

HOW TO MAXIMISE TRAFFIC FLOW AND EFFICIENCY IN AIRPORTS



The benefits of effective line marking and compliance in airport management

ABSTRACT:

THE BENEFITS OF EFFECTIVE LINE MARKING & COMPLIANCE IN AIRPORTS:

Virtually all airports around the world use the same language of lines and patterns for runway markings to ensure both air and ground traffic are provided with clear directions.

From designated areas for aircraft to pedestrian walkways; all runway and taxiway line markings provide safety for passengers, crew and airport employees and enhance the efficiency of traffic flow.

This clear delineation is vital to convey coherent ground to air information and ensure the orderly flow of aircraft without runway incursions and other accidents.

Whether the pilot is taxiing to the runway or ground crew are transporting luggage from one terminal to another, high-quality line markings ensure a safe and efficient airport.

Compliance is a key issue. Often the line markings fade and even flake due to the use of traditional products and application methods. Once the markings are laid there needs to be a strategy in place to inspect, repair and maintain them.

This white paper examines how airport operation managers can reduce risk and delays while maximising impact with the use of high-quality line markings.



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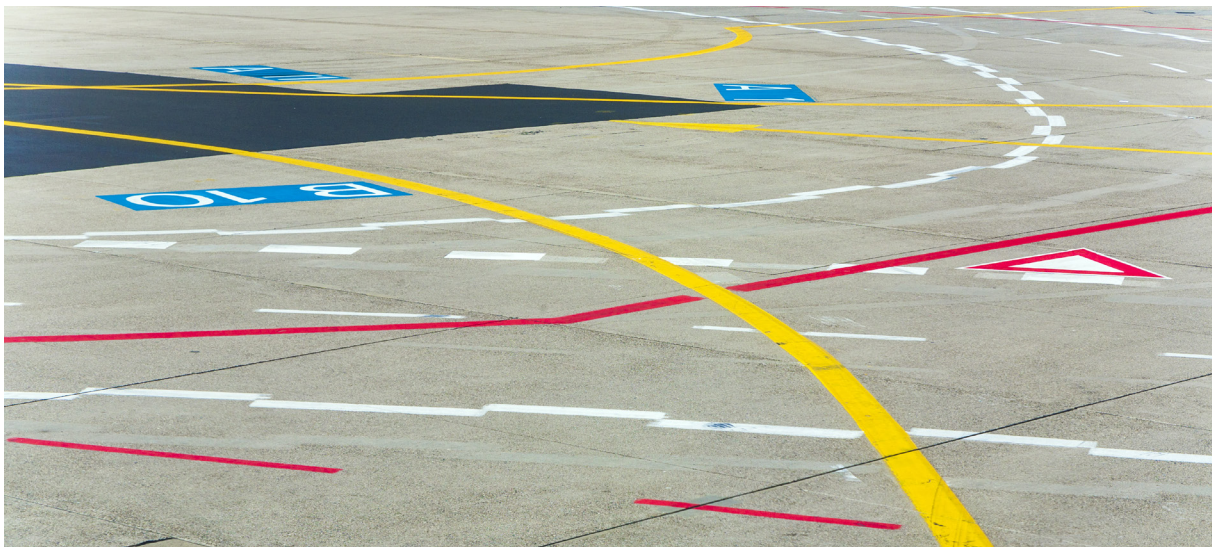
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INTRODUCTION:

IT IS ESSENTIAL FOR MAINTENANCE AND REDESIGN TO BE AT THE FOREFRONT OF EVERY AIRPORT OPERATOR'S BUSINESS PLANS.

The challenge in the effective management of airport operations is reducing delays and preserving a safe and appealing environment for passengers, crew and ground staff.

There is a secondary consequence in that poor safety, inefficiency and tired airport aesthetics has an effect on customer trust and staff satisfaction.



The airlines may complain if the inadequate look and feel impacts their passenger experience or brand.

Furthermore, should accidents occur as a result of poor line markings, the airport could be in breach of the regulations set by the Health and Safety Executive (HSE) and the Civil Aviation Authority (CAA).

In summary, it is essential for the application and maintenance of high-quality line markings to be at the forefront of strategies to enhance safety, traffic flow and overall effectiveness. This white paper explores the areas for attention and looks forward at airport innovations to improve efficiency.

