How Solid is that Paper Wall?

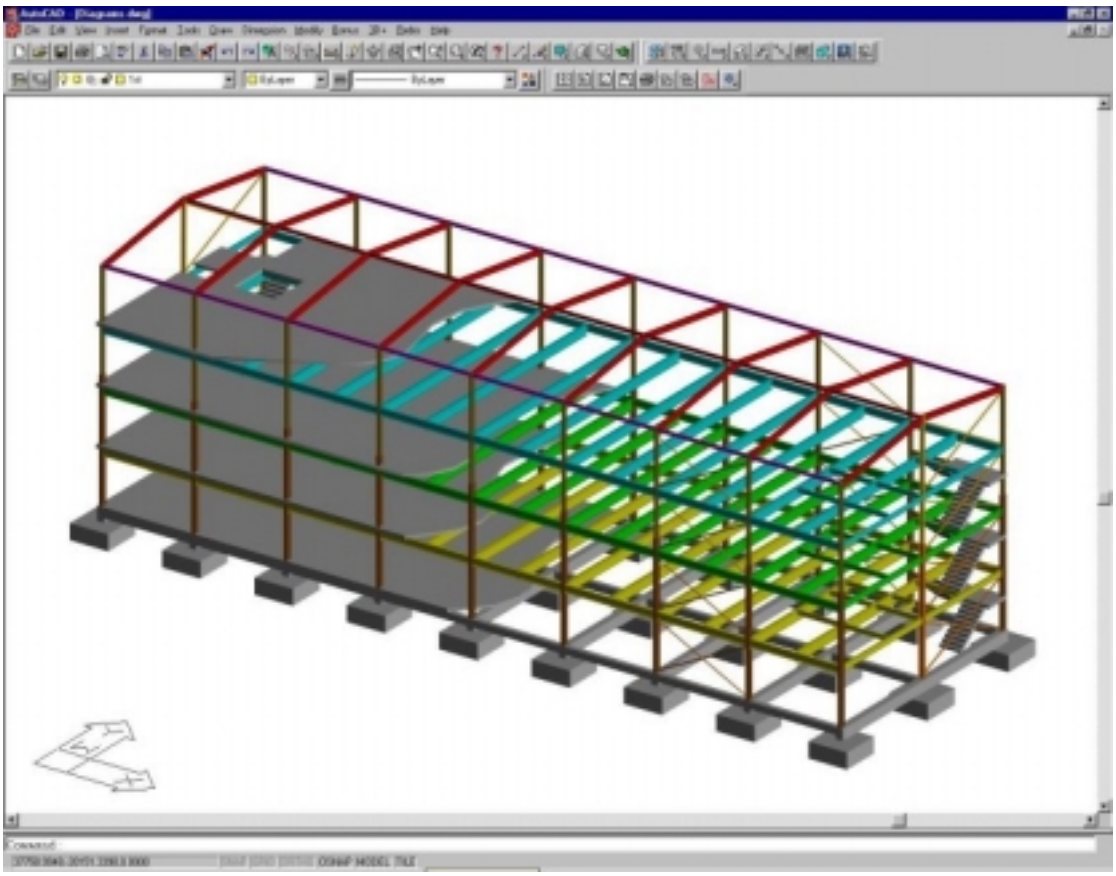
by Richard Dobson, Technical Director for FASTRAK, 3D+ and TEDDS, CSC (UK) Ltd

Introduction

Clients, architects, engineers, detailers, fabricators and contractors constantly create, use and transfer information internally and between each other. This information is the primary building block of any structure. On many projects today, this information is still delivered in 2D and on paper.

Yet, today's 3D-information technology now allows us to 'walk through' structures before they are built and to build structures before setting a foot on site. Industry working methods and patterns will inevitably change as a result of new software tools, now available to the design office, for 3D design and modelling of building structures. So how can the small consultancy or fabricator start to prepare for this shift?

The Big Picture



A building model

Architects and engineers build idealised models. These models allow analysis and design to be performed and are purely a representation of the real world. Each is created for its own particular purpose.

In the design and construction phases of any building, before and during the creation of the real world structure, there are many models developed for many different purposes, each playing a part in the building's evolution. Such models include:-

- client's brief (a conceptual model)
- architect's model
- analysis model
- structural design model
- environmental model
- HVAC model
- mechanical engineer's model
- facilities management model

In days gone by, these models were each represented on paper by one discipline and issued to other disciplines internally and externally when appropriate. Thanks to information technology, methods are starting to change.

Major organisations, like Laing Limited, are today creating composite models, combining the architect's walls, doors and windows with the structural framing and the HVAC plant and piping, to create a composite model. This composite model enables spatial management between disciplines, identification of optimum construction sequences, real time visualisation and, perhaps most significantly, prototyping of the construction process.

In the future, it is possible to envisage that all these functionally separate but related models will be intelligently connected throughout the design, construction and life phases of a building. However, today, the intelligent interaction remains a dream for even major organisations. Therefore, how can the small consultancy or fabricator hope to begin to prepare for the realisation of the dream?

