

**The 2010 PTA**  
**POST-TENSIONED STRUCTURE**  
**Awards**



**MediaCityUK**

Salford, Manchester

A multi-office development for the BBC

## **MediaCityUK**

### **A multi-office development for the BBC**

Phase 1 of the Peel Group's MediaCityUK will provide a purpose-built media zone across 36 acres of Salford Quays near Manchester. The development includes offices, studios, retail space, 378 apartments, a 2200-space multi-storey car park, two hotels and a public piazza. Opening is scheduled for 2011 but the BBC has already taken possession of its three buildings and is currently progressing through the technical fit-out. The Corporation will shortly relocate 2500 staff to Salford, bringing five departments from London together with all BBC Manchester operations.

The management contractor, Bovis Lend Lease, started work in the summer of 2007 at the height of the construction boom. They decided to stagger the construction of the BBC's studios and production buildings to reduce the enormous peak in labour. Consequently, the site and design teams have benefited from three years of continuous work.

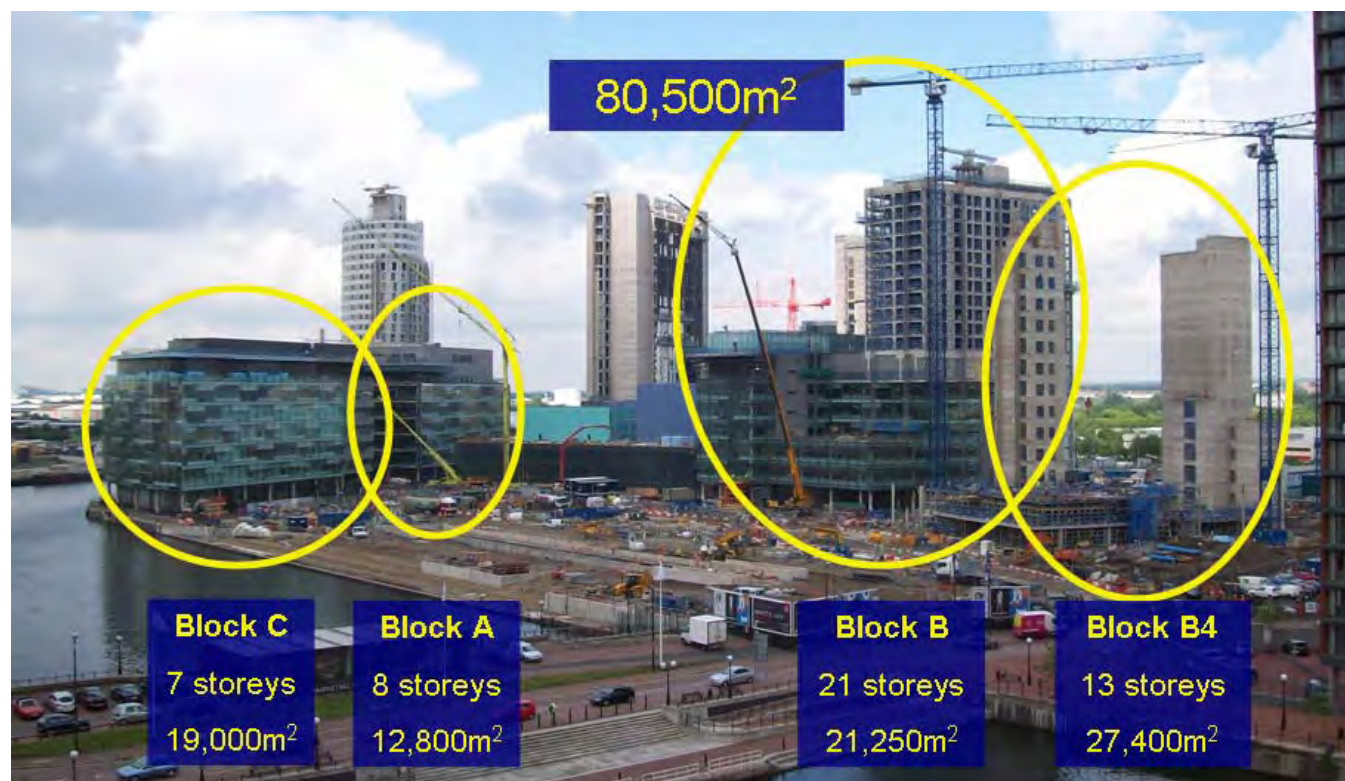
Heyrod Construction was the frame contractor for the four concrete buildings and it appointed Freyssinet to do all the post-tensioning work. The first building to start, late in 2007, was Block C on the corner of the site with a double aspect overlooking the Manchester Ship Canal and Salford Dock. Block A was next in February 2008, comprising of eight PT floor levels and a residential tower of 25 floors in traditional reinforced concrete. This was followed a couple of months later by Block B comprising of PT floors to seven levels of office area and twenty one floors within a residential tower. All three are to be used by the BBC as production and office space. The Architect for these buildings was Chapman Taylor with Jacobs as the Engineer for the buildings and infrastructure works.

