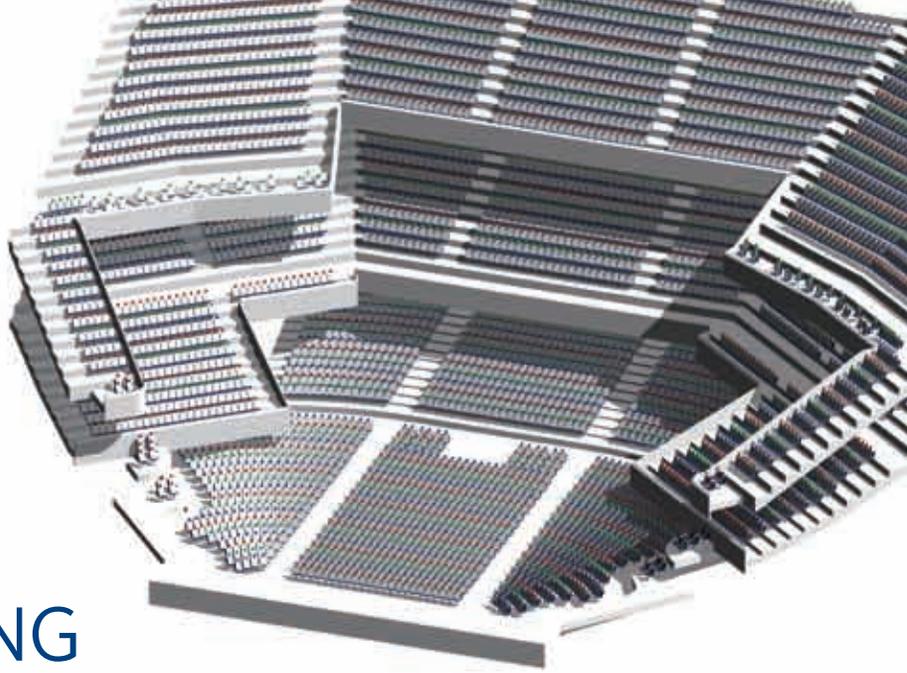




“ This project would be mysterious without BIM. ”

Mr. Francis Leung, Director (Head of BIM Team),  
WSP Hong Kong



# DESIGNING SINGAPORE'S SCI-FI BUILDING

**Project:** Singapore Civic, Cultural and Retail Complex (CCRC)

**Location:** One North, Singapore

**Type:** Integrated Complex

**Scheduled for completion:** 2011

The 3D model on Francis Leung's computer screen looks so outlandish, it might portray a gigantic walking machine from a Star Wars movie. Yet it shows the design for Singapore Civic, Cultural and Retail Complex (CCRC), an integrated complex that will soon take shape in Singapore, and with a few clicks of the mouse, Francis Leung – Director (Head of BIM Team) of WSP Hong Kong, takes us into the building, and onto the stage of its centrepiece, a 5000-seat theatre.

The view from on stage shows rows of seats. Another click of the mouse, and Francis Leung adds ovals representing heads, each with lines to mark the levels of eyes. Viewed from on stage, we can see which seats afford views of the stage, and where seats might be raised, or structures moved, so everyone will have a grand view in the finished theatre. “We can walk through, and check every angle,” says Francis Leung. “For example, we can move the camera across the stage from left to right.”



## Complex geometry

CCRC will have 9 levels devoted to civic and cultural space, 4 levels for retail and entertainment space, also 3 levels of carpark in the basement. The theatre will be on the upper floors.

CCRC's architect is Andrew Bromberg of Aedas Ltd., whose projects typically involve very complex geometry. CCRC is no exception: its form and building functions are inter-related, and the geometry is so complex that 3D planning and design proved essential.

Though 2D drawings were tried early in the design process, it transpired the project required a 3D model to centralise all design elements as well as the geometry, giving precise data on all floors.

## Precise 3D planning and design

When Francis Leung joined WSP Hong Kong, he brought experience in working as a structural engineer, and in using Revit for BIM – and soon established BIM teams within WSP's Asian operations. All his projects involve Revit, including the challenging CCRC. His engineering background helps him with the building's geometry, which requires considerable use of mathematics – for instance in Ocean Heights One, a façade will be made from 10,000 individually sized pieces, with eight numbers required to specify the dimensions of each one.

“Our task is to assist with the geometry,” says Francis Leung of the CCRC project. “We use the software to help with establishing the design elements. For example, the complex roof needs geometry, and architects then give us their design intent and we rationalise it and build the building massing, which defines the form of the geometry, so we can put on the building elements such as roof and façade panels.”





