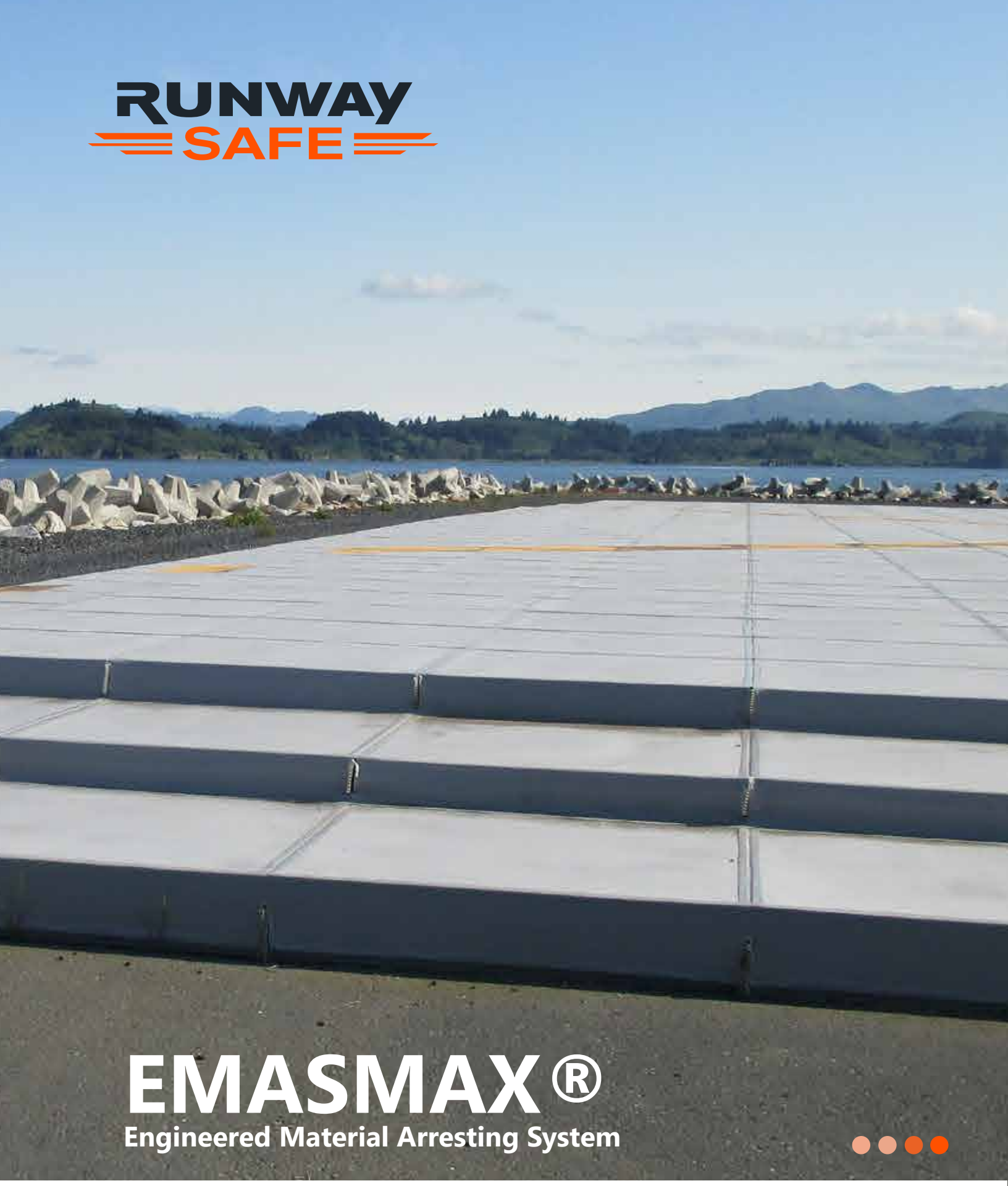
RUNWAY SAFE



EMASMAX®

Engineered Material Arresting System

EMASMAX®

EMASMAX® - the pre-manufactured EMAS block system

EMASMAX® (Engineered Material Arresting System) is a bed of customized precast cellular concrete blocks, designed to crush and move under the weight of an aircraft and, as a result, provide predictable & controlled deceleration in case of an overrun. Once the aircraft has stopped, the unique EMASMAX® material allows passengers and crew to exit the aircraft safely as well as letting the aircraft be easily removed from the arresting system, and finally for the system to be quickly restored to full functionality. EMASMAX® is designed to give optimized performance, tailor-made to runways and to accommodate an airport's specific aircraft fleet mix.

