C12. Final Design of RC Columns

Final design of the RC columns is not documented herein. The method is as indicated at the preliminary design stage section B7.

C13. Detailed Design of the Core

C13.1 Preliminary discussion and statement of limitations of this section

The analysis and design of a reinforced concrete core for a high rise building incorporating composite construction is essentially the same as that for a reinforced concrete building. Depending on the detailing it is possible that the steel frame may behave in a more ideally 'pin jointed' fashion than a reinforced concrete frame. This may make the steel framed composite building less 'forgiving' than a reinforced concrete building that will inevitably tend to have considerable 'rigidity' due to the nature of the 'monolithic' connections between concrete columns, beams and slabs. This partial rigidity in the RC building may in turn give rise to significant rigid frame 'portal' strength and stiffness against horizontal loading that could allow for a reduction in the strength and stiffness of the core. On the other hand the reduced overall mass of a composite building may lead to reductions in the size of the core depending on the balance between vertical and horizontal load effects.

Despite this, for design purposes many buildings, whether reinforced concrete or steel framed composite, are designed assuming no contribution to horizontal strength and stiffness from the frame and consequently the design of the core for RC or composite construction under this assumption will be identical.

This section does not present fully detailed calculations for either the analysis or design of the reinforced concrete core because the focus of this design file is on those aspects of design that are relatively unique to composite construction.

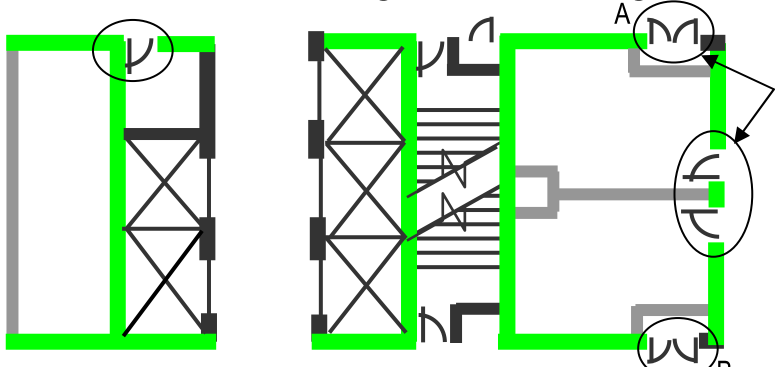
The analysis and design of the core of a high rise building relying on 'pure shear core action' represents the single most complicated and critical element of the structural design of a high rise building. This is particularly the case where the building height exceeds say 15 or 20 storeys or where horizontal loads are larger than normal due to high wind loading or seismic loading. Core design should always be undertaken using rational engineering principles but equally, senior engineers with experience of the realities and practicalities of high rise construction should inform the design.

The following record of design calculations is not intended to represent a definitive method for the final analysis and design of a high rise core. It is intended to be representative of an approach that has been successfully applied to the design of reinforced concrete cores symmetrically placed in a symmetrical building (so as not to be required to carry significant torsion loading) and where the building is no more than 20 floors in height.

The emphasis is on modelling for analysis and the determination and interpretation of predicted stresses and stress resultants and comparison to code defined limits. No detailed design calculations are provided though some indication of the design method is provided.

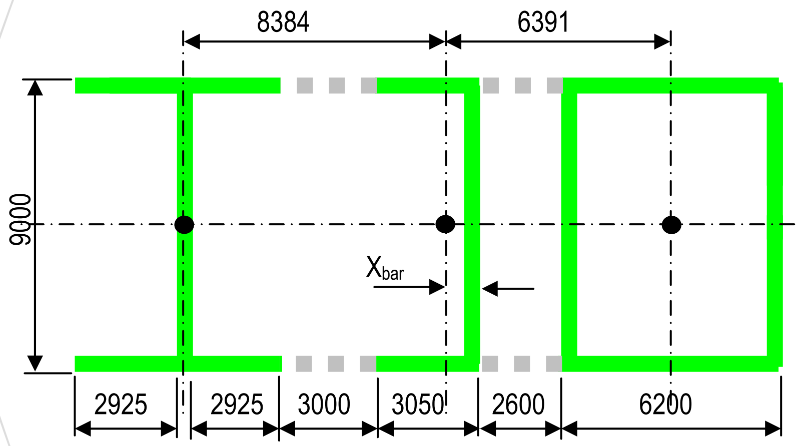
There have been some deliberate simplifications and omissions in this section some, but not all, of which have been noted.