THE BENEFITS OF EFFECTIVE LINE MARKING IN AIRPORT MANAGEMENT:

Effective line marking saves lives; pilots, passengers and ground crew rely on airport operators to provide the safest environment possible on their airfields. The lines must be bright, bold and long-lasting so that they are extremely visible day or night, and convey the vital information needed to navigate around the airfield safely.



Pilots navigating airfields are tasked with safely transporting passengers in an environment where a catastrophic error is potentially only seconds away. Even for the experienced pilot, signage significance and runway markings can be confusing; and, despite regulated uniformity at airports across the world, there are still differences. Pilots are human and not exempt from error.

ENHANCING SAFETY:

THE IMPORTANCE OF LINE MARKINGS FOR PILOTS:

Lines are the only continuous visual aid so need to:

1. GUIDE PILOTS TO AND FROM THE RUNWAY



2. PROVIDE SITUATIONAL AWARENESS



3. HELP AVOID AIRCRAFT INCURSIONS.



UK airport operators must comply with the line marking recommendations set by the Civil Aviation Authority to prevent runway incursions and excursions.

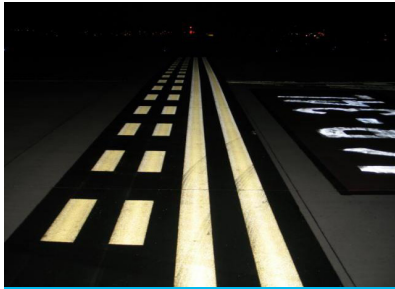
If line markings are insufficient, they cause confusion, contribute to an incursion and reduce safety.

The most important aspect of markings is visibility; markings should:

- **Be conspicuous under low visibility conditions.**
- **Be highly visible; especially in the dark.**
- **Reduce confusion for pilots.**
- **Enhance safety.**



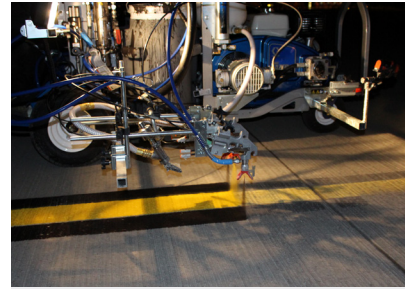
TO ENHANCE VISIBILITY:



Use of glass beads and black borders for low visibility conditions.



Use of high-quality durable paint and other materials.



Correct method of application for line markings

Line markings must provide the optimal visibility available on runway and taxiway including:

- Hold bars
- Threshold markings
- Aiming point markings
- Designation markings
- Geographical position markings
- Surface painted signs
- Non-movement boundary markings
- Centre lines
- Fixed distance markers
- Edge lines
- Touchdown zone markings
- And many more

Line markings on the apron are also vitally important for safety. This is the hub of aircraft and passenger operations. Clear delineation and zoning helps prevent accidents and injury to ground workers in particular, but also to airline crew and passengers.



GROUND OPERATIONS:

Operations is a very hazardous environment. Ground operations includes all aspects of aircraft handling and aircraft movement around the airfield, except when active on runways.

The safety challenges for ground operations staff include:

- Personal safety; not being hit by a vehicle or aircraft.
- Ensuring aircraft are not involved in collisions.
- Preventing runway incursions.
- Safe parking and docking of aircraft.
- Ensuring jet efflux from large aircraft does not hazard small ones.
- Preparing aircraft for departure in such a way that the subsequent flight is safe too.
- Correctly loading cargo, including dangerous goods and baggage.
- Fuelling aircraft with sufficient and verified levels.

These activities and more are often carried out at night, in low visibility conditions and in bad weather. Therefore, line marking and lighting **must** be enhanced to ensure **maximum safety** to personnel .

PASSENGER SAFETY:

The pedestrian zones of an airfield are equally as important as the vehicle areas. They show passengers the best routes to walk between the terminal building and aircraft to ensure their safety when boarding and disembarking.

Most risks to passengers on the apron arise from passengers being unfamiliar with the hazardous environment. Therefore, one of the main tasks when designing procedures and line marking is to ensure that they stay away from hazardous areas or are properly guided.



It is also common for passengers to feel unsafe and more vulnerable on the airfield. Mitigating this helps boost customer satisfaction and reduce complaints from passengers and the airlines.

Hazards to passengers include:

- Getting lost due to ambiguous or improper markings, which greatly increases the chance they get into a hazardous situation.
- Being hit by a vehicle or aircraft.
- Injuries caused by a propeller, jet blast or excessive engine noise.
- Getting injured inside the aircraft, for example due to an incident on the apron.

