WHITEPAPER

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What are the Main Considerations when Selecting a Floor Coating Material for Commercial and Military Aircraft Hangar Facilities?

From the outside an aircraft hangar might look more-or-less like a gigantic, uncomplicated box – but aviation professionals know that internally there's an intricate beehive of complex activity taking place that unavoidably involves heavy equipment, expensive assets and fire risks.

Making sure that the hangar facility can handle this type of work safely and efficiently means carefully considering a variety of elements. A principle factor is ensuring that the floor maintains a level and functional surface despite the movement of aircraft, heavy impacts and exposure to corrosive chemicals. Should the floor finish fail then it instantly affects the on-site safety and operational capacity of the hangar whilst lowering its value and incurring unwanted repair costs.

What is an Aircraft Hangar?

The hangar is a vital component in the infrastructure of any airline or airforce, as it provides a base for storage, repair and maintenance without which the aircraft would not be able to operate.

The hangar will typically be split between several main spaces, including the main hangar area, workshops, storage, administration offices and amenities. The hangar space itself could range from simply protecting aircraft to having large-scale specialist coating equipment.

An effective hangar should be designed to minimise the maintenance time and to maximise the flying availability of the resident aircraft. The design can vary depending on the type of aircraft involved and its operational requirements, for example a hangar for large, commercial passenger planes is going to need to perform different functions to one that caters to a select number of specialist military jets.

What is an Aircraft Hangar Typically Constructed From?

The majority of hangars are constructed from a steel frame, with arch truss systems being a popular design method for some of the tallest and largest free-span buildings. Steel is widely recognised as being the best material to cope with the on-site challenges and prefabricated steel frames can also be self-erecting, which avoids excessive construction phasing.

For all hangars there are several key characteristics – principal amongst these is having large areas of free floor area. Such wide and unbroken expanses of floor means it is important to install the right flooring system, as

applying an inadequate solution could create a problem across the entire site.

Even if only a small area of the floor fails it makes this part of the hangar less effective or even completely unusable, which is an undesirable outcome in a facility where any available space is a premium asset. Not being able to utilise the entirety of a hangar means operating at a reduced capacity, as extra aircraft, equipment or manpower will be forfeit.

Is There any History to Aircraft Hangar Design?

The rapid advance of aviation technology has demanded a similar development of the industry's accompanying infrastructure – with hangars being no exception.

The wingspans and tail heights of corporate and commercial aircraft are continuing to grow and modern hangars have to be designed to accommodate this. Whilst this means increasing the available space it also means simultaneously increasing the sturdiness, load resistance, fire resistance and durability of these structures.

The vast scale of modern hangars is exemplified by the Brisbane Airport Heavy Maintenance Hangar, which is the largest single open span hangar in the southern hemisphere. This state-of-the-art hangar was designed specifically to meet the heavy maintenance needs of Boeing 767 and Airbus A330 aircraft with a clear width span of 160 metres and a door opening height of 26 metres.

Just as with the smaller capacity of older hangars, the limited door widths, lack of overhead cranes and unsophisticated maintenance facilities - simple concrete floors are no longer sufficient for modern aircraft. The porous nature of concrete can easily be contaminated by fuel spillages and a difficult to clean finish increases the risk of flammable liquids remaining on the floor.

TIP:
Demarcation can help hangars make the most of the available floor area.

A concrete floor could even pose risks to the sensitive electrical equipment of today's aviation industry, which needs to be sheltered from static charge build up and excessive dusting.

Fire Safety

Fires within hangars are relatively infrequent events, but when it does happen it can be disastrous. Therefore it is vital that the facility's design comply with the appropriate fire-avoidance regulations set out by governments, local authorities and airport officials.

The possibility of different types of fires that can occur within a hangar has to be considered, including chemical, electrical, aviation fuel and structural fires. The biggest fire risk is usually from spilled fuel, as this could lead to a fire that is very difficult to extinguish. To put the seriousness of such a blaze into perspective, a pool of Jet A fuel 15 metres in diameter can produce a heat release rate in the region of 300 megawatts and a few hundred litres of ignited fuel will destroy most facilities that have not been properly protected.

Today's preferred fire-suppression technique is to use a foam system that covers the entire floor area in a total deluge that quickly chokes out the fire whilst it is still small and contained. This method is

preferable to sprinkler or standpipe alternatives as foam stays above the burning fuel and clings to its surface, smothering the fire by cutting off oxygen and suppressing fuelvaporization. In contrast fuel can rise above water and continue to burn, vaporize and reignite.

Effective floor drainage is an important part of a foam suppression system, as the deluge needs to quickly flow out of the area, washing away the burning fuel and depositing it down the drains.

As with most safety issues, prevention is better than a cure, and easy to clean floors that drain effectively will help remove flammable liquids from the area before they can become a concern.

Climate Conditions

The climate can play a significant role in hangar design and usage. Locations with high temperatures and humidity will need to account for this in the design and construction phases, as expansion joints will need to be installed into the floor to compensate for excessive movement at a sub-floor level that could crack the screed and floor finish.