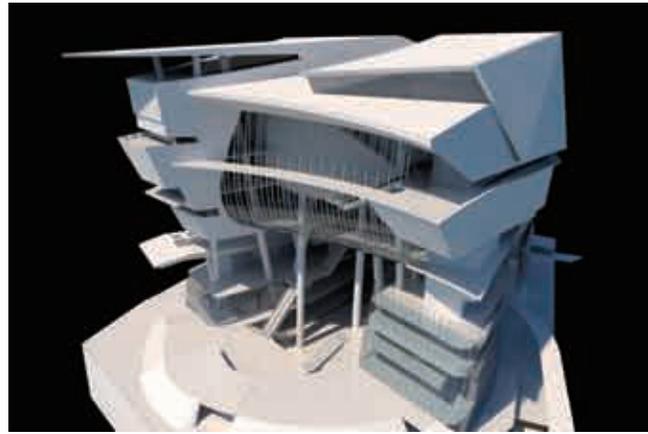
### All planes are real, with re-usable coordinates

Francis Leung believes, “This project would be mysterious without BIM. We need to define the form, and each slab has to follow the form.” With Revit, it is possible to readily create precise 2D sections through the model. “All planes are perfectly built as planes,” says Francis Leung. “Revit can produce re-usable coordinates for corners.” These are akin to coordinates on a 3D map, and help with aspects of construction such as giving dimensions to the manufacturers of the façade.

Revit also generates measurement in terms of dimensions and elevations, enabling the design team to check all spatial requirements, including headroom and passageway widths. Detailed coordinates and elevations define control points for the complex form.

### Enabling coordination between disciplines

The Revit model includes design elements from different disciplines, such as theatre decks, theatre structures, theatre skin, slanted columns, amphitheatre, escalators, façade system and external ceiling, facilitating coordination between disciplines. “All these elements are relatively easy to build to a high level of accuracy in Revit,” says Francis Leung.

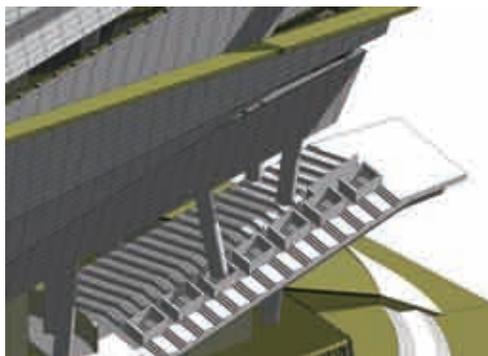


## Checking for clashes, sight lines and structural integrity

Significant potential clashes have been discovered through using the BIM model, including several that would likely have been overlooked with more traditional design techniques. When the design team changed the location of an air cooling tower, the new position looked fine on 2D plans, but an analysis tool in the Revit model showed there was an error. This error was clearly visible on the model, which showed the tower partly protruding from the building façade – and so helped prevent what could have been a costly mistake during the construction phase.

Additionally, using Revit software, Francis Leung and his team are checking sight lines in the theatre, and so helping the theatre designers ensure everyone in future audiences will have a good view of the stage. “We have a schedule showing the exact number of seats being added to the auditorium without tedious manual count.”

The Revit model also helps with assessing the building's structural integrity. “We take analytical lines for each element, and send them to an analytical model,” says Francis Leung.



## Helping to improve Revit

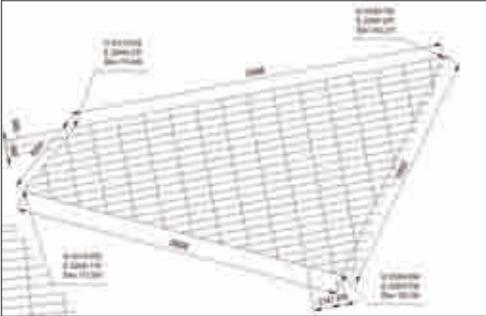
Francis Leung is closely involved with the development of Revit, and says the latest version – 2009 – has several improvements, including handling of joints between slabs and beams. “Before, you had to click around them to put them together,” says Francis Leung. Now, Revit can automatically combine slabs and beams – for complicated structures like CCRC, this results in significant time savings, and eradicates relatively small yet troublesome errors.

Buoyed by successes with CCRC, Francis Leung aims to boost integration of MEP into Revit models, and produce combined services drawings that will help construction work to proceed on schedule, with potential clashes eliminated during design stages.





## ABOUT WSP GROUP



WSP Group plc is a global business providing management and consultancy services to the built and natural environment.

Established in the UK in the '70s and listed on the London Stock Exchange since 1987, the company has grown through strategic development into one of the largest international consultancy groups in the world employing ca 9500 staff worldwide.

WSP operates as a specialist in the property, environmental, transportation and infrastructure sectors providing a full range of services from planning through to design, implementation and maintenance.

Thanks to its multi-disciplinary capability, WSP can offer fully-integrated delivery teams to local and global clients. We have a strong commitment to local business development and sustainability in all of the countries where we operate.

With a proven track record of major project delivery for our clients, WSP has established a world-class client base and enjoys a high level of repeat business.

Clients include government departments and agencies, leading private and public sector organisations and major multi and bilateral international financial institutions.

WSP Group has extensive international experience in America, UK, Europe, Africa, the Middle East, and Asia gained through working in over 60 countries and currently has permanent offices in 35 countries.