The airport operator and airlines have responsibility for ensuring the movement of passengers is strictly supervised and controlled. Therefore, safety line marking must be clear to all staff and support current health and safety procedures.

MAXIMISING TRAFFIC FLOW & EFFICIENCY:

IT IS ESSENTIAL FOR THE IMPACT OF LAYOUT DESIGNS ON EFFICIENCY TO BE AT THE FOREFRONT OF EVERY AIRPORTS OPERATOR'S BUSINESS PLANS.

Airport operators are charged with the task of moving many passengers, baggage, catering and aircraft as efficiently as possible. They must do this while maintaining a profitable business, running operational improvement efforts and maintaining sustainable business models.



A record-breaking 4.1 billion passengers flew on scheduled airline services in 2017, according to the International Air Transport Association (IATA). That was 280 million more than the previous year, representing a 7.3% increase, and they predict further growth over the next few years. This means increasing congestion at airports around the world will become a sticking point, presenting a challenge for airport operators. Many airports in the UK, including Heathrow and Birmingham, are feeling the pressure and are bidding to expand in order to meet the growing demand.

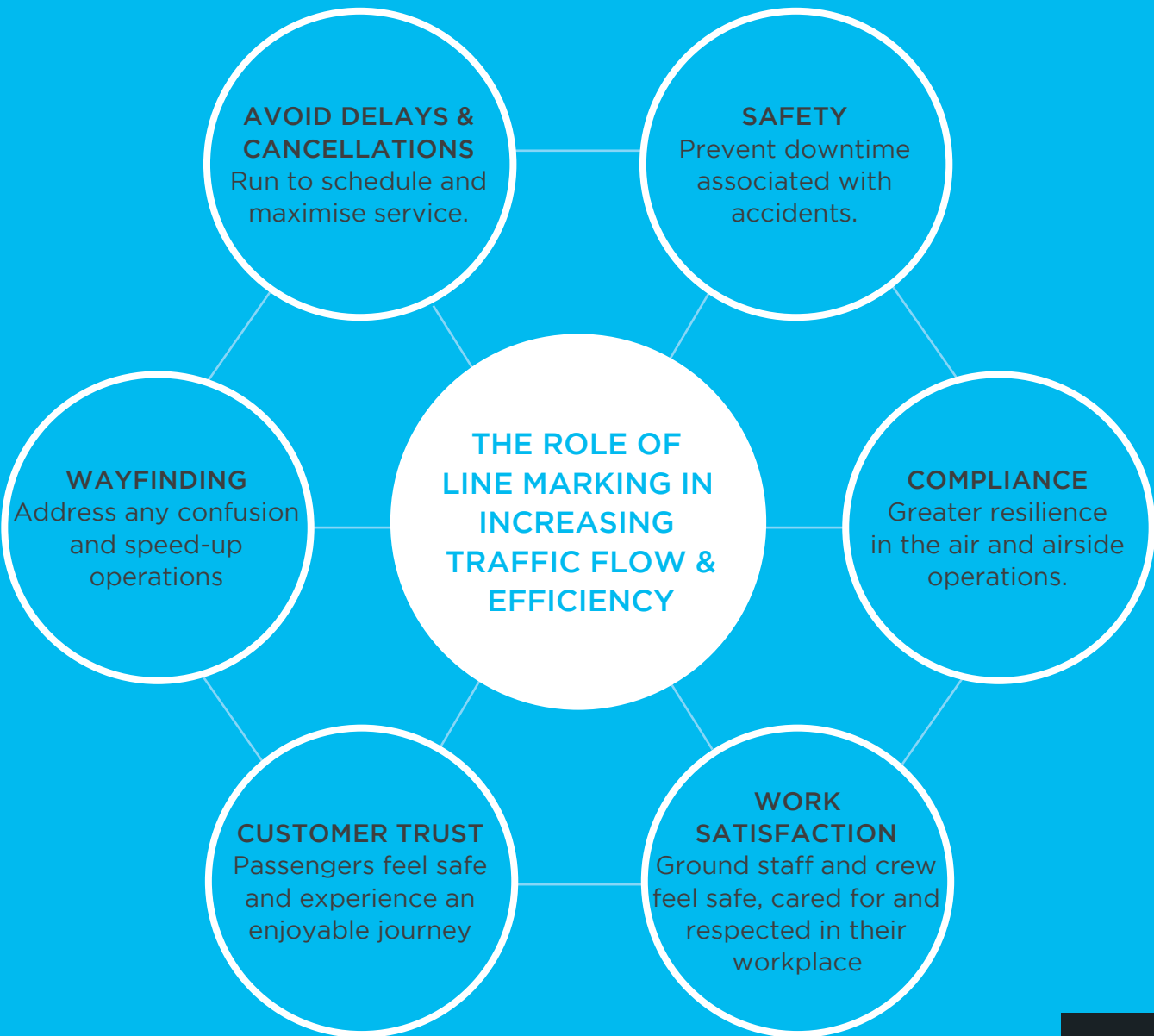
Despite sector growth, it is estimated that over half of all airports continue to be loss-making and this is often due to inefficient operations. By improving surface access, baggage systems, security, wayfinding, infrastructure, logistics and digital resilience – to name but a few – greater efficiency and profits can be made.

