The 2010 Post Tensioned Structure Awards

Strata

Elephant and Castle
London

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Strata (Formerly Castle House)

Strata is a 147 metre high, 43-storey residential development which forms the focal point of the £1.5 billion, 170 acre regeneration of the Elephant and Castle area in central London (see image 1). The innovative design of the structure creates a dramatic new landmark on the London skyline and is the first building in the world to have three integrated wind turbines, each nine metres in diameter, which are housed in the twenty metre section at the top of the tower. This 43 storey development comprises 408 apartments which provide far-reaching views across the Capital. CCL was commissioned to undertake the specialist design, supply and installation of the post tensioning for the post-tensioned levels.

The objective for the design provided by CCL was to create a flat soffit within minimal floor to floor heights whilst at the same time maintaining a reduced slab thickness. The use of post-tensioning on this project made it possible to achieve long spans with difficult plan geometry, to maintain a structural depth of typically 200mm on spans of up to nine metres. (see drawing 2510-09-PL-102 rev 05) This slab depth would have proved impossible using traditional reinforced concrete construction methods. At the same time the post-tensioned slabs provided deflection and crack control for these spans across the tower.

Also included in the design was a stage stressed transfer beam at level two of the main tower. This was used to control deflections as construction continued above, whilst minimising structural depth and headroom implications.

Any requirement for downstand beams in the typical residential floor plate was removed which facilitated the routing of services and the soffit marking of tendons.

The floors themselves were of a curved design which created additional complications. These were overcome by the use of every size of anchorage from within CCL's innovative XF range which was developed to exceed the requirements of BS EN 13391 and ETAG 013. CCL was the first company within the UK to develop a range of post-tensioning anchors to these rigorous standards and the Strata project itself was the first in the UK in which these products were installed. The use of the CCL XF system allowed the interconnection of smaller anchors with wider duct. The subsequent use of

wider duct for the curved tendons around the edge of the building resulted in reduced friction when pushing the strand up to 30 metres in a multi faceted curve (see image 2).

The construction of the tower began in July 2008 and the floors were completed in 49 weeks, which resulted in an impressive completion rate for most of the post-tensioned floors of one per week (5.5 day average).

Use of post-tensioning resulted in a reduction of 50 – 75mm of concrete per floor when compared to traditional reinforced concrete construction. This permitted an overall saving of approximately 2000m^3 of concrete within the superstructure alone (around 760 tonnes of embodied C02), with further savings resulting in the substructure in the form of reduced depth and diameter of piles and consequently reduced muckaway. The combined reduction in the concrete per floor was equivalent to approximately three metres, or an additional floor within the same building envelope when compared to traditional construction methods.