An additional contract now nearing completion is Block B4, a new higher education campus for the University of Salford, which will house 700 students and staff.

The design of the post-tensioned slabs and beams on all four blocks was led by Freyssinet with Matthew Consultants doing the detailed design of the flat slabs to Block B and two floors of Block C. Freyssinet's in house team designed the Block B cantilever beams, Block B4, Block A and the remainder of Block C.

### The post-tensioned flat slabs

All four buildings are notable post-tensioned structures in their own right but together the area of PT floor slab totals 80,500m<sup>2</sup> making MediaCityUK one of the most significant PT office developments in the UK.



The structural arrangement of each block is as follows:

- Block A has eight levels of 275mm-thick PT flat slab on a typical grid of 9 × 9m. Where edge deflections are critical, 1500 by 425mm-deep PT edge beams have been added. The total PT slab area here is 12,800m<sup>2</sup>.
- Block B again uses 275mm PT flat slabs for the typical 9 × 9m areas but with 1500 × 450mm-deep PT edge beams where the grid pushes out to 10.5 × 9m. PT slab area totals 21,250m<sup>2</sup> spread over 21 storeys. Details of the 8.25m cantilevers are given below.
- For the seven-storey Block C, the slab deepens to 300mm to cater for grids up to 12 × 9m with 1500 × 450mm edge beams. The 275mm slabs are again used in the 9 × 9m areas, bringing the total area to 19,000m<sup>2</sup>.
- Thirteen-storey Block B4 has a zone of 400mm deep slab for a 12.8 × 9m panel adjacent to the main core and 275mm slabs in the 9 × 9m grids elsewhere. As the cladding is different on this block, Freyssinet has been able to design the slabs without edge beams. This block totals 27,400m<sup>2</sup>. Details of the cantilever slabs are given below.

The post-tensioning system used for the flat slabs of all four buildings was the Freyssinet 4S15 flat duct bonded system.





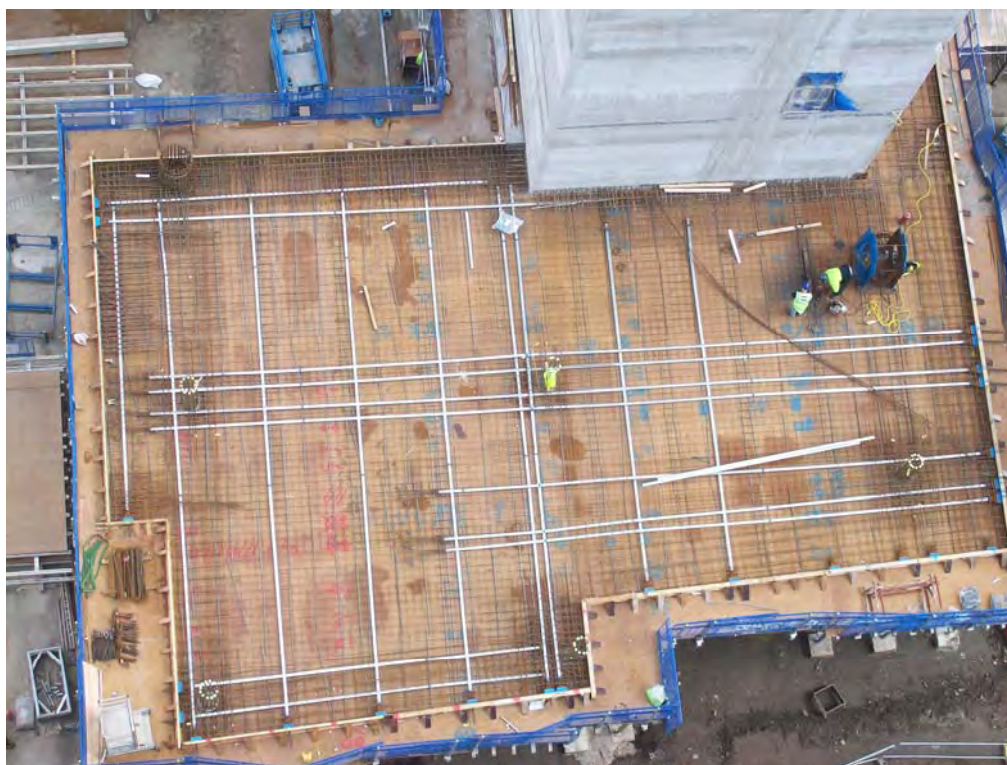
*Above: The frame of Block A nears completion.*