The intensive UV exposure of hot climates can also discolour surfaces and impair the floor. UV resistant systems should be specified for locations where this is a concern to ensure a long-lasting solution that retains its colour.

Tyre Marks

Hangars are expensive facilities and tyre marks not only lessen the interior aesthetics but they can also damage the value of the site. These marks are caused when heat and pressure make chemical components leach out from the tyre and chemically bond with the floor.

This won't affect the integrity of the tyre, but it will lead to unattractive smears across the hangar floor that are very difficult to remove.

The main heat sources are thermal radiation from the brake assemblies and heat created by the friction between the tyres and runway, with the weight of the plane providing the necessary pressure. It is impossible to stop these sources from radiating heat so abrasion resistant flooring should be installed to stop the plasticizers from the tyres infiltrating the finish in the first place.

Fuel Resistance

No matter how diligent a facility is about cleaning and maintenance, harsh products such as acetone and jet fuel such as SKYDROL will inevitably spill onto the floor. As well as the fire risk this raises, such substances will also eat into concrete floors, turning a smooth and efficient floor into a porous, flaky and difficult to clean surface.

Once a floor's integrity has been comprised it makes it harder and harder to clean away any other spillages, as contaminants and liquids build up within the gaps in the floor, creating a vicious cycle that further deteriorates the site's safety and cleanliness levels.

Impact Resistance

It won't only be liquids falling onto the floor, as airmen and staff working in the hangar could easily drop heavy tools or equipment. This makes the compressive strength and impact resistance of the floor an important factor of the hangar's design. A flooring system that is too weak will inevitably crack and fail when subjected to normal work practises.

Slip Resistance

Having the right building design and safety practices has always been essential to avoiding accidents in what can be a prime environment for serious harm to come to employees or damage to aircraft if the area is not properly managed.

The severity of the risks within hangars can be seen from a National Business Aviation Association (NBAA) estimate that says 10% of all aircraft ground damage is caused by hangar movements, with environmental factors being a main cause of this damage.

The slip resistance of the floor can be key to reducing the number of on-site accidents, as it increases traction underfoot. This can make a real difference in the aircraft maintenance areas where heavy foot traffic and spillages of lubricants, oils and fuel is common.

Aggregates can be broadcast into resin floor coatings to enhance the floor's anti-slip profile while maintaining an attractive, seamless coating. The aggregate size can be customised to match the specific requirements of individual sites. Broadcasting aggregates into a resin floor also has the added benefit of increasing its durability and lengthening its longevity by creating a much tighter matrix.

Colour/Linemarking

Having a lot of free floor area is not just about the size of the building, but it's also about how the floor area is utilised. Clever use of walkways, on-site navigation and workflow can all help hangars comply with regulations and make the most use of the available space.

Some hangars will be bound by regulations that require them to have clearly identifiable walkways and boundaries that must be kept clear for passage purposes or to avoid problems such as overlapping aircraft tails.

Bright and obvious signage on the floor is ideal for meeting this requirement and can also be utilised to designate emergency paths that improve the safety of employees. Clever use of floor signage can also help to maximise the available floor space by marking out the best positions for the aircraft during entry, exit or storage.

A crisp white floor will not only make coloured linemarking stand out, but it will also make any contaminants or spillages easier to spot and clean away.

Epoxy & Polyurethane Floor Coatings

Epoxy resin floor coatings have become a popular choice for hangars thanks to the ability of these solutions to provide a robust platform for aircraft maintenance that can withstand the on-site challenges over an extended period of time whilst providing additional operational benefits.

Resin floor specialists can provide epoxy solutions that have been specifically tailored to resist long-term exposure to chemical attack from the corrosive hydraulic fluids, engine oils and fuels used in the aviation industry. To ensure that the floor will not fail these systems will also be strong enough to cope with heavy impacts from tools and intense pressure from heavy wheeled traffic.

To avoid the potentially dangerous build up of flammable liquids, the seamless nature of epoxy floor coatings facilitates easy cleaning that quickly removes spillages and contaminants from

TIP:
Seamless flooring makes it easier to remove potentially hazardous fuel spillages.

the area. Drainage systems can be incorporated that work alongside the site's fire suppression system so that the foam rapidly flows away.

The bright, clear colour of epoxy floors helps hangars to ensure a floor area that is not only aesthetically pleasing, but which also assists on-site maintenance by showing up dropped substances. Hangars can make use of the wide variety of colour options to differentiate between different floor zones for safety or work management purposes. Clear signage can also be incorporated into the floor to mark out crucial points such as aircraft positions and employee walkways or to aid workflow around the building and point out safety warnings.

The UV resistance and resilience of polyurethane systems means that the floor will retain its crisp colour despite extensive use in hot climates that have high levels of UV radiation. Its high abrasion resistance will stop facilities having to worry about hot tyres leaving marks across the hangar floor.

Anti-slip aggregates can be included within the resin make up of an epoxy system to provide extra grip underfoot. The anti-slip profile of the floor can even be tailored to meet the varying requirements of different areas of the hangar complex.

This guide has been produced to give an overview of floor specification considerations when selecting suitable systems for use in aircraft hangars.

Detailed recommendations and advice are available from our network of regional technical and sales representatives.

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