Bentley
*Advancing* Infrastructure

CASE STUDY

# AFRY Helps Scania Drive Toward Sustainable Transport with New Autonomous Vehicle Test Track

## OpenRoads™ Designer and LumenRT Optimize Constructability, Reducing Environmental Impact

### INVESTING IN TECHNOLOGY-DRIVEN TRANSPORTATION

With the rapid development of autonomous and electrified vehicles, Swedish truck and bus manufacturer Scania is developing a new test track in Södertälje, 40 kilometers southwest of Stockholm. As part of their ambition to move toward more sustainable transport systems, they are investing approximately SEK 1 billion in the planned test track, consisting of several roads and areas designed to enable testing of heavy vehicles under various conditions. "We, for instance, need to be able to simulate different traffic situations, such as busy urban environments, highway access, and hilly and/or curvy roads," said Lars Hult, senior project leader at Scania.

To design the track to simulate multiple scenarios, Scania hired AFRY for their design and engineering expertise. Situated amid an 85-hectare site, the track needed to be designed to include a three-lane, high-speed oval vehicle test section, a mixed traffic area for simulating varying road conditions, a multifunction brake test area, and service areas for servicing, parking, and charging the vehicles. The track design also had to be flexible enough to accommodate future testing scenarios.

### ADDRESSING COMPLEX SITE CONSTRAINTS AND COMMUNICATION

The test track includes 19 kilometers of roads with more than 60 intersections and junctions. The project had to navigate complex, hilly terrain, and ground conditions consisting of organic material and clay, highly constraining the track layout. Further constraints were placed on the design by the adjacent existing infrastructure, making the track roadway scheme more complex. "All kinds and types of roads and areas are connected to each other and geometrically dependent within the 85 hectares and over 19 kilometers of roads," said Adam Wieczorek, group manager at AFRY. Changing any single element would impact the layout of other track sections and existing infrastructure, making mass balancing and minimizing environmental impact even more challenging. The design and construction of the track would require massive earthworks, rock cutting, and blasting.

"The project geometry and existing conditions and constraints made the project highly demanding," said Wieczorek. AFRY wanted to implement collaborative modeling in a dynamic, 3D digital environment. They realized that choosing software capable of evaluating numerous design alternatives amid the varied terrain was essential to avoid rework, enable change management, and ensure constructability. AFRY also recognized the importance of communicating the design intent to the local community and stakeholders, requiring them to integrate a realistic 3D visualization of the proposed track into their dynamic digital solution.

### ESTABLISHING A DYNAMIC 3D DESIGN ENVIRONMENT

AFRY selected Bentley technology to implement a federated design approach, establishing a collaborative, model-centric, digital project context. The software also provided dynamic relationships between 3D elements so that numerous track design alternatives could be evaluated and modified to ensure constructability. "Bentley's OpenRoads Designer stands out in the [infrastructure software design] market and brings all these capabilities together, along with a rich CAD data interoperability," said Wieczorek. Having 3D models of the different track areas in multiple CAD files, with dynamic relationships maintained, streamlined workflows and analysis of multiple design options.

## PROJECT SUMMARY

### ORGANIZATION
AFRY

### SOLUTION
Roads and Highways

### LOCATION
Södertälje, Stockholm, Sweden

### PROJECT OBJECTIVES
- To build a new test track for autonomous and electrified vehicles.
- To establish a dynamic 3D modeling environment to optimize design and constructability.

### PROJECT PLAYBOOK
LumenRT, MicroStation®, OpenRoads Designer

## FAST FACTS
- As part of their commitment to sustainable transport, Scania hired AFRY to design a new test track for technology driven vehicles.
- The undulating terrain and interdependency between the proposed track design elements required establishing a dynamic 3D modeling environment.
- Using OpenRoads and LumenRT, AFRY performed federated modeling, analyzed numerous design options, and visually communicated design intent to the stakeholders and community.

## ROI
- Working in a dynamic 3D modeling environment using OpenRoads reduced modeling time by 30%.
- Based on the 3D models, AFRY saved 30 resource hours through automated drawing production.
- AFRY's digital approach reduced the environmental impact of the test track and successfully contributed to the development of sustainable transport solutions.

"Bentley software provided AFRY team with a collaborative and interoperable design environment [where] engineering ideas were relatively easily introduced to the 3D data rich models…and then communicated to the project stakeholders with eye-catching visualizations."

*– Adam Wieczorek, Group Manager, AFRY*

The 3D models were crucial to information exchange and were imported into LumenRT to generate visual animations and live cubes to interactively review the design and perform a visual assessment of the project.

Integrating LiDAR survey data to create digital terrain models in OpenRoads provided AFRY with a better understanding of the existing ground conditions. Based on the models, AFRY performed accurate earthworks calculations and mass balancing for every design alternative. Bentley's solution easily handled the voluminous project data, helped optimize road surface shaping, and automated analysis of the varying surface parameters and forces to accommodate the high vehicle speeds on the limited length of the round track. However, while dynamic digital design and 3D deliverables were key to project success, traditional 2D models were still necessary for permitting. OpenRoads automated not only optioneering, but also drawing production, producing the required drawings directly from the 3D models. "All of this automation, together with dynamic [3D] relationships between elements, saved a number of working hours," said Wieczorek.

## DIGITALIZATION SUPPORTS SUSTAINABLE TRANSPORT SOLUTIONS

The dynamic OpenRoads environment allowed AFRY to perform optioneering and analyze multiple options to determine one with minimal impact to the environment while considering project budget at the same time. With accurate geotechnical data and LiDAR-based digital terrain models, AFRY minimized wastage and optimized mass-balancing and constructability. Compared to updating static 3D elements, progressive digital modeling saved AFRY 30% in time evaluating alternative design solutions. The model-centric approach also reduced drawing production time by 20%, ensured full data consistency, and saved approximately 80 hours on quantities calculations by extracting bill of quantities directly from the models. "The project was delivered to the client on time and within budget," said Wieczorek.

Detailed studies of 3D models and animated visualizations in LumenRT digitally revealed few infrastructure clashes and mismatches in road connections during the design stage, eliminating costly errors and rework during construction to save potentially millions of Swedish crowns. AFRY's dynamic digital approach also balanced earthworks, reducing environmental impact, consistent with the ultimate project goal of lowering the carbon footprint through sustainable transportation. The in-depth testing of vehicles on test tracks prior to manufacturing ensures transport safety and sustainability. The investment in Södertälje will bring direct economic benefits to local and regional Swedish communities. Through innovative digital engineering, AFRY contributed to Scania's mission of developing autonomous and electrified vehicles to be used globally to improve the environment. "We are really glad we could work with Scania and contribute to their mission of creating a world of environmentally friendly mobility," said Wieczorek.

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