

4.5.9 FRAMEQUICK: A KEY TO MODERN FABRICATION

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Executive summary

A number of advances in technology are coming together in a way that could revolutionise construction of steel buildings at a scale and price that is affordable to a typical Australian fabrication shop. This paper explores the possibilities of a flexible beam and column fabrication facility that will produce precision-made structural members tailored to suit any building. The system is designed to deliver members on demand so that deliveries to site are in the exact erection order and the manufacturing time is so short that floorspace requirements at the fabricator are halved and raw material stock and work in process could be measured in days.

Adoption of this system and complementary systems by industry could increase the turnover of the fabricating industry by a factor of two-three and result in massive savings for the Australian economy.

From the architectural and design point of view, FRAMEquick gives great freedom of design with spans up to 25m and curved, haunched or asymmetric beams being as easy to supply as straight sections. Structural members can be individually designed to allow penetrations for air-conditioning and other services through the beam to minimise floor heights and optimise material use. At the same time fire ratings and vibration standards are confirmed.

While fabricated sections are notionally more expensive than rolled sections, in many cases, because of the ability to optimise the material usage (e.g. make a 650mm deep beam rather than have to go up to a standard 700WB) and to make beams with narrow top flanges for composite decks, the fabricated structures are lighter, thus offsetting higher labour cost.

As the members are supplied complete with fin plates, base plates, splice plates and fascia outriggers etc, on-site drilling and welding can be almost eliminated. Where site work is required, the positions of attachments can be marked out on the metal so that site cost and erection time are absolutely minimised. This concept has already been proved with highway bridges with spans to 25m and accuracies better than 1mm. Due to the high level of automation, delivered cost to site of completely detailed and painted structural members would average around \$2300–\$2500 per tonne and

erection cost would be lower than industry standards because of the minimal field work and assembly accuracy.

FRAMEquick

Framequick is a concept for a flexible automated system using current generation software, machine tools and robotics to fabricate beams and columns for commercial, institutional and residential buildings. It is not a total building system like the Japanese systems, but a scalable small system that could easily be employed by quite a number of existing Australian fabricators. It does require a tighter level of integration between the engineer and fabricator but offers lower cost, shorter lead times and greater design flexibility.

Framequick is scalable so that a minimal system can produce about 1 tonne per hour of completely detailed beams; i.e. all the 'jewellery', bolt holes and end preparation, is included. This system will employ from none to seven shop floor staff and two to three engineers/programmers. In the early stages there can be a mix of robotic and manual welding so there is a smooth introduction of the technology. As demand increases production can be scaled up to 2000–3000 tonnes per month by replicating some components and increasing the size and sophistication of others. As production scales up, more sophisticated software packages reduce data preparation and programming time so that labour and capital costs do not rise proportionately.

The key factory components are robot welding cells and a high-performance cutting and drilling machine. The key software is a suite of structurally oriented CAD/CAM systems.

The system can be used with fabricated plate girders and columns, hot rolled structural sections and round or rectangular hollow sections. It can also be mixed with other beam fabrication systems such as the Zeman corrugated web construction.

It is dependant on a combination of current technologies:

CAD/CAM software

- structural design software such as Strucad, X-steel etc.
- beam/fire design software such as Fabsec
- offline robot programming
- offline cutting and nesting software.



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