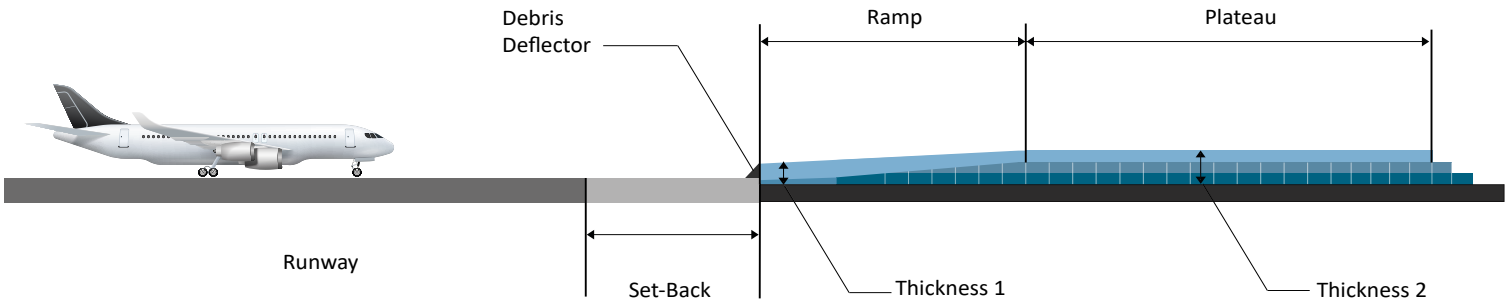
EMASMAX® – officially accepted since 1996

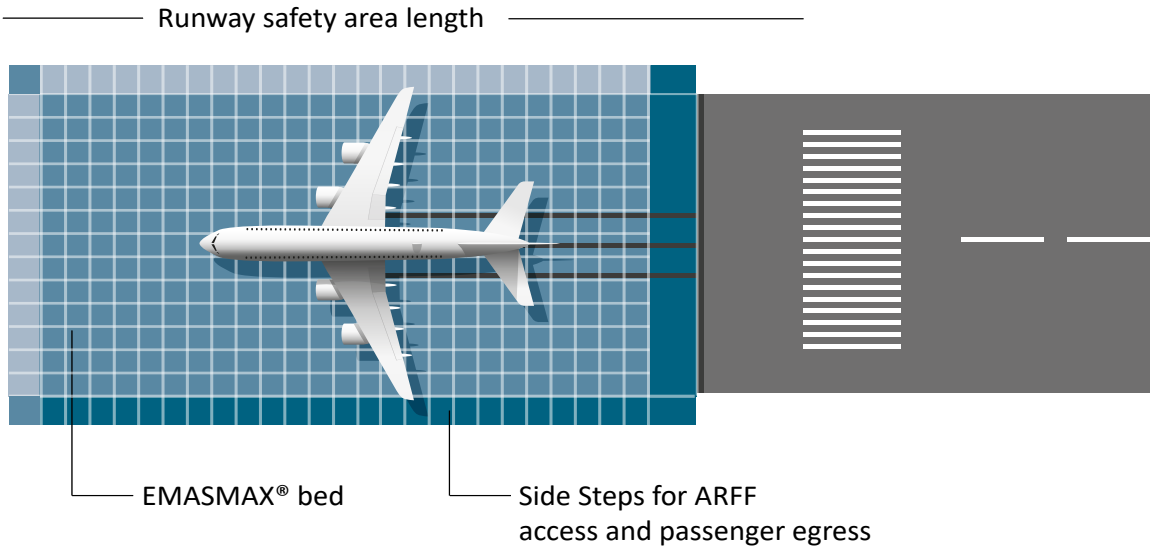
The first EMAS block system was installed at JFK International Airport in 1996. Today, EMASMAX® is in place on more than 120 runway ends worldwide, and has been credited with no fewer than 17 successful emergency arrestments. EMASMAX® has proven to be effective at saving lives while protecting assets and infrastructure in the event of an overrun. EMASMAX® is also recognized and has been accepted by a host of civil aviation regulators around the globe, including ICAO, EASA, US-FAA, UK-CAA and French-DGAC.