Goods flow into and out from an aircraft terminal, including everything from catering supplies for airlines to baggage. Stringent security measures require these to be checked before continuing to their destinations, but the logistics must run smoothly regardless.

There is also an array of people working at each aircraft stand, including engineers and baggage handlers. This is also where airline crew and the passengers themselves will board and disembark the aircraft.

Efficiency is what keeps everything and everyone at the airport flowing in the right direction to minimise delays. An unexpected mishap at an airport can cause major disruption and cost millions.

For example, drones were spotted in the airspace of Gatwick Airport on the run-up to Christmas 2018, resulting in 36 hours of delays, the cancellation of about 1,000 flights and affecting more than 140,000 passengers. It is estimated the chaos caused by the drones cost Gatwick Airport and the airlines at least £50m in lost revenue, compensation and cancelled bookings. Thankfully most incidents do not create that level of disruption, but even the smallest delays set off a chain reaction and the costs add up.



COMPLIANCE AND MAINTENANCE:

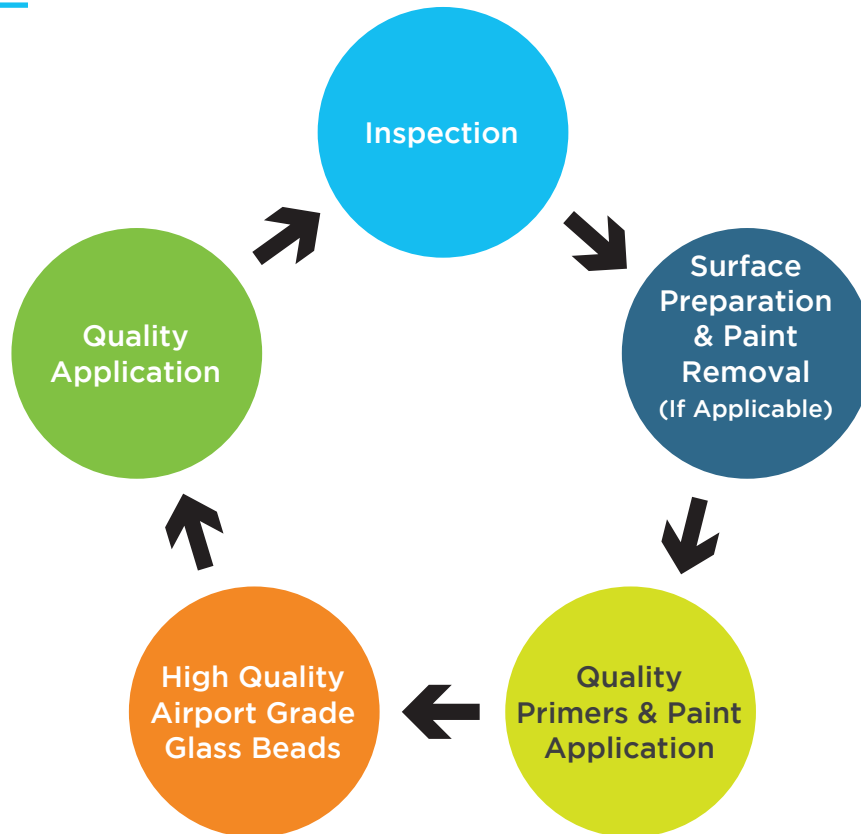
Effective airside line marking is vital to an airport running safely, smoothly and efficiently. Lines on runways, taxiways and aprons need to be regularly inspected and maintained properly, while having a minimal impact on other operations.



