COMPANY
Cardno

LOCATION
Brisbane, Australia

SOFTWARE
AutoCAD® Civil 3D®
Autodesk® Vehicle Tracking

Integrated infrastructure design and visualization

Cardno uses Autodesk infrastructure software to design and visualize a mine's roadways and vehicle movements

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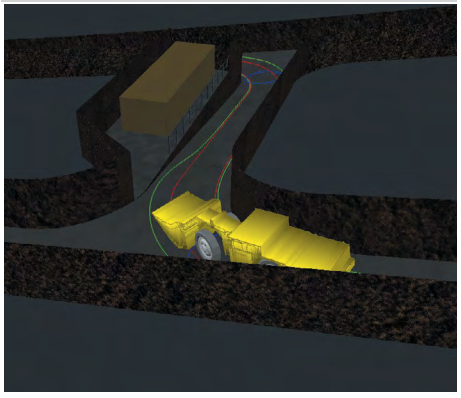
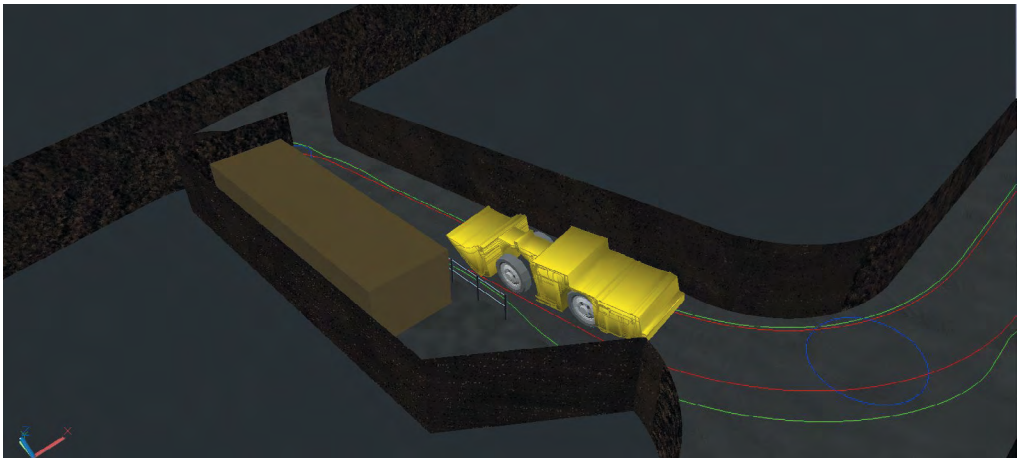
—**Frank Kolenda**
Drafting and Design Manager
Cardno





Images courtesy of Cardno.

The project

Cardno is an infrastructure and environmental services company headquartered in Brisbane Australia, with offices and staff around the world. One of the firm's most recent Australian projects was the development of access roads for a coal mine in New South Wales. The owner of the longwall mining operation engaged Cardno to help design three "cut-through" roadways about 300 meters below the surface, linking the mine's two underground main "heading" roadways.

The parallel headings are roughly 40 meters apart. One is the main surface access and the other contains a belted conveyor system that transports coal to the surface. The cut-throughs connect the two headings for maintenance, and some have flat platforms carved out one side to accommodate equipment used to operate the conveyor belts.

The headings are approximately 5 meters wide and 3.5 meters high. Mining personnel drive articulated underground loaders through these roadways and cut-throughs, so the design must accommodate the safe maneuvering of these vehicles, which are almost 10 meters long and weigh approximately 27 tonnes.

The challenges

Even though the two headings are parallel, one has a downward sloping vertical grade while the other has a downward sloping vertical curve. This means the three cut-throughs will vary in both height and grade. "As the road descends into the mine, there's not a lot of room in the tunnels and some grades are as high as 19 percent," says Frank Kolenda, a Cardno drafting and design manager. "Given these tight fits and steep slopes, we had to make sure that the loader could make the sharp turns into those cut-throughs *and* do it without tipping over."

With a schedule of just two weeks and a progress meeting after the first week, Cardno had to quickly develop its design. In addition, the firm had to *visually* demonstrate to its client that its design would enable drivers to safely navigate and turn the loaders through the cut-throughs.

The solution

Given the short time frame, Cardno used AutoCAD® Civil 3D® to design the cut-through roadways and Autodesk® Vehicle Tracking software to evaluate the movements of the underground loader and provide clearance analysis. The 3D modeling environment of Civil 3D helped the firm quickly produce design documentation that included cross sections of the tunnel, road, and loader as it negotiated the proposed roadways. In addition, the integrated simulation capabilities of Vehicle Tracking enabled Cardno to create animations of the loaders moving through the tunnels, helping its client visualize and better understand Cardno's proposed design.

AUTODESK.

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A model design environment

Cardno quickly started its Civil 3D design effort by utilizing the client's existing AutoCAD files containing road elevations of the main headings, tunnel coordinates, and proposed locations of the cut-through roads. The dynamic modeling capability of the software enabled Cardno to create 3D surfaces, alignments, profiles, and corridors that automatically adjusted to each other.

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In addition, using the software's intelligent breaklines to define the boundaries of the equipment platforms helped Cardno quickly accommodate client changes. "Several times, we had reconfigure a platform's size and shape," says Kolenda. "By simply moving the breaklines, the design model and surfaces automatically updated to reflect the changes."

Integrated evaluation of vehicle movement

At the start of the project, Cardno's client supplied specifications for the loaders and the maximum cross angles they could handle without tipping over. The firm used this information to model an articulated loader in Vehicle Tracking to evaluate the maneuverability of the loaders in the context of the cut-through designs. Cardno also used Civil 3D and Vehicle Tracking to determine if the cross grades of its design surfaces would cause the loaders to tip over, and also whether the roadway's vertical curves would cause the loaders to bottom out or get caught on road crests. The Vehicle Tracking software is integrated within the AutoCAD environment, so no time was lost by having to export or convert design data from one software solution to another.

In addition, the firm used Vehicle Tracking to produce rendered 3D images and an animated drive-through simulations that showed the movement of the loaders as they moved through the tunnels. "We knew that some people at the client's progress meeting would have trouble visualizing the movements of the loaders based on 2D plan drawings or sections," says Kolenda. "The 3D animations we generated were an easy and effective way to demonstrate what drivers would see as they drove the loader between the headings."

Results

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For more information, visit
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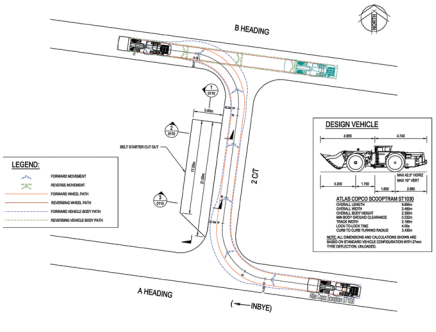

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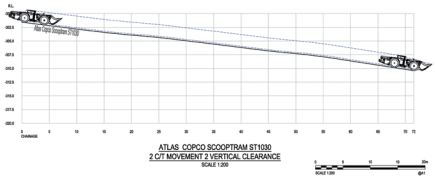

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