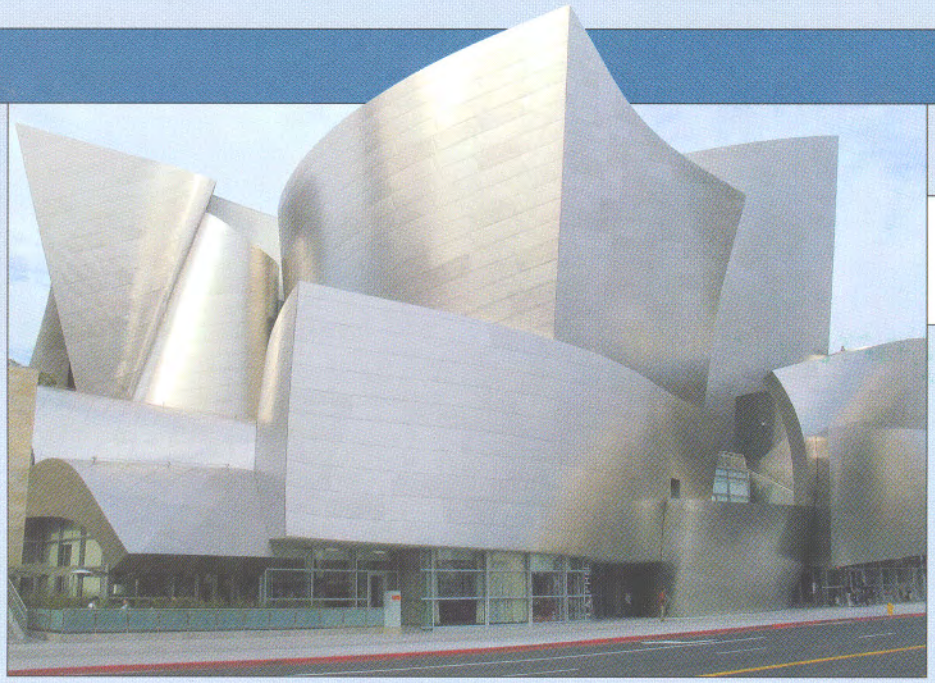

Architect Frank Gehry has been using the CATIA 3D design for more than a decade, on projects such as Spain's Guggenheim Museum and Los Angeles' Walt Disney Concert Hall (pictured).

Construction looks back for the future

While most people in the seventies were wearing flares and burning bras, not everyone was seduced by Timothy Leary's invitation to "turn on, tune in and drop out". In the decade of flowers and free love, a French aerospace company developed an advanced software solution that is now revolutionising the way buildings are designed.

Originally developed by Dassault Systemes, and now in the IBM stable, CATIA (Computer-Aided Three-Dimensional Interactive Application) is an advanced software solution that is being applied to the building industry.

Instead of creating physical mock-ups from CAD drawings, CATIA does this electronically and allows those working on a project to perform operations, such as 3D design, product analysis and equipment development, with everyone able to access the data in a common format.

The most famous proponent of this system is architect Frank Gehry who designed the Guggenheim Museum at Bilbao in Spain and the Walt Disney Concert Hall in Los Angeles. He has been using CATIA for over a decade, as a design tool and a way to meet tight production deadlines. Both the architect and the contractor share the CATIA data, resulting in a high degree of accuracy and rapid construction, without traditional drawings and documents.

CATIA Version 5 is an integrated suite of Computer Aided Design, Engineering and Manufacturing (CAD, CAE and CAM) applications. It provides 3D Product Lifecycle Management solutions for collaborative product development and enables the sharing of 3D models. It allows the automation and validation of design and manufacturing data (product synthesis), structural analysis of any type of assembly and a scalable platform for collaborative work and data management. The 3D knowledge-based product portfolio covers all specialised CAM applications.