C13.2 Basic modelling of the core using beam elements



OVERALL CORE LAYOUT IN PLAN

Some doors are ignored in the model for simplicity. This is non conservative. Doors at A and B will considerably reduce the ability to shed load into the right hand wall as a flange to the box section. To incorporate doors at A and B requires the introduction of another vertical beam representing just the right hand wall.

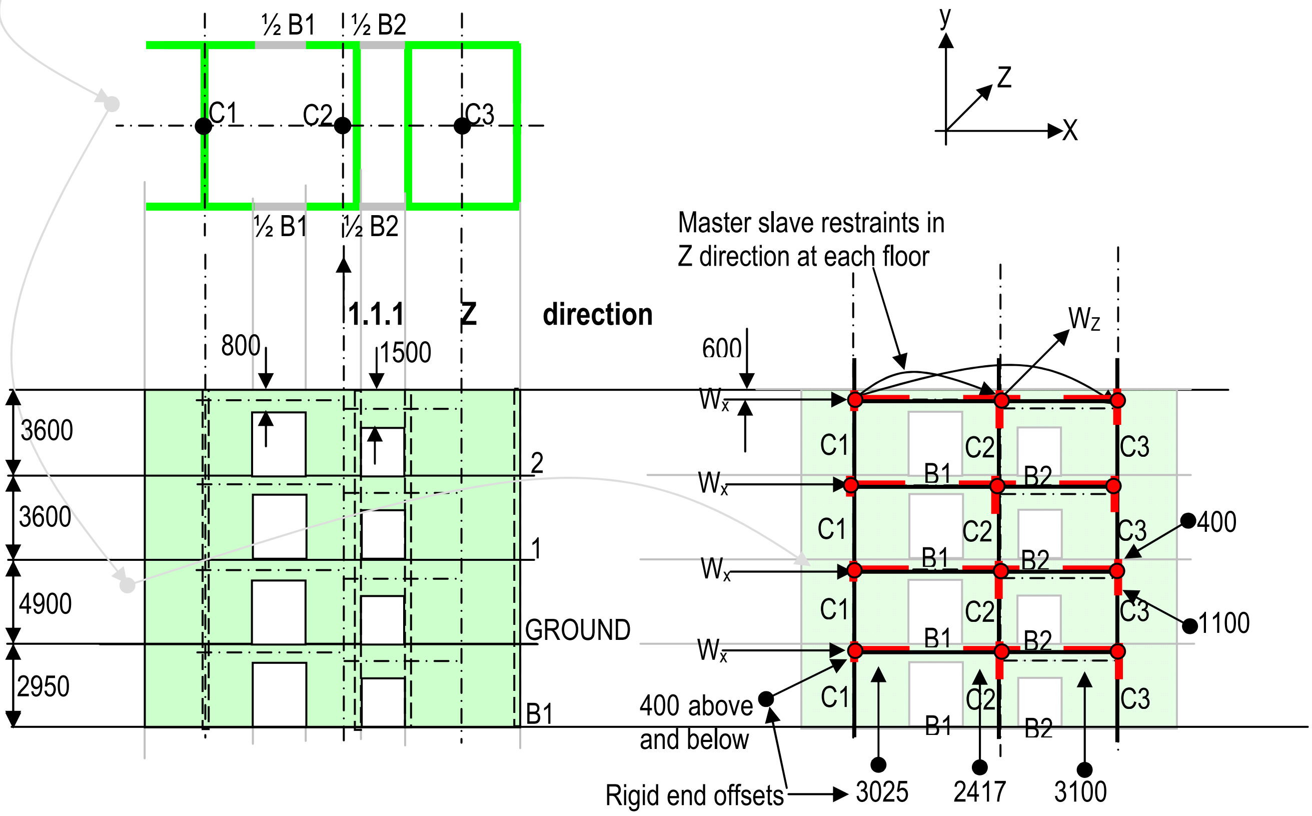


Distance to centroid of central channel

$$X_{bar} = \frac{2x3050x200x1525 + 8600x200x100}{2x3050 \times 200 + 8600 \times 200} = 691 \text{ mm}$$

Note all walls are assumed to be 200 thick. Note 'link beams' provided over openings. These provide important shear connection between the three parts of the core. They play a similar role to that of shear studs that link the steel and concrete parts of the composite beams.

PRIMARY STRUCTURAL WALLS EXTRACTED FROM CORE LAYOUT (with simplification)



REPRESENTATIVE PART ELEVATION

REPRESENTATIVE MODELLING

AUSTRALIAN STEEL INSTITUTE
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