4.6 RELATIVE VALUE PROPOSITION

4.6.1 GROUP REPORT

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The Warren Centre

Executive summary

This paper discusses in detail the findings of the Relative Values Issues Group, which focused on the relative values, monetary and otherwise, of the use of steel and concrete as framing materials for commercial buildings.

The group found that at present concrete is a more attractive framing material. However, while raw material for concrete is likely to increase in the near future, there is a substantial opportunity for steel to reduce its costs in the future. This will be achieved by the adoption, by all participants in the steel value chain – such as engineers, drafters, fabricators and material suppliers – of new technologies that allow seamless interoperability between these participants.

The relative values of steel and concrete are summarised in Table 1, which compares the two materials with the prevailing low-tech and the new steel delivery methodologies.

General

The value proposition is what the customer (or decision maker) sees or perceives is being offered and delivered into the marketplace. The relative value proposition compares the important attributes of steel and concrete to enable decision makers to decide to choose either a steel or a concrete frame for the building in question.

This section discusses the merits of each of the attributes listed below for both steel and concrete frames.

The commercial building industry environment

The commercial building industry comprises a disparate group of developers, owners, architects and project managers who have the responsibility for delivering a wide range of commercial building types to the owners/occupiers. Buildings under consideration in this project include low-high rise offices, shopping centres, hospitals and government buildings.

The commencement of any development project starts with the purchase of the land. A concept study is then undertaken to determine the most economic outcome for the development, taking into account planning regulations, likely rental returns, and the net lettable area of the building. These commercial decisions are then reflected in the maximum capital cost of the building as dictated by the rental revenue stream. This capital limitation then impacts on the building in terms of finishes, services, façade etc. At approximately 25 per cent of the building cost, the frame impacts on the management of capital costs.

Table 1: Assessments of Relative Values – Present and New Steel Technology

Item	Superior material – present steel practice	Superior material – new steel practice
Cost	Both approx the same	Steel
Time	Steel may be quicker	Steel
Safety	Steel and Concrete Equal	Equal using hi-tech steel
Sustainability	Concrete deemed better at this time – steel industry to seek new rating	Steel – if re-rated by GBCA
Fire engineering	Concrete	Equal
Risk	Concrete	Equal
Design process	Concrete	Equal
Design change and re-work	Concrete	Steel
Technical Issues		
- TI.1 -Accuracy of construction	Equal	Steel
- TI.2 Services interface	Equal	Steel
- TL.3 Façade interface	Equal	Steel
- TI.4 Floors and roof	Concrete	Equal
- TI.5 Core design	Equal	Equal
- TI 6 Floor vibration/deflection	Concrete	Equal
- TI 7 Cranage issues	Concrete	Steel
- TI 8 Building geometry	Concrete	Equal
- TI 9 Durability and maintainability	Equal	Equal
- TI.10 Footings and foundations	Equal	Steel
Delivery structure	Concrete	Equal

It is at this concept design stage that the decision on framing material is taken. In general, the engineering design with respect to structure and services is limited in detail, except for site-specific issues. For major works, it would be expected at this stage that the preliminary framing would be developed in 3D format for both steel and concrete solutions. A services engineering consultant should be engaged at this stage to advise on duct sizes and location, with this information being incorporated into the 3D model.

At this stage there is generally a reduction in design effort until a 'keystone' tenant is confirmed, at which time, the design program and construction period becomes critical due to the commercial conditions of the tenancy. This invariably means that some re-design of the building is required to meet the specific needs of major tenants. The availability of the 3D model at this time is essential in handling change with the development of detailed design.

At present, and in particular for large, high-rise, commercial projects on the eastern seaboard, concrete is often the automatic choice for the framing system due to the following:

- Concrete is about the same cost as steel
- Change can be accommodated more readily with concrete.
- The concrete industry is well organised with reliable supply.
- The pre-stressed concrete industry is very attuned to meeting the needs of the building industry with design and construct offers.
- Concrete is assumed to have a higher sustainability rating.
- Concrete is assumed to have superior fire resistance.
- Concrete pump technology ensures minimum cranage for frame construction.
- Concrete is more accommodating for services installation, ceiling treatment and floor to floor heights.

The new steel paradigm

Unlike other industries, the Australian steel fabricating industry has been slow to take up much of the existing computer-driven technology, which has made steel framing so competitive and so successful in Europe and the UK.

The Warren Centre survey conducted by the Technology Group (see Section. 5.6.3) indicated poor take-up of 3D documentation technology by fabricators and slow adoption of NC driven fabricating equipment e.g. cutting, drilling, marking. Architects and engineers, other than those from the very progressive firms have been slow to adopt 3D technology. On the other hand detailers as a group have shown the most enterprise, possibly because their survival depends upon high productivity.

This technology revolves around the use of 3D design tools, which are initially used to design the building and to form the database starting point for the building information model (BIM). As described by Barrett, (Section 1.4) the digital outcomes of the 3D structural model are then used as inputs to programs for:

- detailing each member
- automatic CNC cutting, drilling and welding machines (beam lines)
- the manufacture of weldments associated with each member
- material take-offs and procurement of the steel. These MTO's are then sorted into sections, cutting lengths to minimise scrap, drilling, marking and nesting programs
- the design of the floors and the procurement of metal decking for these floors
- the marking-off and identification of every steel member in terms of member number, mass, truck delivery and section.

The paper by Farley (Section 4.5.9) discusses the fabrication part of this technology in more detail. The new low-cost fabrication approach allows the alternative production of more efficient fabricated plate sections (compared with rolled sections) which can be tailored to accommodate services.

The net result of the application of the new steel technology to serve the building industry would be a reduction in the delivered price of steel framing of about 20 per cent (Farley Section 4.5.9) or about $100/sq m in a typical non-CBD, medium-rise building.

Japan has pioneered automated, self-climbing, canopy-style erection methodologies (Taylor et al 2003) that:

- allow all-weather construction
- allow 24/7 construction
- minimise large cranage use
- improves on-site safety.

However, it is doubtful if the size of the Australian market could justify introduction of this technology at present.

There is also the potential in the use of quick erection techniques to replace the alignment and bolting time of the connecting members (Munter 2006).

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STEEL – FRAMING THE FUTURE

The University of Sydney

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CONTENTS

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