This optimal solution for airfields has been created from decades of extensive R&D and field experience, including live, full-scale aircraft testing and hundreds of trials using specially-adapted vehicles. This experience, and this robust product development process, provides our customers with an extra degree of assurance that each of our installations is uniquely tailored for their needs - and capable of providing reliable protection for decades.

EMASMAX® installation

The EMASMAX® is installed at the end of the runway, normally with one ramp up to full depth, followed by a plateau. The finished bed incorporates "side steps" around the perimeter, which allow firefighting and rescue vehicles to drive up onto the bed in case of emergency, while also allowing passengers to disembark. Debris Deflectors are installed in front of the EMASMAX® bed to protect against Foreign Object Debris (FOD) or jet blast from aircraft operating in the opposite direction.





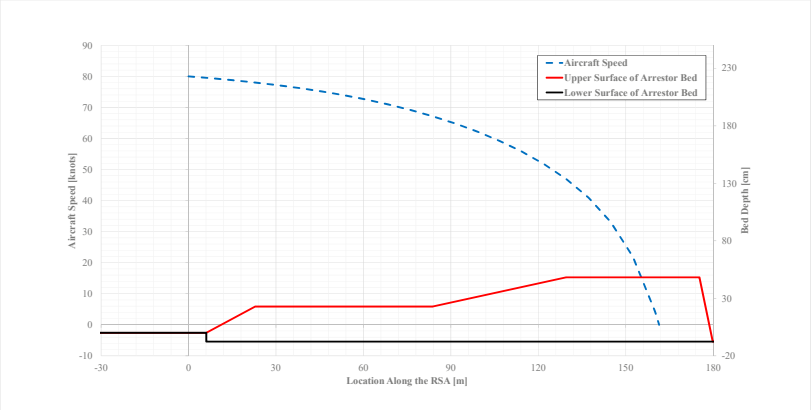
EMASMAX® Blocks

A typical EMASMAX® bed consists of 2,000 to 4,000 lightweight 4ft x 4ft pre-fabricated cellular cement blocks that come in three distinct FAA-accepted strengths in order to best accommodate the aircraft at your airport. These block variants are typically referred to as “50”, “60” and “80” strength.

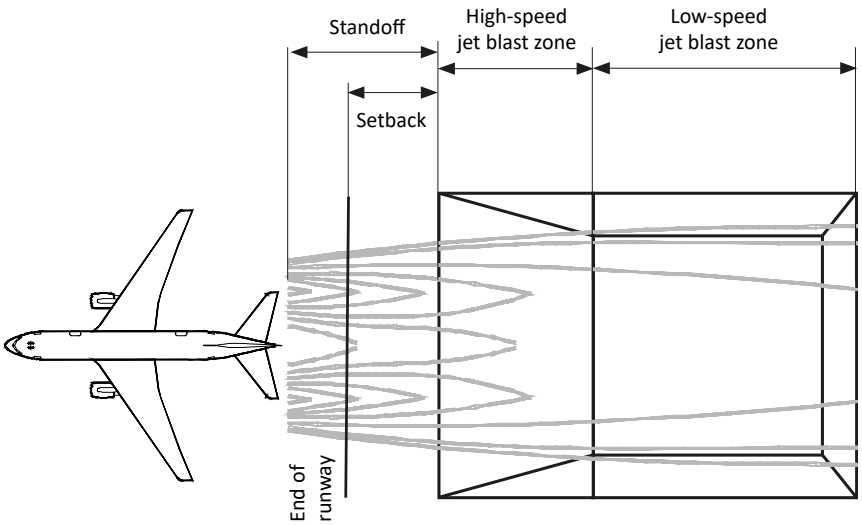
Product Performance Assessment & Modeling Process

Runway Safe utilizes an FAA-validated design method to predict the performance of the EMAS. The basis of our design method is our FAA-accepted computer simulation program. It carries out complex analysis of over 100 variables for each operating aircraft.