8 MYTHS ABOUT AIRFIELD MARKINGS:

1. Painting over old paint is okay; there is no time to remove or clean it.
2. Markings are easy to apply, training is not necessary.
3. One product fits all requirements
4. A typical markings installation is enough.
5. Airfield markings provide the same level as safety to pilots as road markings do for drivers.
6. It is not our responsibility to make sure the markings are effective.
7. If the CAA inspection cited no discrepancies, then the markings are effective.
8. Marking maintenance is needed at least every year, and especially in the winter.
9. Waterborne paint does not last.

QUALITY MARKING SYSTEM:



THE MAINTENANCE CHALLENGE:

- Recognising what is broken and knowing how to fix it.
- Coatings deteriorate gradually.
- When to maintain is subjective.
- It is inconvenient; find ways to minimise the impact on other operations.
- Short windows of opportunity.
- Poorly applied markings perform badly.
- Training staff to apply the lines or managing sub-contractors and their security clearance.



HOW TO MAKE MARKINGS LAST LONGER:

1. Properly prepare the surface for best adhesion
2. If applying over existing markings, ensure they're not too thick or peeling.
3. Make use of glass beads in your paint marking application.
4. With new markings, use best practices and high-quality materials.
5. Recognise not one fits all; there are different paints and applications for different purposes.
6. Properly inspect and maintain the marking regularly



SURFACE PREPARATION:

Firstly, as with any application, preparation is essential. 80% of paint application failures are a result of poor preparation. If there is anything on the existing surface to prevent the bond of the new coating to either the surface or existing marking, the application will fail very quickly. This can be in a time as short as a few days. This is not only a waste of product and time, but also of money and investment.

The ICAO Aerodrome Design Manual States:

“The surface should be cleaned properly before initial painting and before repainting. The surface to be painted should be dry and free from dirt, grease, oil, laitance, loose rubber deposits, or other foreign material which would reduce the bond between the paint and the pavement.”

We believe that the term cleaning should be more specific and to include...

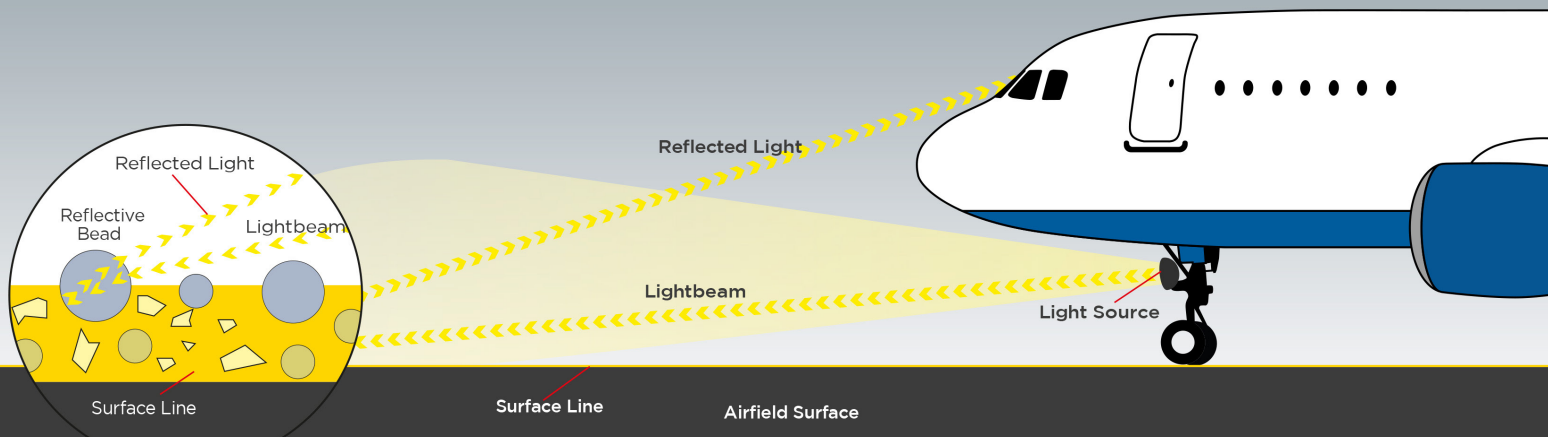
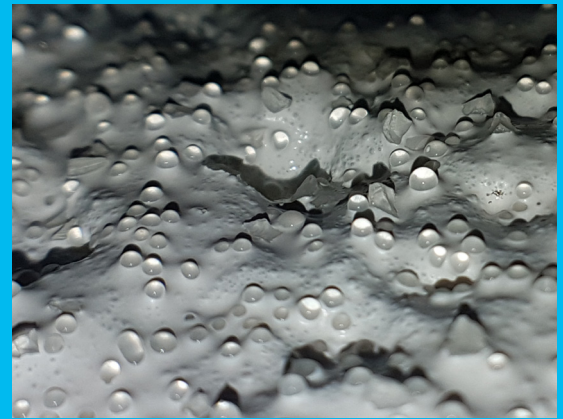
. . . Shall be cleaned by water jet, shot blasting or other mechanical method to remove all loose and poorly bonded paint; and shall be followed by sweeping and blowing or by similar methods as required to remove all dirt, laitance, and loose materials.