The Paper Building

If one looks at the construction industry today, there are paper walls all around us – they perform one key function, they are the means by which communication of unambiguous technical information is achieved. However, these walls are also barriers. Some of the more obvious walls to 3D electronic information flow include:-

- the architect's drawings
- the tender documents
- the contract documents
- the fabricator's shop drawings

There are many moves to improve the flow of this information by use of electronic standards, use of project intranet and project web sites together with the adoption of 3D modelling technology. Today, these tend to be set up on large-scale projects and require agreement between large numbers of industry participants. Having successfully achieved this stage, then

the time scale for reaping real financial benefit tends to be long, particularly in the case of the standards.

The Paper Wall

The level of investment required for project models is often out of reach of the smaller consulting engineer and fabricator. However, there is another way in which such organisations can start to prepare for the inevitable changes in working practice within the industry. Instead of focusing exclusively on the adoption of electronic information exchange with external organisations, small companies could gain significant benefits from transferring information internally more effectively.

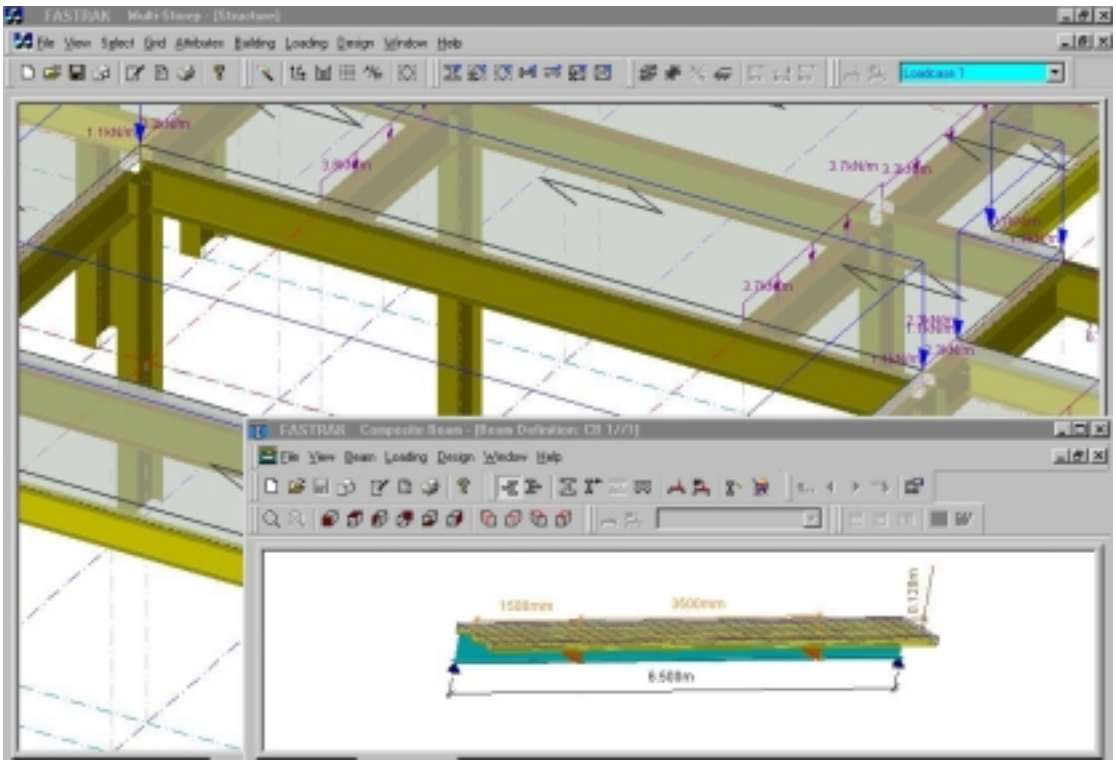
Within an organisation, there are many paper walls that result from today's working practices, points where paper or computer models are used to communicate information between disciplines. A primary example is the paper wall that exists between design engineers and CAD technicians.

Design engineers produce GA's, sketches and graphical representations of design. CAD technicians use these graphical representations as the start point to produce their 2D CAD drawings/details and even their 3D detailed models. It is a divide across which much information passes in graphical form but, as of today, little of it electronically.

The design engineer

Engineers concentrate on structural idealisation to develop member forces and moments for design purposes. To assist in this task, they focus on the creation of analysis and design models.

Over recent years, 3D design software tools have been significantly enhanced to match the working requirements of engineers. These software tools help engineers to refine analysis and design models to the level of accuracy required, ensuring an efficient design solution.