*Above Right: Deck installation continues on block B4.*

*Right: Tendon layout on pour 2, level 1 Block B4.*

*Below: Blocks B and B4.*

*Below Right: Grouting with Tecroc pre-bagged Cable Grout*





## Long cantilever beams on Block B

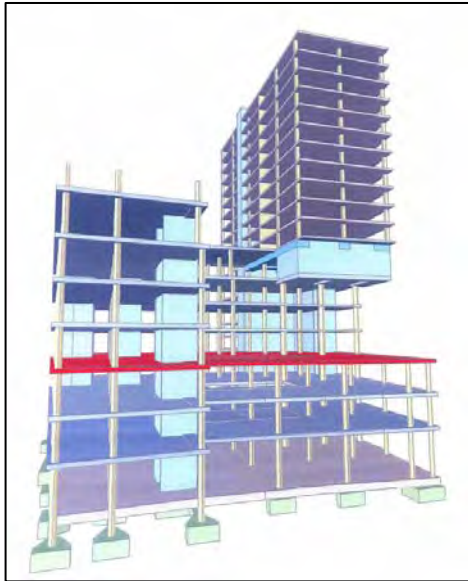
Block B is dual use, being offices for the BBC at the lower levels and apartments from level 6 to 21. On the east wing, the apartment block footprint is greater than the supporting office footprint below and the solution developed by Chapman Taylor was an 8.25m cantilever on the front of the building to create a dramatic feature visible from the public piazza below. Freyssinet worked closely with, Jacobs to ensure the end design met the spatial, structural and deflection tolerances. The solution was three post-tensioned concrete beams, 1.75m deep by 2m wide to support the 11 storeys above. Each beam contained ten 19-strand tendons, which give a total prestressing force of 42,000kN per beam to resist the 56,000kNm ULS bending moment. The 28-day concrete strength was 60MPa.

Post-tensioning is an excellent way of forming cantilevers. Not only do the tendons deliver the required strength, they also provide an upward deflection due to the tendon profile. This physically lifts the tip of the cantilever and the designer can play with the post-tensioning force and tendon profile to tune the uplift to match the downward deflection from the structure above. Thus, deflection control is mastered.

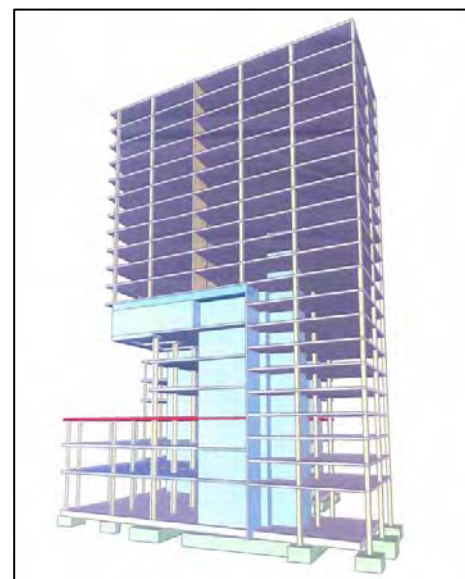
Interestingly, as level 6 was designated a plant room, the main transfer structure was provided at level 7 with level 6 suspended from it. The reduced headroom beneath the beams could be accommodated within the plant area. In order to limit stresses and deflections the transfer beam tendons were stressed in two stages. After the construction of levels 6 and 7, eight out of the ten tendons in each beam were fully stressed and grouted. Construction then progressed up to and including level 13, whereupon the remaining two tendons in each beam were stressed and grouted.