CATIA V5 has specification-driven modelling for part design, assembly design and integrated drafting. Complex and free form surfaces can be created and modified, while electrical, fluid and mechanical systems can be designed and integrated within a 3D digital mock-up. In short, it's a very useful tool!

The potential of this sophisticated technology is one of the issues highlighted by the *Construction 2020* report, released by the Cooperative Research Centre (CRC) for *Construction Innovation*. The report aims to refine future research and was produced in consultation with industry leaders around the country.

Construction 2020 identified eight key themes, or visions, that reflect the major concerns of the industry for the future and for the expected operating environment. Two of these key issues concern the adoption of information and communication technologies, and virtual prototyping for design, manufacture and operation.

The first recommends that the property and construction industry becomes more engaged in IT developments in order to be more competitive.

The latter, virtual prototyping, is a 'try before you buy' option, encompassing the whole process from inception to design, construction, demolition and rebuild. It is predicted that virtual prototyping is likely to become the basis for design, procurement and asset management in the next five to ten years.

To this end, the CRC is collaborating with government, industry and its research partners to develop software tools that can use three-dimensional CAD technology to model complex

building designs. By focussing on the objects within 3D CAD models, the information about different elements can be encapsulated, relationships can be defined and the generation of plans and sections is automated.

The 2D CAD systems that are currently being used represent objects using basic graphics, such as lines and circles, leaving the drawing open to interpretation. It is also difficult to automate the extraction of information.

The shift to 3D CAD technology allows the generation of plans from one model, saving time and reducing errors, as well as allowing multiple analyses to be performed from the one consistent data source. Monotonous activities can also be automated.

The CRC is working on four tools with the aim of increasing the quality of buildings and increase the productivity of the teams designing, building and maintaining them.

LCADesign is a green calculator for architects and engineers working on new commercial buildings. It is an automated eco-efficiency tool that can test the design of a building against a variety of ecological indicators, such as embodied energy and pollutant generation. These assessments are made directly from 3D CAD drawings, regarding the building materials, products or designs.

Another tool is the *Automatic Estimator* for the quantification and costing of designs from the 3D model of a building. The software reads the model and identifies its components against user-defined measurement rules. A

Dr Keith Hampson, CEO of the CRC for Construction Innovation, addressed the industry through a series of national workshops in July on the Construction 2020 findings.

Bill of Quantities (BoQ) is generated against the user's cost database, linked to a viewer that indicates which building components have been measured against an item in the BoQ and which haven't.

This estimating software is also able to test a number of alternate designs early in the process, and users can adjust the rules and add new ones as needed. It currently handles reinforced concrete, post-tensioning, formwork, masonry and structural steelwork, with the inclusion of other trades planned in subsequent stages.

The *Automatic Code Checker* assesses building designs for compliance with the compulsory AS1428 *Design for Access and Mobility*. The software takes a 3D model of the building and goes through it, recognising rooms, doors, corridors, stairs, ramps, toilet provisions and other relevant elements. It also has the potential to assess compliance costs of new codes.

The *Contract Planning Workbench* automates the generation of activity schedules through a three-step process. Firstly, it identifies all the building components and decides which support other components. They are classified according to the construction materials and component type, and appropriate activities and resources are then attached to them. One component may generate several activities, such as a concrete slab generating place formwork, place reinforcement, place concrete and cure concrete.

In this situation they can be automatically aggregated, so that all columns on a floor may be poured under the same activity. The final step is to generate geometry files and a schedule that can be read by *Common Point*, a computer program that watches the sequence of construction activities.

The current prototype of the *Contract Planning Workbench* handles columns, beams, slab and walls from a 3D model, and the second stage will incorporate a more complete range of building components and construction types.

With all of these technologies likely to be introduced in the next two to ten years, the building and construction industry looks set to undergo a period of rapid change.

Even if it is metaphorically kicking and screaming as it finally enters the 21st century, it seems inevitable that the industry is about to leave the outdated practices of the last century in the past, where they belong. **BA**