GLASS BEADS:

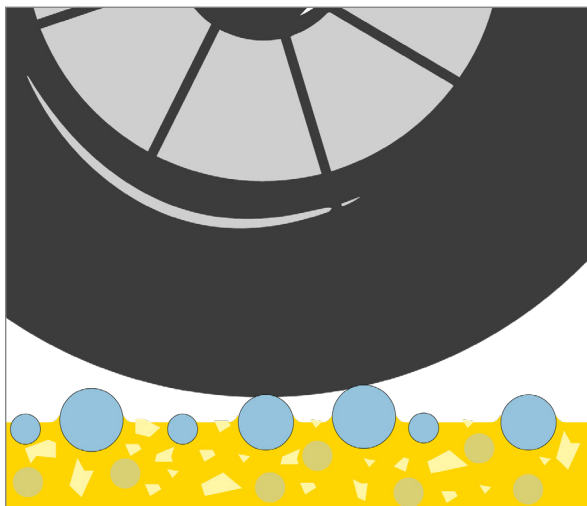
Reflective beads are glass particles that are embedded in to the paint at the time of application.

Airport beads reflect light from a light source back up at the plane cockpit, (similar to CATS Eyes seen on road). This is to ensure the marking is visible in darkness and low-light situations. (See illustration below)



HOW GLASS BEADS EXTEND THE LIFESPAN OF MARKINGS:

Not only do glass beads greatly increase reflectivity, but they also increase the durability of the marking by up to 4 - 5 times longer than when beads are not applied. This is due to the fact that when a wheel, or likewise, passes over the line, it comes mainly in contact with the elevated embedded bead, rather than the painted line. (See illustration below).



Beads Applied - Marking will last 4- time longer



No Beads Applied - Fast wearing line



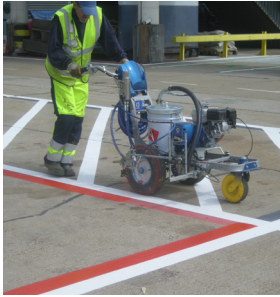
QUALITY PAINT TYPES:

There are three most reliable paint options for durable line marking.

MMA/Methyl Methacrylate	Epoxy	Acrylic
MMA cold plastic based. Solvent-free formula.	Epoxy based. Lower in solvent content	Solvent-based toluene-free.
Excellent adhesion on hard surfaces, such as asphalt and concrete.	Excellent adhesion on hard surfaces, such as asphalt and concrete.	Excellent adhesion on hard surfaces, such as asphalt and concrete.
Extremely hard-wearing with very fast dry times.	Approved for use on airfields. Hard-wearing and well-proven in demanding locations.	Fast-drying
Markings stay bright and crisp for longer.	Can be manufactured to any RAL colour, with short lead times.	High solids content gives excellent opacity and colour retention.
White is retro-reflective; all colours can have reflective beads added.	White is retro-reflective; all colours can have reflective beads added.	White is retro-reflective; all colours can have reflective beads added.
Lasts at least 3 times as long as thermoplastic.	Fast-drying. Very resistant to fuels and oil.	More environmentally-friendly than other products such as chlorinated rubber.

All line marking options can be used alongside anti-skid, slip resistant coatings for both aircraft, vehicle and pedestrian zones to reduce the risk of accidents.

APPLICATIONS FOR SPECIFIC PURPOSES:



STAND MARKINGS:

Stand markings should:

- Be Brightly Coloured
- Be Fast Drying
- Have Crisp Distinct Edges

Findings show that an acrylic based or a MMA line marking paint or surface coating is best suited for this application.