*Each of the 1.75m deep cantilever beams on Block B contained ten 19-strand tendons*



*The 8.25m cantilever on Block B supports twelve floors.  
Images courtesy of Jacobs*





### Cantilevers on Block B4

The engineer and architect on this block were Halcrow Yolles and Sheppard Robson respectively. They also schemed cantilevers on the front face overlooking the piazza. The modest 2.75m cantilevers of the east wing were managed with the standard 275mm-deep PT flat slab but the 5.2m cantilevers of the west wing needed help from three 3m-wide by 400mm-deep PT beams. The incremental deflection at the tip was limited to just 12mm.



### Environmental benefits

MediaCityUK is the first scheme in the world to become a BREEAM approved sustainable community and achieved this by incorporating world leading sustainability into the design. Compared with conventional reinforced concrete frames, the decision to use post-tensioning on this project has saved an estimated 1000m<sup>2</sup> of cladding, 6050m<sup>3</sup> of concrete, 2600 tonnes of steel, 1000 return lorry journeys and 4200 tonnes of CO<sub>2</sub>.

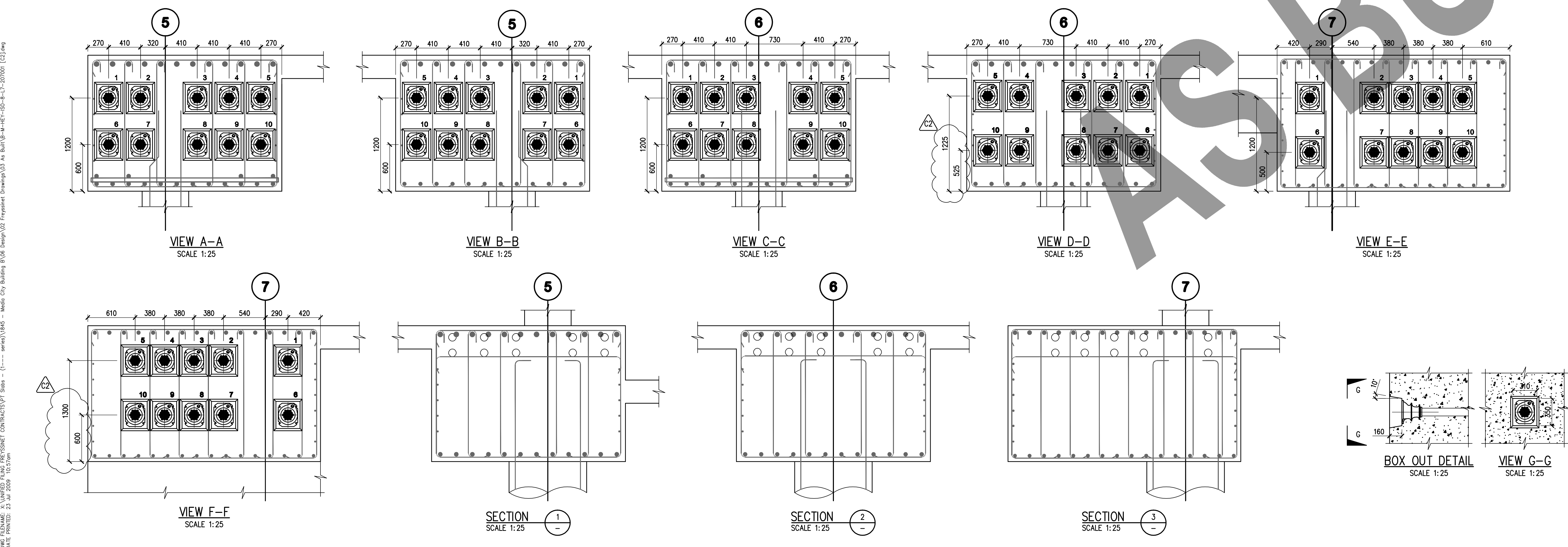
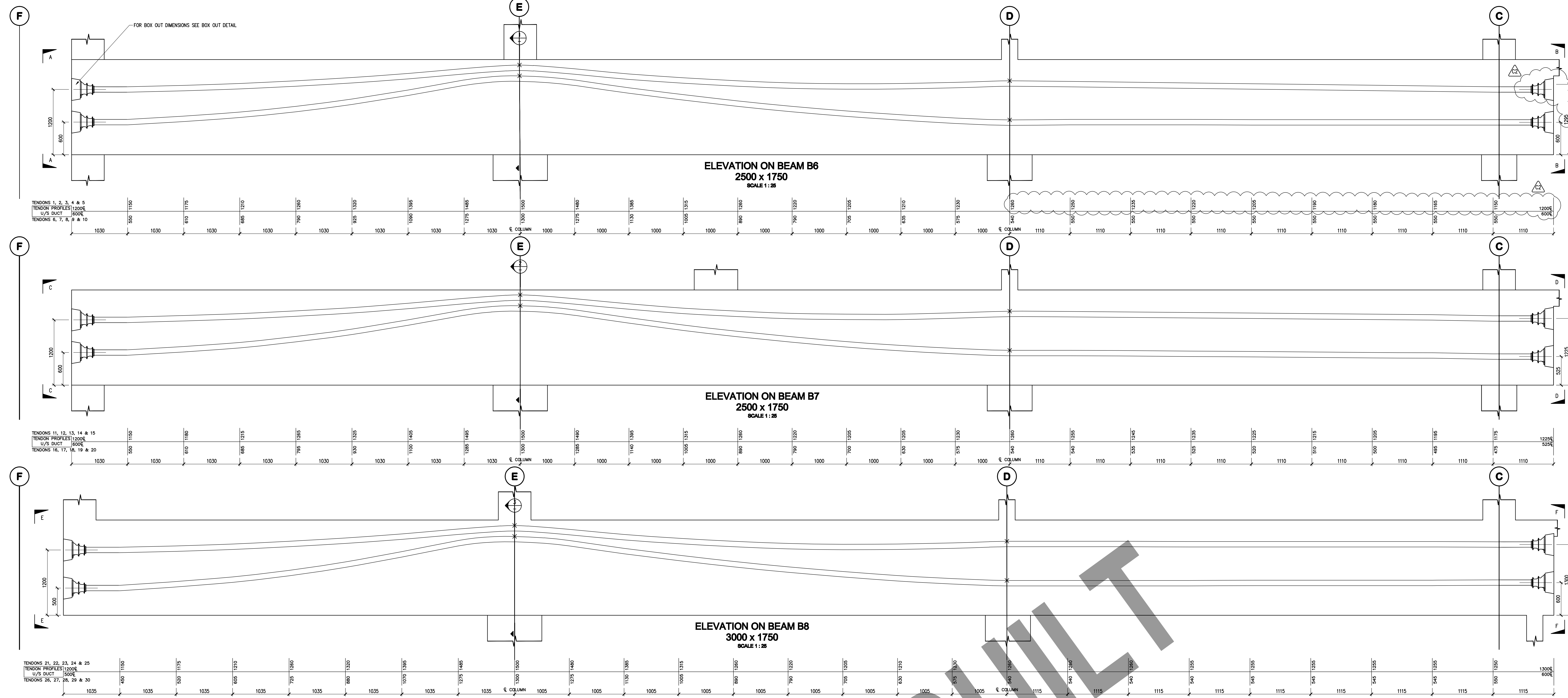