When carrying out its modeling, Runway Safe relies heavily upon the airport client to provide complete, accurate information on the range of aircraft that must be considered, as well as any operational constrains.



In general, the main objective of the performance modeling is to obtain the maximum EMAS performance achievable within the limits of the landing gear size/strength of each aircraft, as well as the length available for the safety area.



EMASMAX® bed design

The finished EMASMAX® arrestor bed typically spans the full width of the runway and is located at the runway’s end. The system is sized for 70-knot performance, where space allows for this (Runway Strip + RESA). In highly constrained areas, like locations with short RESA/RSA, we will design the EMASMAX® to utilize the space that is available for maximum stopping capability, making the most of what is available.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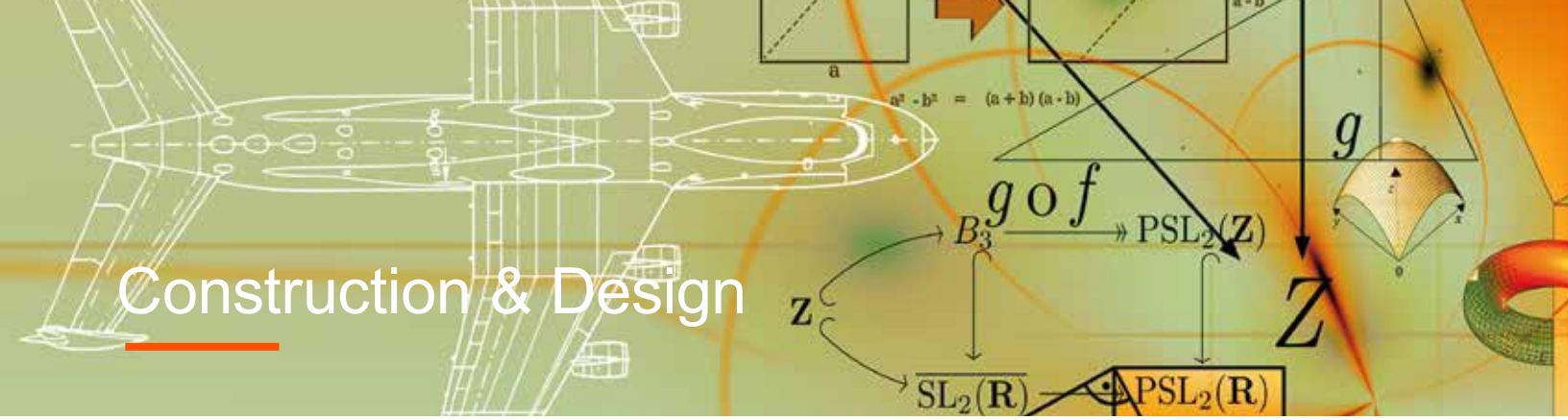


Construction & Design

How is EMASMAX® constructed?