TAXIWAY MARKINGS:

Taxiway markings should:

- Be Highly Reflective
- Dry Fast
- Be Highly Durable and Resistant

Many airports around UK and Europe use either acrylic or epoxy line marking paint for these applications.



RUNWAY MARKINGS:

Runway markings should:

- Be Very Highly Durable
- Have Fast Cure Times
- Offer excellent opacity & whiteness

Runways are very heavy use areas and can't have long periods of downtime. The use of durable fast drying one-pack epoxy lining paint is highly recommended for this application.

AIRFIELD MARKINGS ARE ASSESSED FOR THE FOLLOWING CHARACTERISTICS:

VISIBILITY:

- Retro-reflectivity (brightness of the marking during low-visibility/darkness)
- Application of the glass beads (optimal embedment is 50% of bead in the coating, more beads visible than paint, and the even distribution of beads across the entire marking).
- Colour (match industry-approved colour codes)

DURABILITY:

- Adhesion
- Thickness/number of layers
- Condition of the surface under the markings

COMPLIANCE:

- Alignment
- Dimension
- Placement



MANAGING THE LINE MARKING APPLICATION

Airport operation managers can opt to manage the maintenance and application of line marking themselves by developing an in-house team, or outsource the work to an external subcontractor.

Either way, you also require an excellent partner with all the knowledge and experience required to consult, advise and supply the high-quality materials necessary to complete the project. Explore different systems with that partner to ensure delivery of maximum value for the whole life cost.

If wishing to develop an in-house team, use a supplier that is able to provide training and access to research and development, and has excellent customer service and ongoing support.



1. DEVELOP AN IN-HOUSE TEAM:

An option is to use your own team to apply the line marking and purchase the line marking machines and paints in order to fulfil the whole process from inspection to applying the paint.

High performance hydraulic striper machines with automatic and semi-automatic guns are ideal for line marking at airports.

ADVANTAGES OF HAVING AN IN-HOUSE TEAM:

- Manage and streamline the whole process from inspection to line marking.
- Better control over downtime and impact on other operations.
- Greater flexibility; do line marking when necessary and tackle small (and large) jobs.
- More cost-effective; own the equipment and no call-out charges.
- Lower risk; own staff are more familiar with the airport policies and health & safety than external contractors.
- Security clearance of non-personnel is unnecessary.
- Opportunity to introduce apprenticeships and for staff members to have training and development.

“ Ultimately, having an in-house team is a highly-efficient way to undertake line marking and it is often more viable than airport operators expect. ”

2. USE A SUB-CONTRACTOR

Another option is to use an external sub-contractor. It is very important to find the right contractor for you as it is imperative that the lines and markings are applied correctly.



TIPS FOR APPOINTING THE RIGHT SUB-CONTRACTOR:

- Find technical specialists who are experienced at marking at airports.
- Make sure they understand the demands on your airport.
- Ask for evidence that they have experience in applying airport markings with the highest level of competence.
- Be in control of the whole system and the products used, including application criteria.
- Agree a pricing structure for small and large jobs and minimise call-out charges.
- Ensure your supplier works alongside your sub-contractor so that the high-quality materials are correctly applied to ensure enhanced visibility and long-life.
- Obtain a performance guarantee.
- Contacts for airport approved contractors are available on request.



ENVIRONMENTAL CONSIDERATIONS:

Airports are under pressure to reduce their environmental impact; line marking systems and equipment can support green initiatives.

CARBON FOOTPRINT:

Use of low VOC (volatile organic compounds) paints.
Use fully electric machine for paint application.



NOISE:

Use of electric line marking machines at certain times to reduce noise pollution.
Use of asphalt on the runway: High stress resistance, ease of patching and line adhesion.



WASTE:

The liner system in some paint packaging allows for maximum product usage, recycling of clean metal tins and reduction of waste costs.



WHOLE LIFE:

Use of long lasting proven product and systems.
Long life surface markings like MMA (see page 16) minimise micro-plastic pollutant in waterways.



INNOVATIONS IN AIRPORT EFFICIENCY:



Technology is set to transform the air industry and the focus is on efficiency and giving travellers a remarkable experience from check-in to boarding the plane. Advances like automated check-in to eliminate queuing, electronic bag tagging to enable baggage tracking, and stringent laser molecular body and biometric scanners to speed-up security are being trialled and potentially installed throughout airports around the world.

