

COMPANY

Norconsult AS, Bane NOR

LOCATION

Vestfold, Norway

SOFTWARE

Autodesk® ReCap™**Autodesk® InfraWorks®****Autodesk® AutoCAD® Civil 3D®****Autodesk® 3ds Max®****Autodesk® Navisworks® Simulate****Autodesk® 360 cloud services**

Early Cost Estimating with InfraWorks

An innovative approach for early costing during preliminary design

We needed a new process to integrate cost and design. Linking InfraWorks and costing databases helps the team's project engineers and decision makers understand the cost consequences of design changes, leading to better and less-expensive design solutions.

– Norconsult AS



Rendering of project station. Image courtesy of Bane NOR, Norconsult, Asplan Viak.

Modernizing the Vestfold line

Norway is developing a new double-track high-speed railway between the largest cities in the southern part of the country. Scheduled for completion between 2024 and 2034, Bane NOR—the Norwegian Railway Infrastructure Managers, a government agency, responsible for owning, maintaining, operating, and developing the country's railway network—is carrying out this long-range plan in phases.

One section of this plan is an upgrade to part of the Vestfold line, from Tønsberg south to Larvik. The project includes roughly 40 kilometers of new track and 5 new stations. The project is in the preliminary planning phase, with Bane NOR and Norconsult—Bane NOR's design consultant on this project—using InfraWorks to find an optimal route between the 2 towns.

The importance of cost estimating

One of the planning team's main goals is to find a corridor for the new railway line that gives the highest cost-per-benefit ratio balanced against the environmental impact.

Since there are many alternative routes over the expanse of 40 kilometers, and those design alternatives are changing constantly, keeping track of the project's cost estimates is both difficult and time-consuming.

The traditional approach for cost estimating on a project like this involves a 3- to 4-day meeting of over a dozen professionals who decide cost classes and document their decisions via paper drawings. This information is then translated to spreadsheet format, which requires several more days of manual effort. Due to cost and time considerations, many months can go by before this effort is repeated. As a result, costs aren't typically an integrated part of traditional decision making during early infrastructure design.

But, clearly, if engineers and decision makers understood the costs of design changes, their decisions would lead to better and less expensive solutions. Therefore, on a project of this scope (with cost differences in the hundreds of millions), Bane NOR and Norconsult needed to rethink how it could integrate cost into its early design process.

Integrating early designs with costs

The team is using InfraWorks as a shared collaboration tool to link early design efforts and cost estimating. Bane NOR has an extensive costing database based on experience from many of their built projects. This database has been programmatically integrated with InfraWorks design tools. This integration uses Excel data tables, InfraWorks railway styles, and InfraWorks tooltips to give the team automatic costing feedback as they develop their preliminary design in InfraWorks.

The design team uses costing data from Bane NOR's costing data by classifying and grouping different sections of railway per meter in InfraWorks—based on parameters such as 'easy,' 'average,' 'difficult,' and 'above ground,' 'bridge,' 'tunnel'—for different ground conditions.

By creating a library of railway styles in InfraWorks for all the different InfraWorks railway classes and connecting them to Bane NOR's costing database, the team is able to automatically estimate costs as the corridor route and design changes. When changes are made in InfraWorks to the track's vertical or horizontal alignment placement, or when an alternative railway style is added, the integration script automatically updates the costs and InfraWorks tooltips provide automatic costing feedback.

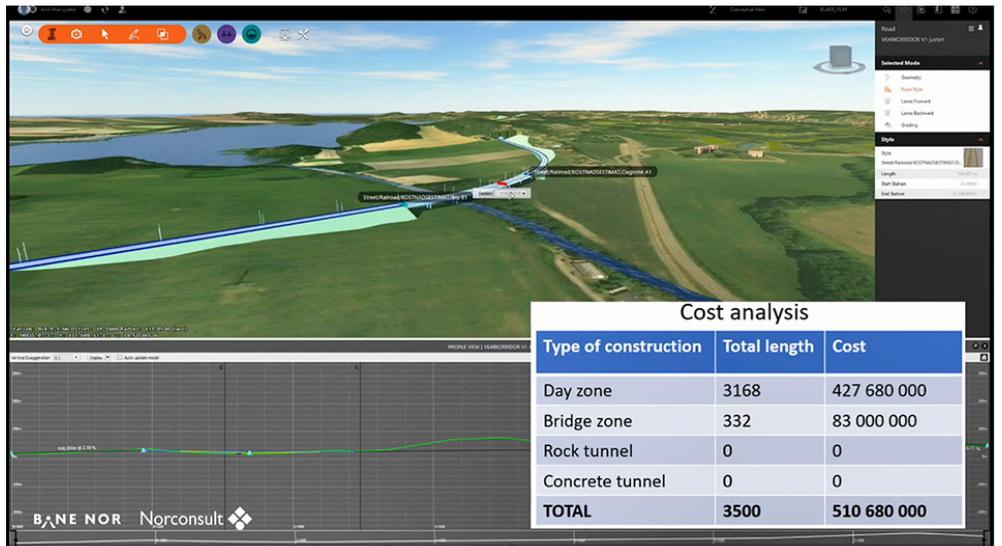
Potential savings

Bane NOR and Norconsult have piloted this integrated costing approach on 10 kilometers of the Vestfold line project. During live design review meetings, the cost consequences of design changes were automatically visible to all disciplines, including environment, agriculture, cultural heritage, threatened species, and geotechnical conditions.

The integrated InfraWorks cost model helps everyone understand how costs for different preliminary design alternatives impact the various disciplines and the overall project cost. As a result, the team has identified cost savings between 50 to 70 million dollars on just this 10-kilometer section alone. Given the total length of the Vestfold line improvement combined with the other rail updates on Bane NOR's agenda, this potential savings could translate into billions of dollars across these other projects.



A station in Larvik. Image courtesy of Bane NOR, Norconsult, Asplan Viak.



An integrated InfraWorks cost model gives the team automatic costing feedback as they develop their preliminary design. Image courtesy of Bane NOR, Norconsult, Asplan Viak.

Integrating cost and early design has resulted in:

- Multidiscipline understanding of cost consequences due to design changes
- Potentially huge design savings
- Reduced manual labor
- An innovative approach for meeting the government's mandate of delivering high-quality railways for less money