Nolan Associates

consulting civil and structural engineers

Project Details

Client	**Rigby / KLM**
Structural Engineer	**Nolan Associates**
Main Contractor	**MJS Construction**
Architect	**Stephen George Partnership**
Steelwork Contractor	**Reid Steelwork**
Cost	**£7.5 millon**

Nolan Associates were appointed as civil and structural engineers for the KLM Engineering's new Hangar 9 and Workshop Buildings at Norwich airport.

The airport's new 54000 ft sq hangar features a 48m span central truss and 45m spanning roof trusses off each side. The building feature two 40m wide doors hung off the roof steelwork.

The central box girder double truss was designed to be stable without additional temporary bracing.

The steelwork roof and columns were a challenging project in itself however the sloping apron design was further complicated by the Covid Pandemic.

The ground floor slab had to be designed for the plane weight plus heavy jacking loads.

The 90mm wide hangar was site on a sloping site and therefore the ground levels varied by 600mm across the site. The level of the ground floor slab had to be considered carefully to reduce the amount of imported fill to a minimum. Imported stone is in short supply in Norfolk during the project which was completed in the middle of the Covid-19 pandemic.

The ground was particularly poor and this was made worse by the poor quality of the imported material. Heavy rains during the project caused the imported material to become fluid and cement and lime stabilisation needed to be introduced to improve the strength of the imported fills.

Drainage

The drainage was also a major challenge as the airport has increased in area dramatically over the years whereas the drainage sizes have not been improved.

Later CCTV reports revealed that much of the drainage was undersized downstream and large storage channels were required to retain parts of the apron rainfall.

The large apron falls towards the new hangar which has large opening doors at the front. Large channel drainage and underground storage within the pipes had to be accommodated to cut off the flow of the water across the apron.

The new apron incorporates a new 900mm deep Qmax drainage channel to catch apron storm water.

Apron Design

The new apron was designed to cater for the increased loadings from the larger Boeing Max 10 planes. Nolan Associates faced many challenges during the design and construction period.

One of these was that the concrete mixing facilities and testing was not available in Norfolk and numerous different mixes were considered to cater for the large loads.

New Aprons and runways are designed using 'A guide to Airfield Pavement Design and Evaluation, DMG 27 produced by The Ministry of Defence Estates.'

There are several design methods in this document including Rigid Design, semi rigid and flexible.

A rigid construction was considered to be the most appropriate solution.

The design relies on achieving a high flexural strength.

With the programme being so tight and with Covid restrictions in the testing labs, flexural beam tests were and pre-commencement testing was unavailable. These are crucial to the design and therefore an alternative method had to be considered to find a direct relationship between core testing and cube testing and flexural strength.

Numerous suppliers said they had not the facility to guarantee the concrete would achieve the desired flexural strength. We examined various mixes and their previous cube results to establish the correct mix for the project.

Photographs