*Salford has attracted a lot of PT construction:  
left – MediaCityUK;  
centre – City Lofts;  
and right – Salford Quays.*

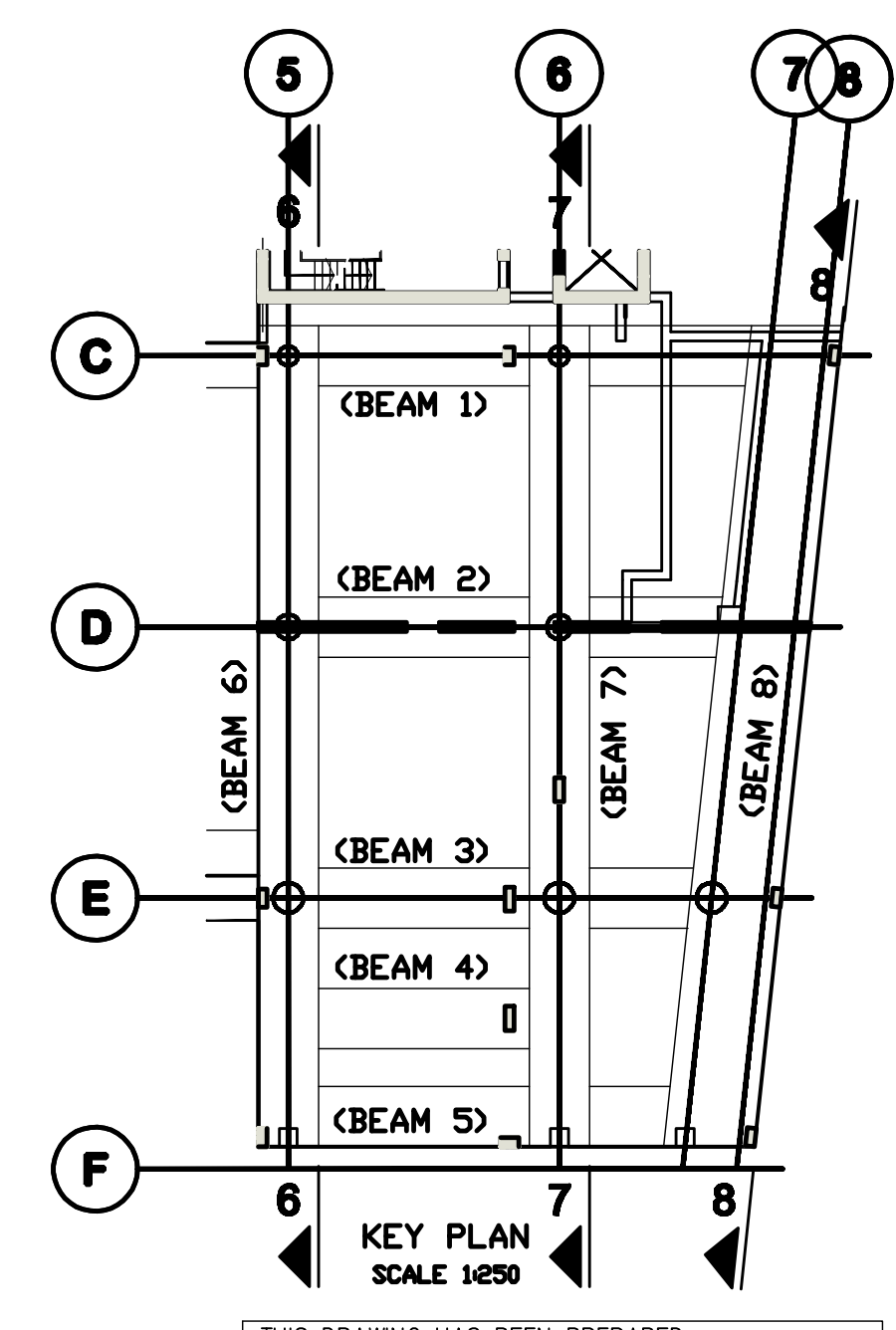


*The development nears completion, March 2010.*





- NOTES**
- All Dimensions are in mm.
  - Concrete compressive strength  $f_{cu}$  at 28 days = 60MPa
  - Post Tensioning Steel Characteristics:  
uncoated, seven-wire super strands,  
low relaxation to BS 5896  
strand diameter: 15.7mm  
strand area: 150mm<sup>2</sup>  
ultimate strength: 1860MPa  
modulus of elasticity: 195,000MPa
  - Friction Loss Parameters:  
angular coefficient of friction: 0.20/rad  
wobble coefficient of friction: 0.002/m  
anchor set (or wedge pull-in): 6mm  
jack friction calibrated into jack force
  - Location of tendons has priority over reinforcement.
  - Grouting to be done after all tendons are 100% stressed.
  - Grouting Vents must be placed at all high points marked with 'X' and at anchorages.
  - All tendons are 19C15.
  - Ducts to be steel corrugated, diameter 100MM for 19C15.  
Ducts are supported at a maximum of 1000mm intervals  
and positioned to a tolerance of  $\pm 5$ mm vertically and  
 $\pm 10$ mm horizontally.
  - Minimum cover to duct is 100mm.
  - All tendons to be stressed to 4241Kn, and from grid line F  
only.  
Stressing Sequence:  
Stressing Phase 1 - After levels 6 & 7 have been cast  
and the concrete strength in the PT beams has reached  
40N/mm<sup>2</sup> and prior to falsework removal; stress 8 out  
of the 10 tendons in each beam in the following  
sequence: 3, 5, 2 then 4, in Beams B6, B7 then B8.  
And then 9, 7, 1 then 5; in Beams B6, B7 then B8.  
Stressing Phase 2 - after level 13 has been cast stress  
the remaining 2 tendons in each beam in the following  
sequence: 6 then 10, in Beams B6, B7 then B8.
  - Dimensions are given to the underside of the ducts.



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are to be checked on site before any  
work is put in hand. If in doubt, ask.