To accommodate the rising demand for air transport, there is an argument that airports cannot just keep expanding their runway capacities forever. Critics say a more innovative solution needs to be found to tackle airport congestion and get more planes up in the air.



LARGER AIRCRAFT

One way to meet growing demand is to make future aircraft bigger; for example, the Boeing 777-9x design and the new “flying wing” concepts. However, airports may need to increase the size of their runways and aircraft stand facilities to make room for larger planes and their passengers.



It remains to be seen whether building larger aircraft is the answer. In early 2019, Airbus decided to end its manufacture of the A380 – the world’s largest passenger aircraft. Critics said the A380 was impractical, too large and therefore unprofitable when seats were empty.



CIRCULAR RUNWAYS

The Aerospace Center of the Netherlands (NLR) is working on a project called the Endless Runway – a circular runway that would significantly reduce airport congestion. Measuring 3km in diameter, the concept allows several take-offs and landings to take place simultaneously. Furthermore, it is calculated that the circular runway can handle the work of four regular straight runways.

The concept of circular runways could potentially increase capacity of airports, dissipate noise pollution evenly, reduce fuel burn and put an end to the problem of headwinds.

The Endless Runway idea is being applied to delivery drones and the first circular test runway will soon be built at a site near The Hague.

CONCLUSION AND NEXT STEPS:

The quality of markings on airfields are vital for airport's safety and efficient operation. Getting it right is a complex process from inspection to application. The line marking itself is a difficult task, because there are often narrow windows of opportunity to get the machines out onto the airfield. The equipment used must also handle a growing variety of colours and types of markings throughout the airfield – from very wide lines that need to be applied and dried quickly to detailed runway markings and lettering. As a result, the technology required to quickly and accurately apply diverse markings is becoming more sophisticated, so choosing the right supplier is vital.

To move forward you need to undertake a review of your airfield line markings. Ask yourself:

1. Are the markings clear, visible and long-lasting?
2. Evaluate their impact on efficiency and wayfinding;
3. Is there an effective system of inspection, repair and maintenance?
4. Finally, fulfilment – do you have the right equipment, supplier, and in-house team (including ongoing training) or contractor?

If you recognise issues, then invite an experienced line marking specialist to undertake a site audit and advise what is required to ensure safety, compliance and enhance efficiency.

Future proof any work so that you also have a plan for ongoing inspection, repair and maintenance; line marking should not be perceived as a one-off project.



AREAS TO ASSESS:



Meon are a supplier that offers a wide range of high-quality lining and surface marking materials and solutions. This range also includes line repair, suitable for both indoor and outdoor use and application machines for all the above.

Products include lining and area paints, taping, stencils, sprays and additives - suitable for many industries and complex problems requiring specific solutions. It also offers professional quality line marking and removal machines for purchase and hire

APPENDIX – THE BENEFITS OF EFFECTIVE LINE MARKING & COMPLIANCE IN AIRPORT MANAGEMENT:

1. Dublin International Airport issued a tender for a new line marking machine that was smaller, easier to use and maintain than what they currently had. They needed a machine offering greater versatility; Their current machine was, too large for apron and aircraft stand markings; and had to be compatible with both water and solvent-based paints and easy to change between paint types and colours.

Meon supplied the Graco 250 DC machine, which met all of their requirements, and had the additional capability to spray apply two different colours at the same time as well as applying glass beads.

Meon also carried out trials to ensure the machine met the airport's needs, and delivered demonstration training.

Dublin International Airport purchased two machines; one predominantly for airfield work and the other for carrying out paint markings in other areas of the airport.

2. The disposal of empty paint tins was costing Dublin International Airport about £60k per year. Meon consulted and provided an alternative paint solution that was more cost-effective while fulfilling all line marking requirements to a high standard.

Meon supplied SPECTRUM ViaLine Toluene Free Paint with EcoPack (eco friendly) tin liners. This option resulted in minimal paint wastage due to the ability to squeeze every last drop of paint out. The tins are clean after use and therefore fit for recycling, gaining income rather than high disposal costs.

Furthermore, ViaLine is a high-solids paint that is free of toluene and low in VOCs (volatile organic compounds), which also supports the airport's environmental ambitions.



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Bert has been involved in line marking and airports sector for nearly 20 years. It is a area and market that he is deeply interested in and passionate about.

Connect with Bert today on LinkedIn to discuss anything you may have found of interest in this white paper.



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