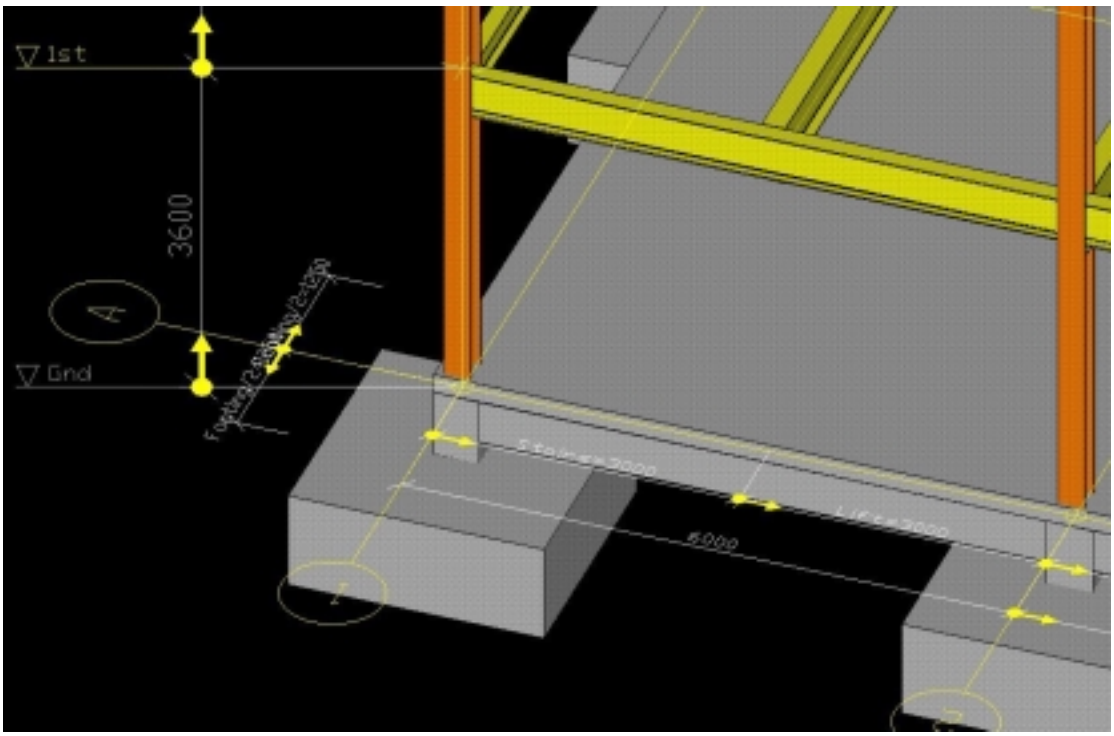


A design model

The results of their endeavours are today passed mainly in paper form, to the CAD technician, as a start of the building of the physical or manufacturing model.

The CAD Technician

Starting from the graphical information provided, the CAD technicians will typically start from scratch to build their own representation of the structure – a physical or manufacturing model.



A physical model

This is a separate but related process that starts from the design information provided by the engineer from paper.

Paper reinforcement!

Companies that can see the benefit of automating the transfer of information between designer and CAD technician identify common issues that reinforce the today's way of working.

Many consulting firms would not dream of letting the CAD technician work from an engineer's model –

- "the engineer's model is too inaccurate to be a starting point"
- "junior engineers do not know how to set out the model".

Equally, many fabricators, whose engineers could pass information automatically out of 3D design systems into detailing systems, insist on their CAD technicians starting a fresh model, rather than building from the engineering design model –

- "the only way to ensure a model is correct is to build it from the ground up and thus ownership of the physical model has to be in the hands of the CAD technicians".

Managers are also concerned by the new working practices –

- "the process of information transfer between disciplines like this is invisible and difficult to manage".

In essence, there are three fundamental components which are core to this change:-

Management – perhaps this is the area that requires the greatest mental change. The processes being managed are still the same, it is the manner in which they are done that is changing. Some of what needs managing is new and "invisible" but this should not prove impossible. It is a matter of putting in place the correct procedures to give clear responsibility to the correctly skilled individuals in order to minimise risk.

Skill sets – the creation of 3D models, which are to be used within the design office, does require engineers to use new skills, perhaps it is time for skill sets to change in line with new working practices

Technology – the software tools now available for use within the design and drawing environment are sufficiently intelligent to handle parametric change and to handle the transition from design to physical models coherently.

The paper walls are coming down

Today, 3D parametric design software, like FASTRAK®, and 3D parametric modelling/drawing software, like 3D+™, is readily available for use within the design office. These modern systems allow design and manufacturing models to be created, used and transferred intelligently. This could be a start point for punching a first hole in the 'paper wall'.

It is often the very small flexible and innovative consultancy practices that adjust and adopt new skills and software tools in their drive for efficiency. These organisations are already breaking down the ‘paper walls’.

While the removal of these internal ‘paper walls’ may not be as high profile as inter-organisation electronic information exchange, it is possibly more fundamental to the successful gradual adoption of 3D technology which will prove to be so vital for the future.

As some of these more minor walls start to come down, skills, trust and confidence in the use of 3D information technology will rise to a level where the move from internal to external information transfer will follow almost naturally.

Engineers build in steel, concrete, timber and masonry. Yet many seem unable or unwilling to break down the ‘paper wall’ that acts as both a means of communication and a divide. This is the next challenge to face our industry.