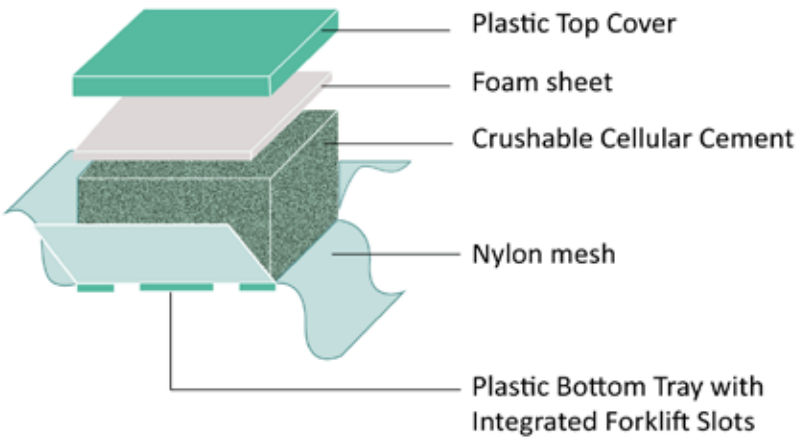
The EMASMAX® arrestor bed is composed of 4-foot by 4-foot low-strength cellular concrete blocks of varying heights, as required for individual EMAS designs. These blocks are produced in Runway Safe's facility in Logan Township, New Jersey in the USA. Each block is encapsulated by a specially designed plastic tray on the bottom and top of the core material, as well as a fabric scrim material on the sides. This casing also contains a UV- and jet blast-resistant coating. Each block is fastened to the pavement with hot asphalt cement.

PAVEMENT – The safety area is graded to standards for drainage and longitudinal slope, adjusted if necessary, based on aircraft performance. The safety area is then paved (shoulder strength, enough to accommodate occasional aircraft without deformation), from the runway end to just beyond the EMAS. Between the runway end and the arrestor bed the pavement might typically be grooved to facilitate aircraft braking.

BLOCKS – The blocks are manufactured in three different strengths; exactly which strengths are appropriate for a runway end will be chosen after running computer simulations that take the fleet mix, topography and available space into account. The precast concrete blocks have trays underneath them, with forklift slots: these make them easier to handle during installation. Each block is also individually tested to provide an assurance of proper strength and quality.

The EMASMAX® blocks are laid out on the prepared base of asphalt or concrete and the individual blocks are then fastened to the prepared base, specifically placed within a surveyed grid using hot asphaltic cement. Once the EMASMAX® blocks are set in place, the gaps between blocks are sealed using a caulk or tape material as appropriate for each location.

JET BLAST-RESISTANT TOP – The blocks are encased in durable Jet Blast Resistant (JBR) top trays to protect core materials throughout the lifespan of the arresting system.



JET BLAST SHIELDS – To protect the EMASMAX® from the intense Jet Blast generated by aircraft engines, a row of shields is installed closest to the runway end.

VENTS – In order to keep the bed intact and dry, vents are installed around the entire EMASMAX® bed so that any water or water vapor can escape from it.

Q&A

When is an EMAS needed?

EMAS is an alternative to a fully-dimensioned RESA and is in accordance with and complies to aerodrome standards; particularly when there is not enough RESA available or when environmental or topographic features limit runway extension options. However, EMAS does not only replace RESA but will also increase safety in situations with tabletop mountains, water, roads, or buildings and other obstacles that are close to runway ends.

How does an EMAS work?

An EMAS works by absorbing the energy of the aircraft as the bed components crush and move: specifically, the cellular concrete that crushes and moves under the landing gear load, reducing the speed of the aircraft.

How is an EMAS designed?

The performance and design of an EMAS is uniquely tailored to each specific airport runway. A detailed performance report will be compiled, taking into account the fleet mix and available area for an EMAS for the specific runway. Upon receiving detailed fleet mix data, as well as information about aircraft types, the number of operations, and other relevant information, an EMAS is designed to maximize stopping performance for the specific fleet mix.

Which aircraft can an EMAS stopped?

An EMAS is designed and optimized for airport-specific fleet mixes. EMAS beds have been developed to stop aircraft that weigh more than 12,500 lbs.

Can you drive on an EMAS?

The EMAS has been designed with slopes so that vehicles can access them from all sides in emergency situations. However, unless there is an emergency, no vehicles should be driven on the bed unless approved to do so by Runway Safe.

What is the minimum space required for an EMAS?

Each EMAS is individually designed for individual runway ends, as well as the aircraft fleet mix that uses the runway. As a result, there is no standard reply to this question. Runway Safe offers free consultations as an initial step to discuss specific needs.

What preparations are necessary before installing an EMAS?