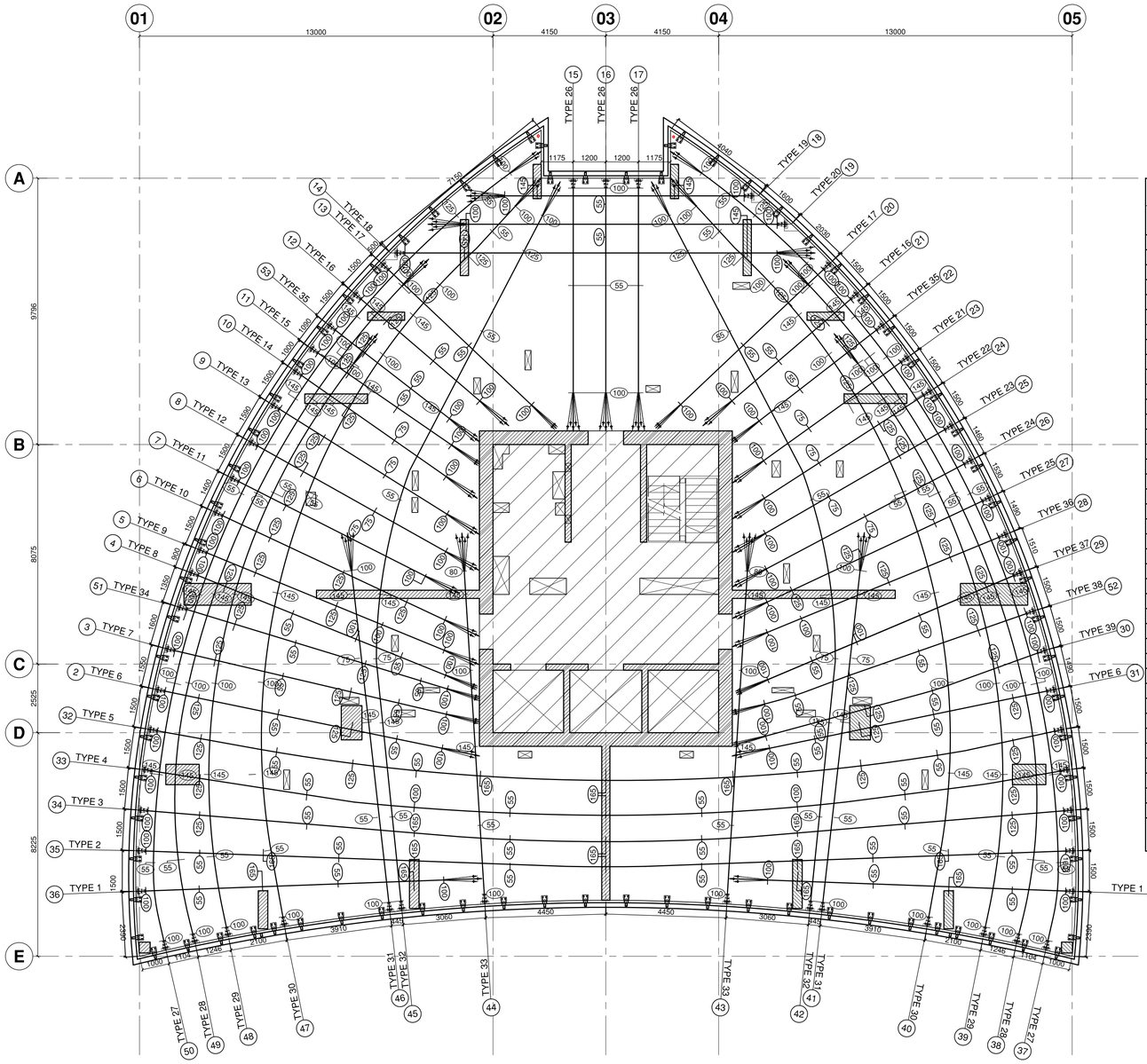
In terms of value for money, the post-tensioned floors produced savings of at least 15 per cent of the costs of the superstructure materials alone and further cost reductions were achieved because of the rapid construction schedule CCL was able to realise, and the use of climbing screens and a formwork hoist (see image 3). Minimal quantities of traditional reinforcement were required which in turn minimised the financial risk to the client over a long construction period in an uncertain market.

The success of the use of post-tensioning in this project was attested by the client, whose positive feedback confirmed the completion of both design and installation of the system on time and within budget. Waste materials were kept to a minimum and all such items were recyclable, thereby reinforcing the sustainability of this method of construction.