Rev	Date	Description	Rev	Date	Description
C2	19-09-08	REVISED	18	AM	
C1	01-09-08	ISSUED FOR CONSTRUCTION	18	AM	
F1	29-05-08	PRELIMINARY ISSUE	18	AM	

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Project  
**MEDIA CITY  
BUILDING B  
MANCHESTER**

Orig. Title  
**OFFICE LEVEL 7, POUR 5  
TRANSFER BEAMS  
PT ELEVATIONS, SHEET 1**

Scale  
1:25 (A0)

Date  
29-05-2008

Drawn by  
DB

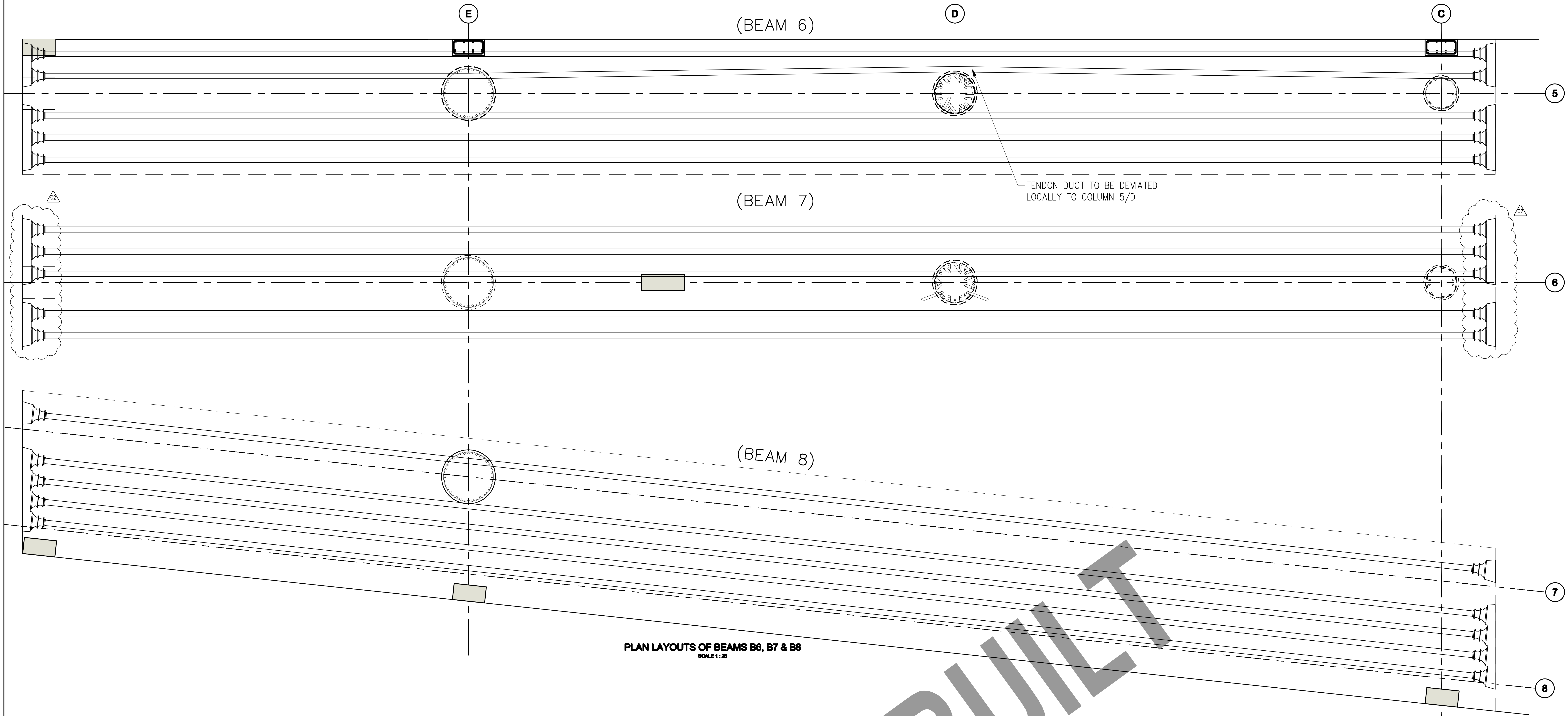
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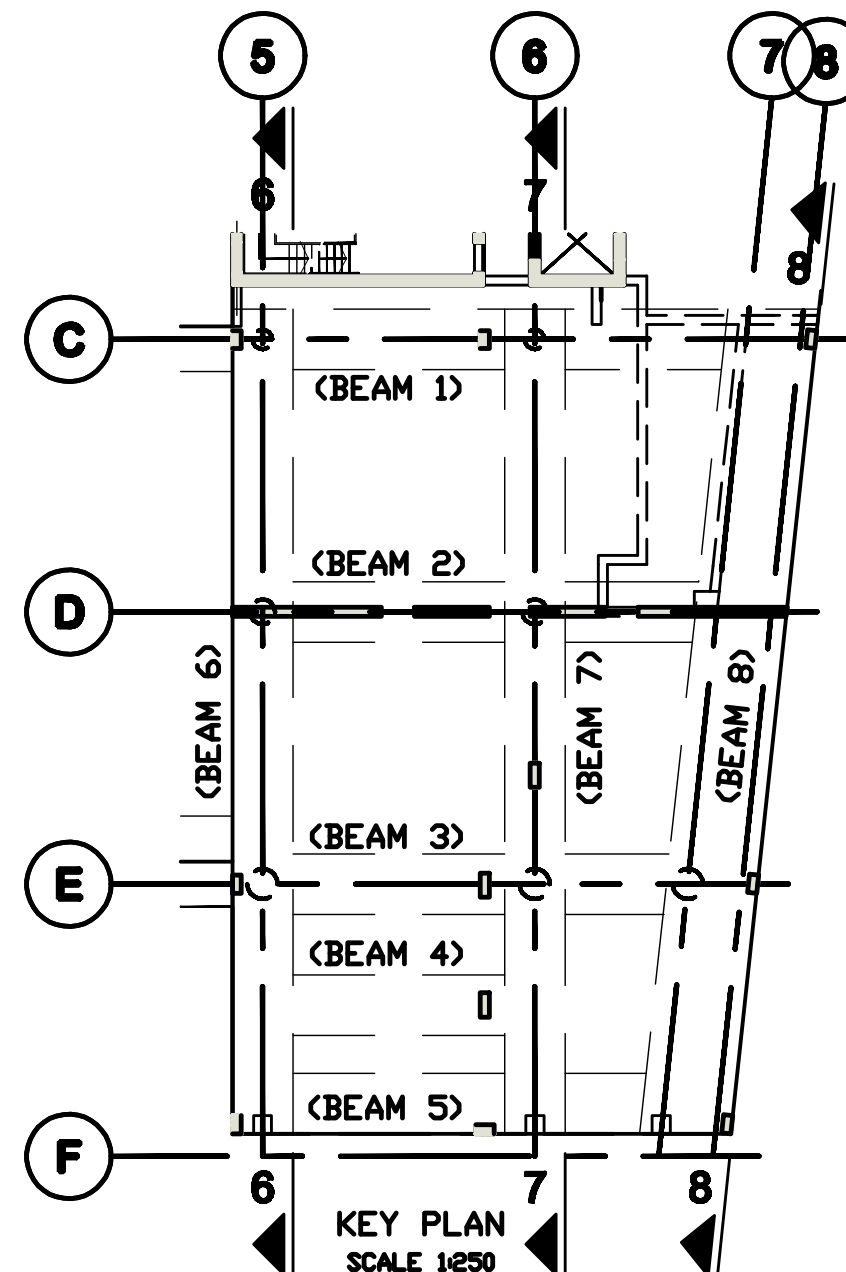
Drawing Number	Rev
B-M-HEY-ISO-8-L7-207001	C2

Status  
**CONSTRUCTION ISSUE**





PLAN LAYOUTS OF BEAMS B6, B7 & B8  
SCALE 1:25



THIS DRAWING HAS BEEN PREPARED FROM DRAWINGS:		
L7 GA	B-B-JAC-2000-LPL-8-18-3026	REV C6
L7 BEAM REG. SH1 1	B-M-JAC-ISO-8-L7-3374	REV C1
L7 BEAM REG. SH1 2	B-M-JAC-ISO-8-L7-3375	REV C2
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Rev.	Date	Description	By	Chk.
C2	16-09-08	BEAM 7 ANCHOR ARRANGEMENT REvised	DB	AM
C1	08-09-08	ISSUED FOR CONSTRUCTION	DB	AM

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Project  
**MEDIA CITY BUILDING B MANCHESTER**

Dwg. Title  
**LEVEL 7, POUR 5 TRANSFER BEAMS PT PLAN LAYOUT, SHEET 2**

Scale  
1:25 (A0)

Date  
29-08-2008

Drawn by  
DB

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AM

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Drawing Number	Rev.
B-M-HEY-ISO-8-L7-207002	C2

Status  
**CONSTRUCTION ISSUE**