The EMAS should be installed after the end of the runway on pavement that can withstand the occasional passage of aircraft without deformation. This is often referred to as shoulder strength pavement The paved site has to be prepared in accordance with national RESA standards, including drainage and slopes.

Q&A (continued)

How long does it take to install an EMAS?

Delivery and planning of an EMAS is dependent on factors such as airfield location and climate. The standard lead time for planning and installing of an EMAS from order to commissioning is typically 9-12 months.

Shorter delivery times may be achieved by reserving capacity in advance of construction. Once a site is prepared, installation of the EMAS is typically a 3-4 week process using night shifts. However, installation can take place in as little as one week if carried out during full runway closure.

What happens in case of an overrun?

After all passengers are evacuated, the first step is to remove the aircraft. This is usually done by pulling the plane out backwards along its own tracks.

The second step is to remove loose parts and, if necessary, to put a temporary top cover on. After this, the runway is functional again.

The last step is to restore the functionality of the EMAS by repairing the damaged parts. This should usually be done within 45 days.

How do you repair an EMAS?

In the event of an incursion, the damaged section of the bed can be repaired without affecting other areas. It should be noted that aircraft overrun repairs are typically covered by the aircraft operator's insurer.

What materials are necessary for repairs?

The same materials and machines that are used to build the bed are also used for repairs. All materials can be supplied by Runway Safe or our local partners.

> *Safety and long-term commitment will **always** be our first priorities.*

The implementation process

Is EMAS the solution for you?

Runway Safe offers consultations for all airport owners. By receiving fleet mix data and information about geographical constraints, our engineers are able to perform a preliminary study of an EMASMAX® for a specific runway. This will give an indication as to whether EMAS can be considered as a solution for a runway safety area.

A more extensive study is then carried out – a Preliminary Performance Report – where the result leads to an initial EMASMAX® proposal that will be optimized for a particular site and fleet mix, considering dozens of variables including speeds, weights, distances, jet blast etc. The information provided in the Preliminary Performance Report is intended for planning purposes only.

What happens then?

A Preliminary Performance Report provides the necessary information for the airport to move into the tendering process for a EMASMAX® solution. If the Preliminary Performance Report shows that favorable conditions for an EMAS exist, the next step would be a site visit, and a detailed discussion of specific needs, site constraints, construction plans and a draft time plan. Based on the assessment of a pre-study, the Runway Safe team prepares a quotation for a EMASMAX® installation that includes the details of the budget process and provides support in the procurement process.

Design - Each EMASMAX® is uniquely designed for the specific runway

Each EMASMAX® is unique, and the performance and design of an EMASMAX® is tailored to the specific requirements of the runway and the airport. During the design phase, our performance engineers work together with the airport team and airfield consultants to optimize the performance of the EMAS – within local restrictions.

At the end of the design phase, a detailed performance report is compiled, taking into account the fleet mix and available area for an EMASMAX® for a specified runway. A bill of materials is compiled, and construction drawings are produced for the planning and mobilization phases.

Planning & mobilization

As each runway and every situation is unique, thorough preparation is vital in order for the project to be successful. Runway Safe cooperates with local construction partners at airports around the world. During the planning and mobilization phase the installation crew is trained to carry out EMASMAX®-specific installation tasks.

Installation & warranty

Depending on runway access conditions, the installation can either be done over several nights or during a complete runway closure. All on-site work starts after Runway Safe and our local construction partner takes over the pavement, which has been designed to support the fleet mix of the specific runway. If this type of pavement is not already in place, it should be planned into the overall project.

As with all infrastructure investments, proper maintenance of an asset is vital in order to ensure performance and reduce lifecycle costs over its 20 year lifetime.

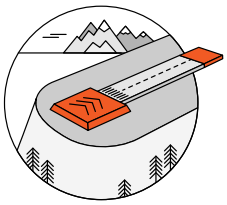
During the warranty period, Runway Safe assumes this responsibility as part of the standard warranty program.

