



Oslo Airport Expands its Terminal with openBIM® and Environmentally Sustainable Design



About the project

Oslo Airport in Norway was built in 1998 with the capacity to cater for around 17 million passengers annually. In 2009 work began on a two-stage expansion project to increase capacity while adding innovative and environmentally sustainable designs to the airport. Stage one would increase passenger capacity to almost 23 million annually by 2013.

Stage two would deliver further expansion plans to be able to handle 32 million passengers by the year 2017. The expansion plan also focused on protecting the environment in and around the airport, aiming to reduce carbon footprint and make use of local materials and resources in the process. The project would expand the terminal to 117,000 m², with a new airside area adding 660,000 m² to the airport itself. The total project cost was around 17 billion Norwegian Krone.

Oslo airport plays a crucial role in the economy and mobility for Norway. It is the main hub for international and local flights, connecting citizens and visitors to all parts of the country. A train station resides in the airport, providing around 70% of airline passengers with public transport to and from the airport. The expansion project planned to double the size of the existing terminal to 115,000 m², adding a new 300m long pier.

openBIM Drives Airport Expansion

Aas-Jakobsen was part of a team called Team_T responsible for the engineering, design and construction, comprising architects and engineers. The multidisciplinary design team applied a holistic approach to sustainability. Firstly, they worked with local resources in the design and construction for both phase one and two. Some of the initiatives included collecting snow during winter time, storing it and using it as a coolant in summer.

Recycled steel and special environmentally friendly concrete mixed with volcanic ash were used throughout the project.

Local timber from Scandinavian forests was used for cladding of the new pier. It was hoped enhanced levels of insulation would provide better energy performance and regulation. The client hoped to achieve a high BREEAM rating through sustainable methods.

Project teams were also instructed to work collaboratively through common goals and exchange methodologies. The 120 contracts in place during the design and construct phases were mandated to submit BIM deliverables in multiple formats. The owner, Avinor AS, and the client, Oslo Lufthaven AS (OSL) recognised a changing landscape with regards to BIM and digital data.

The client required all data models to be handed over in both native and IFC formats. buildingSMART standards were therefore mandated as a means to deliver openBIM for the successful delivery and archiving of digital data for use in operations and maintenance. This owner driven foresight was as a result of strategic planning to ensure data is not lost in differing formats, and it could be used beyond the design and construction phase.

buildingSMART solutions and standards

The open approach taken by team members allowed for not only greater collaboration, but higher quality of data. Even as far back as 2009, the client was promoting the use of buildingSMART's Industry Foundation Classes (IFC) as a means to manage unpredictability and change. The client was keen to ensure the data models would not go out of date, or be restricted to a specific software version. IFC is not limited by these factors.

One of the primary reasons was the non-proprietary nature of IFC as an exchange and archive methodology for BIM deliverables. The broad adoption of IFC gave flexibility, data fidelity and a standard approach to the design process. The client also allowed native formats to be used, particularly in phase one.

Project Overview

Aas-Jakobsen (Team_T)

Location:

Oslo, Norway

Objectives:

To expand the airport terminal and reach high environmental BREEAM score.

Software used:

ARCHICAD, EDMmodelServer, Grasshopper, MicroStation V8i, Navigate Simple BIM, Navisworks, Novapoint, ProjectWise, Revit, Solibri Model Checker, StreamBIM, SYNCHRO PRO, Tekla BIMsight, Tekla Structures, Trimble Connect, Vectorworks

buildingSMART tools:

IFC 2x3

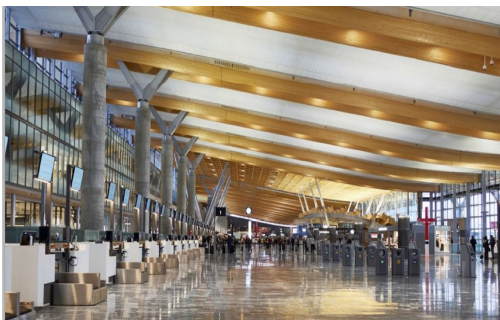
Oslo is the main international airport catering for domestic and international destinations. The airport connects to 26 domestic and 152 international destinations, catering for over 28 million passengers in 2018 meaning it's the second-busiest commercial airport in the Nordic countries.

Highlights:

- Client mandated native file formats and IFC
- Over 1,305,000 IFC structural objects modelled
- Delivered on time and under budget

By 2011, the design team had a large number of software applications and wanted to push an openBIM approach as a means of standardisation. At this point, all design teams had to submit in IFC format, as well as their native file formats. This meant teams could choose their preferred authoring applications without needing to make a choice, as long as IFC was adopted too.

This bound the various project teams, contractors and software vendors into delivering genuine interoperability across many different applications. The meant between 250-300 people could maximise the data associated with BIM deliverables without compromise through a structured file flow system. Teams were also connected to their local domain network. Having a single vision helped with a large number of models and objects as part of the handover process.



Models and objects were created using a multitude of software platforms and applications. For the structural modelling alone, 1,305,000 objects were produced in IFC format. The contractors produced around 700,000 models in IFC format, and the HVAC objects totalled around 149,000. Adding scale and consistency to the process. Aas-Jakobsen BIM Coordinator, Bjørnar Markussen, stated that “openBIM and IFC file format are essential.”

Results

By adopting an openBIM approach, the combined teams were able to deliver on time and under budget. The airport is now more spacious and inclusive of the local environment. The project also achieved certification BREEAM NOR rating of “Excellent”. By choosing environmentally friendly materials, the building’s CO2 emissions were reduced by 35%.

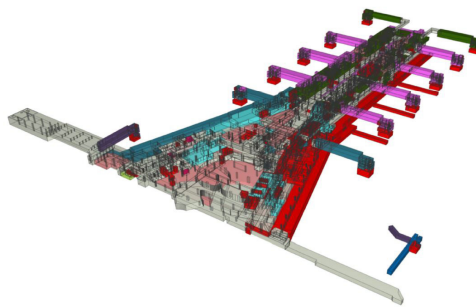


Furthermore, energy consumption at the airport has been cut by more than 50% compared to the existing terminal. Passenger comfort and well-being have been key drivers of the design throughout.

Artificial lighting was added to supplement natural daylight and can be set to reflect different moods according to weather, season and time of day.

The compact layout of the building, transparency and open spaces were enhanced, and wayfinding improvements provided reassurance and peace of mind for travellers. A panoramic window at the north end of the pier, a 300-metre long skylight and curved glazed windows on both sides open up the view to the surrounding landscape and beyond. Dag Falk-Petersen, CEO of Avinor commented: “Oslo Airport is now more spacious, more efficient and more comfortable for the passengers. The expansion project was delivered on time and under budget by the design team.”

Much of the success can be attributed to the mandate of IFC format for BIM deliverables, enabling a truly openBIM approach. Applications like Revit, Tekla Structures, ArchiCAD, Vectorworks, MicroStation, NovaPoint and Rhinoceros Grasshopper delivered models in IFC format.



Data management was seamlessly managed through a combination of platforms. Bentley’s ProjectWise was the work-sharing application and delivered a connected data environment with other solutions such as Solibri Model Checker, Trimble Connect and Synchro Pro. This level of interoperability delivered a truly openBIM collaboration and was a major reason for the delivery of this airport expansion project.

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The expansion project was delivered on time and under budget by the design team.”

Dag Falk-Petersen
CEO, Avinor Airport

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