IMAGE 1

IMAGE 2

IMAGE 3



THIRD FLOOR TENDON SCHEDULE

TYPE No	No OFF	ANCHOR TYPE	NUMBER OF LIVE ENDS	NUMBER OF STRANDS	STRAND TYPE	GUTS (kN)	*LENGTH (m)	SUGGESTED PLACING SEQUENCE	JACKING FORCE PER STRAND	EXTENSION (mm)	STRESSING
1	2	XF-10	1	3	12.9 SUPER	186	12.75	3	149KN	69	SINGLE END STRESSED
2	1	XF-10	2	3	12.9 SUPER	186	34.50	3	149KN	218	DOUBLE END STRESSED
3	1	XF-10	2	3	12.9 SUPER	186	34.50	3	149KN	229	DOUBLE END STRESSED
4	1	XF-10	2	3	12.9 SUPER	186	34.35	3	149KN	230	DOUBLE END STRESSED
5	1	XF-10	2	3	12.9 SUPER	186	33.90	3	149KN	216	DOUBLE END STRESSED
6	2	XF-10	1	3	12.9 SUPER	186	12.30	1	149KN	74	SINGLE END STRESSED
7	1	XF-10	1	2	12.9 SUPER	186	11.85	1	149KN	71	SINGLE END STRESSED
8	1	XF-10	1	2	12.9 SUPER	186	11.50	1	149KN	67	SINGLE END STRESSED
9	1	XF-10	1	3	12.9 SUPER	186	11.35	1	149KN	67	SINGLE END STRESSED
10	1	XF-10	1	3	12.9 SUPER	186	10.70	1	149KN	64	SINGLE END STRESSED
11	1	XF-10	1	3	12.9 SUPER	186	9.50	1	149KN	59	SINGLE END STRESSED
12	1	XF-10	1	3	12.9 SUPER	186	9.75	1	149KN	56	SINGLE END STRESSED
13	1	XF-10	1	3	12.9 SUPER	186	9.05	1	149KN	51	SINGLE END STRESSED
14	1	XF-10	1	3	12.9 SUPER	186	8.30	1	149KN	45	SINGLE END STRESSED
15	1	XF-10	1	2	12.9 SUPER	186	7.60	1	149KN	41	SINGLE END STRESSED
16	2	XF-10	1	3	12.9 SUPER	186	7.70	1	149KN	41	SINGLE END STRESSED
17	2	XF-10	1	2	12.9 SUPER	186	8.90	1	149KN	50	SINGLE END STRESSED
18	1	XF-20	1	5	12.9 SUPER	186	15.50	5	149KN	100	SINGLE END STRESSED
19	1	XF-20	1	5	12.9 SUPER	186	10.60	5	149KN	66	SINGLE END STRESSED
20	1	XF-20	1	5	12.9 SUPER	186	13.20	5	149KN	84	SINGLE END STRESSED
21	1	XF-10	1	3	12.9 SUPER	186	7.95	1	149KN	45	SINGLE END STRESSED
22	1	XF-10	1	3	12.9 SUPER	186	8.70	1	149KN	50	SINGLE END STRESSED
23	1	XF-10	1	3	12.9 SUPER	186	9.40	1	149KN	54	SINGLE END STRESSED
24	1	XF-10	1	3	12.9 SUPER	186	10.00	1	149KN	59	SINGLE END STRESSED
25	1	XF-10	1	3	12.9 SUPER	186	10.55	1	149KN	63	SINGLE END STRESSED
26	3	XF-20	1	5	12.9 SUPER	186	9.30	4	149KN	55	SINGLE END STRESSED
27	2	XF-10	1	3	12.9 SUPER	186	34.30	4	149KN	195	SINGLE END STRESSED
28	2	XF-10	1	3	12.9 SUPER	186	27.85	4	149KN	159	SINGLE END STRESSED
29	2	XF-10	1	3	12.9 SUPER	186	23.80	4	149KN	133	SINGLE END STRESSED
30	2	XF-10	1	3	12.9 SUPER	186	31.00	4	149KN	173	SINGLE END STRESSED
31	2	XF-20	1	5	12.9 SUPER	186	14.05	2	149KN	83	SINGLE END STRESSED
32	2	XF-10	1	3	12.9 SUPER	186	28.35	2	149KN	165	SINGLE END STRESSED
33	2	XF-20	1	5	12.9 SUPER	186	13.70	2	149KN	84	SINGLE END STRESSED
34	1	XF-10	1	2	12.9 SUPER	186	11.65	1	149KN	69	SINGLE END STRESSED
35	2	XF-10	1	2	12.9 SUPER	186	7.10	1	149KN	38	SINGLE END STRESSED
36	1	XF-10	1	3	12.9 SUPER	186	10.95	1	149KN	66	SINGLE END STRESSED
37	1	XF-10	1	2	12.9 SUPER	186	11.55	1	149KN	69	SINGLE END STRESSED
38	1	XF-10	1	2	12.9 SUPER	186	11.80	1	149KN	70	SINGLE END STRESSED
39	1	XF-10	1	2	12.9 SUPER	186	12.20	1	149KN	71	SINGLE END STRESSED

* LENGTH: THE LENGTH GIVEN IS THE TOTAL LENGTH EXCLUDING STRESSING TAILS

Legend:

- Stressing End
- Dead End
- 55 — Height from slab soffit to center of tendon duct shown thus
- RC slab to be designed by others

REV.	DATE	DESCRIPTION
05	29-05-08	Issued For Construtions
04	17-04-08	Issued For Construtions
03	31-03-08	Issued For Construtions
02	27-02-08	As clouded
01	04-02-08	As clouded
00	04-01-08	Issued For Aproval

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PROJECT
CASTLE HOUSE

ISSUED FOR
CONSTRUCTION

POST-TENSIONING DRAWING TITLE
TENDONS LAYOUT
LEVEL 03

DRAWING NO./FILE NAME	REV.
2510-03-PL-102	05

PROJECT NO.	DATE	SCALE @ A1	DRAWN BY	CHECKED BY
B-044-0077	04-01-08	1/100	T.S	S.K