is arranged to be placed in 5 layers as a means to control temperature generated from concrete as well as to ease the handling of large amount of concrete during work.
Photo 6a – Excavation of the cofferdam down to the formation at about -20mpd
Photo 6b and 6c – casting the 9m deep foundation raft in various portion (total in 18 pour and concrete volume 36,286m³)
Figure 1 – Building section showing the construction arrangement from the foundation raft up to the first outrigger set on 6/F.

Photo 7 – Core wall and the mega columns constructed within the cofferdam close to the ground level. Usual large-panel steel form was used up to 4/F before the erection of the jump form.
Photo 8 – Construction of the floor system from ground to 1/F spanning from the core wall to the mega columns using traditional timber panel formwork.

Photo 9 – Commencement of excavation on the side of the cofferdam to form the remaining portion of basement structure.
Photo 10 – Main building structure constructed up to 4/F. The jump form was erected on the 2/F for the onward construction of the core wall.

Photo 11 – Main building structure as seen in February 2006 with the jump form for the core wall and the climb form for the mega columns in full operation.
Photo 12 – overview seeing the construction of the basement using typical bottom-up arrangement with shoring support counter-act onto the completed main tower structure. The diaphragm wall panel as side to the previous cofferdam was demolished as the excavation proceeds.
Photo 13c – Construction of the tower before entered onto the typical cycle. By the time the jump form for the core wall was being erected and the basement construction on the side commenced.

Photo 13a and 13b – the core wall and mega columns of the main tower structure ascending from the cofferdam. The tunnel tube of the MTR Tung Chung Line is located on the strip of land on the lower side of the cofferdam.
Photo 14 – aerial view of the Kowloon Station Development and the nearby facilities

Tunnel tube of existing MTR Tung Chung Line and Airport Express

Tunnel tube of future Kowloon Southern Link (2009)
Photo 14a – close up of the gigantic jump-form system for the core wall construction
Photo 14 – Overview of the tower structure with the jump-form for the core wall, climb-form for the mega columns and a set of lift-form for an appended wall (the finger wall, at the right side of core, orange in colour) in operating position.
Photo 15, 16 and 17 – Close up of the lower portion of the main tower with the structural layout and floor system clearly seen.
Figure 2 – Typical Construction Sequence and safety provisions
Figure 3 – Typical layout of core wall
Photo 18 – Close up of the core wall structure with a set of self-climbing loading platform being erected for the lifting of materials and equipments.
Photo 19 and 20 – Typical view of floor deck spanning between the core wall and the external frame before concreting
Photo 21 – Typical floor layout detail at the building corner on 15/F. The set-up of climb-form for a mega column can also be observed.
Photo 22 – Installing the climb-form for the mega column as seen from the side. The steel shutter panel was not fixed onto the main frame of form at this stage.

Photo 23 – Setting-up of the climb-form mounted on top of the mega column with the enclosing safe screen and work platform already in place.
Photo 24 – Two sets of climb-form in szonized operating phase.

Photo 25 – Reinforcing bar of the mega column being fixed with lapping coupler as seen on the work platform ready for concreting.
Photo 26b – General view of the jump-form for the core wall as seen on the platform deck. Due to the large size of the core wall (measured 38m x 38m), two separated sets of jump-form were installed and operated in stepped sequence to make each lifting more easy to handle.

Photo 26a – Reinforcement detail for the core wall as seen on the work platform. In order to reduce the thickness of wall, Grade 90 high strength concrete was used for the core wall and the mega columns from the basement up to 60/F.
Photo 27a and 27b – The jump form for the construction of the core wall in two operating phases. Note also the set of lift-form (orange in colour) on the right side of core wall for the construction of the finger wall.
Photo 27c and 27d – lift-form (orange in colour) used for the construction of the finger wall appended to the core wall.
- Steel Outrigger (occupying 3 Floors)
- Pre-stressed R.C. Outrigger (occupying 5 Floors)

Figure 4 – Outriggers Distribution
Frame embedded in core wall

Figure 5 – composition of a set of typical Outrigger
Figure 6 - Steel Outriggers Construction

Core Wall

Mega Column

- 81/F (325.1mPD)
- 80/F (320.6mPD)
- 79/F (316.1mPD)
- 78a/F (312.1mPD)
- 78/F (308.0mPD)
- 77/F (303.9mPD)
- 76/F (299.4mPD)
- 75/F (294.9mPD)

30m

Embedded anchor frame

Outrigger frame

Connection joint
Photo 28a, b and c – anchor frame to be embedded in the core wall for the tightening of the outrigger member
Photo 28d – installing the jointing member (K-knot) of the outrigger onto the slot provided in the mega column.

Photo 28e – outrigger member in initial connected position before final adjustment and welding.
Photo 29a and 29b – Unlike other outrigger system used to stiffen the structural frame for highrise tower, ICC employed a set of cast-in-situ RC outrigger system., tensioned in various stages. This design was employed to gain time in the planning and fabrication of the structural members. Photo 29a shows a set of anchor block on the side of the mega column. Photo 29b is another set situated inside the core wall.
Photo 30a and 30b – In order to facilitate the lifting of huge amount of materials to support the construction, besides the provision of 4 sets of tower cranes and a concrete boom mounted on the top of the core, a temporary access tower with link bridge constructed in steel is also installed for the lifting of workers and materials. Photo 30 shows the external view of the access tower and the material hoist. Photo 31 shows the detail of the mounting.
Photo 31a, b and c – construction detail of the access tower and link bridge for the material hoisting system
Photo 32 – External view of the tower as seen in October 2006 showing all the major structural parts of the tower were under construction at its typical cycle. This included the core wall structure, the finger wall (wall appended to the core wall up to 50/F, the mega columns and the floor deck). Note also the spacious entrance canopy with about 25m headroom on the lower right corner of photo.
Photo 33 and 34 – Gradual progress of the tower structure as seen in early to mid 2007 with the installation of curtain wall for the lower floors which scheduled for the obtaining of the temporary operation permit by November 2007.
Photo 38a and 38b – Exterior view of building showing the installation of the curtain wall
Photo 39a – View of the landscape garden on the podium deck of Kowloon Station as seen from the roof of Sorrento by the end of 2006. The Harbour Side (君臨天下, left) and two service apartment/hotel blocks (The Cullinan, 天璽) are on the sides of the ICC Tower. While the landscape garden, by that time still under construction, was part of the provisions for the shopping mall, the Elements project.
Photo 39b – View of the ICC Tower in March 2008 from the roof of Sorrento with the other MTRC property developments on the sides.
Photo 40 – The structural frame for the entrance canopy hood under construction. The hood will provide a covered link between the mall of Elements and the main lobby of ICC.

Photo 41 and 42 – exterior view of the canopy hood
Photo 43a – Exterior view of the entrance canopy. On the left of the canopy is the vehicular drop-off platform which was opened after the obtaining of the temporary operation permit in November 2007. A work access way and material loading area was provided on the right, fenced by hoarding, to support the construction work for the remaining portion of the tower structure until its handling over in mid 2010.

Photo 43b – Interior view of the entrance lobby (inside the canopy) as seen in June 2008. The tower by the time was leased and in use under a temporary operation permit.
Photo 44 – The completed landscape garden and the spatial layout leading to various property developments as seen in May 2008. The entrance hood to MTR Kowloon Station is situated in the centre of the garden. A square on a lower level of podium outside the entrance canopy to the ICC Tower and other greening facilities can also be seen in the upper part of the podium.
Photo 45 – The entire development in the Kowloon Station on the southern tip of the new land formed by the West Kowloon Reclamation as seen from Tai Kok Tsui
End of presentation