

## Creating a bold design with ArchiCAD using curved surfaces

Concrete tube blends into the scenery of Japanese resort town, Old Karuizawa

### Artechnic

The residential building “SHELL” -- [ArchiCAD 15's](#) global signature building -- maintains the harmony with the environment in one of Japan's most prestigious resort towns, despite its bold design using a concrete tube as a base form. The architect and representative director of Artechnic, Mr. Kotaro Ide, used ArchiCAD to gradually develop the design from the image and functions of a resort villa sustaining in the nature of northern Japan. In addition to striving to achieve an excellent design using a 3D model, Mr. Ide managed to create a design with the functions the client requested, while maintaining durability and constructability.

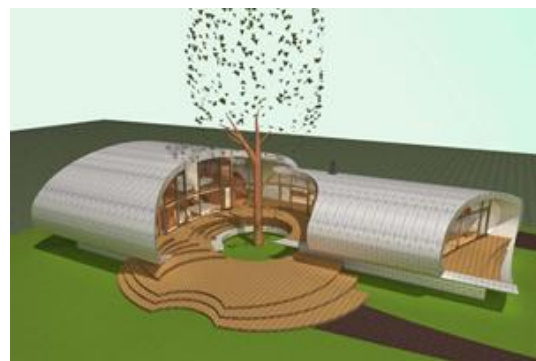
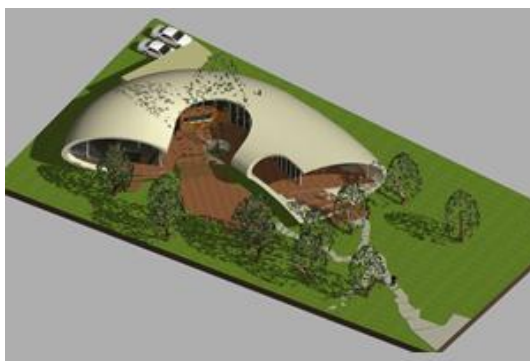
### A 2D curved surface with constructability in mind



Mr. Kotaro Ide,  
Representative Director of Artechnic

Mr. Ide, who had thought about how the villa could blend in with and also sustain itself in the natural environment, imagined a “structure of living space surrounding the existing fir tree on the site.” He focused on the design that followed the process of creating the functions the client had requested. Ease-of-use, comfort, and simplicity were considered general requirements for the villa. “The winters in Karuizawa are harsh. It can be really cold in the winter and during the summer the humidity can be high. Therefore, wooden houses don't last if maintenance work is neglected. After considering these points, we decided on an image of using a concrete shell, which ‘floats’ above the ground,” explains Mr. Ide. Created with ArchiCAD, the initial design looked like a giant shell with a 3D curved surface. However, to produce the 3D curved surface on steel-framed concrete would be very difficult. “I wanted to form the concrete without any joints in order for the building to stand up to the

harsh environment. We modified the shape to a tube, and used a method of forming the bottom and the sides using formwork casting; for the roof, only the bottom surface would have formwork, and concrete would be poured into it using a plastering method,” Mr. Ide said. There is no beam in the interior. The structure is based on a tube only.



Assimilating the initial image of the 3D curved surface, the form was modified to a 2D curved tube for easier constructability

The concrete is 330mm thick on the top and bottom, while the sides are 730mm thick, giving the form a successive changes. The final design depended heavily on mechanical basics. Mr. Ide created a cross-section of the ArchiCAD model, and used it for plastering work. The inside surface of the concrete was sprayed with 60mm thick, rigid urethane for insulation; an additional 10mm of hygroscopic finishing was sprayed on top.

## A level of perfection only 3D can achieve

Inside SHELL, the floorboards are laid about 1.4m above the ground level, and furniture, windows and doors were placed on top. We tend to think curved surface waste the usable space, but space is used effectively for the placement of sofas and a kitchen in this project. "ArchiCAD was really useful when testing the placements and shapes of furniture and equipment near the curved surface. On 2D drawings it is hard to generate the intersection point coordinate, so you could only review that about 2 to 3 times within the limited time of design, whereas with ArchiCAD it is possible to simulate about 20 times repeatedly. As a result, the design perfection level became very high," says Mr. Ide. The interior elevation drawing for openings were also generated from ArchiCAD model data. The construction involved placing openings along the elliptical surfaces of the tube. In the beginning, Mr. Ide expected a discrepancy in the accuracy of the concrete casting construction to be about 20mm, but in reality, the maximum precision error was about 3mm; as a result, all the windows designed with CAD measurements were installed without problems. Pipes and other ventilation equipment were placed mainly under the floor. During the absence of the residents in wintertime, the automated air-conditioning system prevents the pipes from freezing, eliminating the hassle of having to drain the water with minimum effort.



Wooden deck and the building surrounding the fir tree

Designed with ArchiCAD, SHELL became exactly the kind of villa it was intended to be: easy-to-use, comfortable, and simple. The owner, who lives in the capital, spends almost every weekend there.

## There is no point if it's not 3D CAD

It was about 1996 -- the year Mr. Ide founded his own firm, Artechnic -- that he started to use ArchiCAD. Thinking that it was not enough to just replace a drawing board and eraser functions with a computer, he implemented 3D CAD from the beginning. Since then, Mr. Ide has broadened his use of the tool as new features were added with each version release. "The teamwork function released with ArchiCAD 13 has been very useful for me to communicate design intent with other individuals. I've heard that the renovation function will be introduced with ArchiCAD 15. I'm looking forward to that because it allows you to check various design alternatives without having to go backwards. Using ArchiCAD gives us the illusion of designing in a 3D movie. Compared to 2D-based design, it is less stressful and, as a result, the staff enjoys working," Mr. Ide concluded.

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