Overrun experience

Yeager Airport (CRW) - USA

On January 19th, 2010, an EMASMAX® was put to the test and proven to be 100% successful when a Bombardier CRJ-200 Regional Jet with 34 passengers and crew aborted takeoff at the very last second and was safely stopped by the EMASMAX® bed. The aircraft had traveled at high speed before penetrating a substantial distance into the EMASMAX®, safely stopping short of a steep cliff at the end of the airport runway.

There were no injuries among the 34 occupants of the aircraft, which was successfully brought to a stop with little or no damage. The runway was reopened within 5 hours following the dramatic event, and the aircraft returned to service three days later.

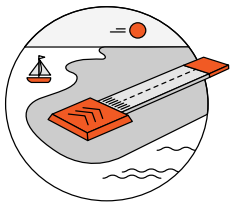


Key West International Airport (EYW) - USA

On November 3rd, 2011, a Cessna Citation 550 came in for landing at Key West International Airport. Due to a failure in the braking system the aircraft was not able to stop in time, and it overran the runway. Fortunately, it was brought to a standstill by the EMASMAX® bed.

All passengers were kept safe and the airport team regressed the aircraft themselves – literally before the dust had settled. They were out in 20 seconds. The ARFF vehicle came to the site just two minutes after being alerted.

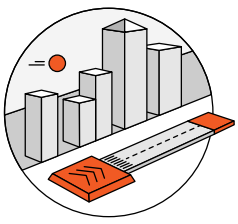
As well as there being no injuries, there was minimal damage to the aircraft itself. It was pulled out of the EMASMAX® and the airport could reopen the runway one hour and 45 minutes later.



Hollywood Burbank Airport (BUR) - USA

December 6, 2018: a Southwest Airlines flight from Oakland to Hollywood Burbank Airport, near Los Angeles, came in for landing and overran the runway during a heavy downpour. The Boeing 737 was brought to a safe stop by the EMASMAX® and none of the 112 passengers or 5 crew members were hurt during the incident. There was only minor damage to the aircraft, and the runway was reopened and kept in operation shortly afterwards.

Thanks to EMASMAX® the aircraft was stopped safely before reaching the fence, which acts as a final barrier before the four-lane highway situated just beyond it.



> ***100%*** *successful arrestments.*

Partnership

Service Agreements

Increase the life expectancy of your EMAS bed. Reduce unneccessary costs with a Runway Safe Service Agreement adapted to your specific needs.

Runway Safe provides Service Agreements for both its EMAS products, greenEMAS and EMASMAX®. These Service Agreements will provide the necessary Inspections, Verification of Fleet Performance (in case the fleet mix changes), and Inspection, Maintenance & Repair Training for airport staff, as well as any other services that might be of interest. Our goal is to ensure that you have EMAS-specific materials and equipment with which you can inspect and maintain your EMAS bed, helping to ensure the long life of your investment.

By having a Runway Safe Service Agreement, you can be confident of getting the right maintenance at the right time – which will keep your EMAS secured for years to come. With decades of experience in maintaining EMAS beds Runway Safe know that every airport is unique. This is why Runway Safe also offers tailor-made Service Agreements that are specific to your airport and EMAS system.

As a Runway Safe Service Agreement holder, you are entitled to prioritized support and many other benefits throughout the agreement period. You will get discounts on Runway Safe original spare parts, consultation, and the materials that are necessary to carry out maintenance of your EMAS system.

Runway Safe Partnership

With over 20 years of experience in providing EMAS systems globally, we want you to have a safety system that performs as expected. Runway Safe takes its responsibility as a manufacturer of safety systems seriously – which is why we also continue working on R&D with suppliers and engineers to be able to offer the best EMAS product, anywhere in the world.

We at Runway Safe see the decision to install a Runway Safe EMAS as the start of a long-term partnership between us and your organization. We will be there from the initial planning phases, for the duration of the installation, and throughout the entire lifetime of your EMAS system.

Taking the first step is as simple as getting in touch with us: we’re only a call or an email away.

”Safety - from start to stop.”

Disclaimer - EMASMAX® is a registered trademark in the US, Turkey, Taiwan R.O.C, Russian Federation, Norway, Indonesia, India, China and Brazil.

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