Optimizing EES Queues

How airports ensure regulatory compliance and prevent terminal congestion

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ISARSOFT

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1. Executive Summary

The Entry/Exit System (EES) has fundamentally transformed border controls in the Schengen Area since its mandatory introduction in April 2026. The regulation mandates comprehensive biometric registration for all third-country nationals entering or exiting the zone. Its practical implementation places a heavy burden on existing airport infrastructure and poses major challenges to conventional operational processes.

Traditional passenger flow management, which once relied on historical flight schedule data and fixed processing times, has largely lost its validity under the new system. In reality, first-time registrations often take up to five minutes per person due to language barriers and travelers' technical uncertainty, instead of the officially estimated 70 seconds. This operational bottleneck fragments passenger groups and leads to terminal congestion. The resulting delays jeopardize flight schedules, cause airline slot violations, and reduce non-aviation revenues.

To mitigate these disruptions, airport operators are forced to transition from retrospective analyses to proactive, data-driven real-time management. Effective terminal control relies on dynamic passenger routing and continuous situational monitoring. When physical terminal expansion is not an option due to spatial or financial constraints, video analytics offers a powerful alternative. Software solutions like Isarsoft Perception utilize existing security camera infrastructure to automatically measure waiting times, monitor crowd density, and trigger alerts before a queue reaches its critical capacity limit.

This whitepaper provides a practice-oriented overview of how airports can meet regulatory EES requirements while maintaining optimal passenger throughput.

2. The EES Dilemma: Regulations meet limited Infrastructure

Since April 2026, the Entry/Exit System (EES) has been mandatorily in use at all external air and sea borders of the Schengen Area. The EES fundamentally digitalizes border crossings: for third-country nationals, digital and biometric registration is mandatory upon entry, replacing the classic, analogue passport stamp with a centralized digital database and the collection of biometric data.

2.1 Requirements for airports

Specifically, airports are required to implement the following measures:

- **Biometric identification:**
  The mandatory capture and storage of travelers' facial images and fingerprints.
- **Automated Pre-Registration:**
  Airports must provide self-service kiosks where travelers can pre-register their data independently.
- **Data Matching:**
  The cross-referencing of travel documents with EES databases and the VIS (Visa Information System) to identify individuals and verify the permitted duration of stay.
- **Real-Time Documentation:**
  Accurate and seamless logging of entry and exit dates directly at the border crossing points.

2.2 Limitations of legacy passenger flow measurement

Prior to the introduction of EES, airport capacity management relied on proven mathematical models. Using historical flight schedule data, passenger statistics, and fixed average processing times - such as for manual passport control - operators could predict with high accuracy how many counters needed to be open to guarantee a smooth flow.

With EES, however, traditional models lost their validity.

> While the European Commission assumed a processing time of approximately 70 seconds, practice reveals a completely different picture: initial registration upon entry often takes up to **5 minutes per person.**
>
> Source: ACI Europe & IATA

Processing times vary widely and become unpredictable for traditional mathematical models. The reasons for this include:

- **Language barrieres among passengers.**
- **Technical uncertainty when operating the self-service kiosks.**
- **Physical delays, such as fingerprint recognition issues with elderly passengers.**
- **The cascading effect: when a single passenger requires 300 seconds at an EES kiosk instead of the calculated 70 seconds, mathematical queuing theory collapses.**
- **Unpredictable staffing levels for airports regarding the number of border control officers deployed.**

2.3 Effects of EES on operational processes

The EES presents enormous operational and economic challenges, particularly for regional airports. Since the new regulations apply exclusively to third-country nationals, EU and non-EU citizens must pass through separate checkpoints. This leads to a fragmentation of passenger flows and exacerbates existing bottlenecks:

- **Lack of space in terminals:**
  Space is limited, and check-in and passport control areas are often tightly confined. Installing the new self-service kiosks requires space that is simply hard to find.
- **The "clustering effect":**
  At regional airports, passengers frequently arrive in concentrated waves, e.g. a fully booked flight from London. If the processing time for a large portion of these passengers increases from around 30 seconds to several minutes per person, queues quickly backs up into the corridors.
- **High investment costs:**
  The procurement of hardware and the necessary adaptation of the IT infrastructure ties up substantial financial resources.
- **Personnel costs:**
  Although the kiosks are "self-service", experience shows that passengers require assistance during their initial registration. Airports must therefore often deploy their own ground staff to help passengers with the scanning process, aiming to relieve the federal police at the counters.

Flight Schedule Delays:
If processing times per passenger increase due to technical issues, language barriers, or system outages, it immediately causes delays in the flight schedule. If checkpoint times become too long, airlines risk missing their slots at destination airports.

The risk of domino effects:
Congestion at passport control leads to boarding delays and increases non-aviation revenue losses, as passengers no longer have time for duty-free shopping.

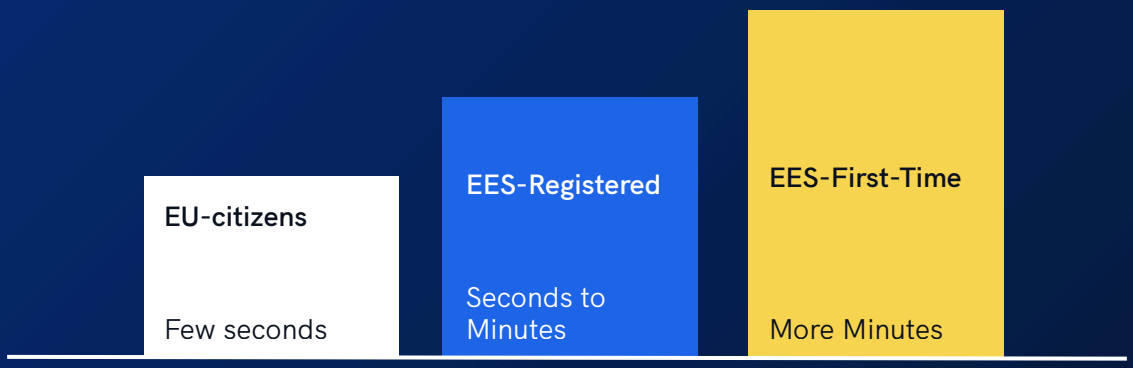
Airports can no longer rely on static average values, and EES regulations demand more space and personnel within the terminal. To successfully meet the challenges posed by EES, airport operators must transition from historical analysis to real-time tracking and predictive analytics.

3. Rethinking Terminal Capacity Management

EES forces airports to rethink their terminal management. When physical space cannot be expanded and processing times per passenger increase, the efficient use of available space and time becomes a key competitive factor. Successful capacity management now relies on two essential pillars:

3.1 Dynamic passenger routing

The classic "First in - first out" principle leads to a system collapse at border controls under EES, as processing times vary drastically.



For airports, this means they must intelligently segment passenger flows well ahead of the actual counters.

Segmentation:
Separating flows into EU/EEA, EES Registered, and EES First-Time isolates the "slow" first-time registrants so they do not block the flow of faster passenger groups.

Queue Design:
Serpentine queues optimize the use of limited space and prevent stalled counters from blocking the entire line. Walking forward slowly and continuously also reduces psychological frustration for passengers.

On-Site Education:
To shorten the time spent at the EES kiosk, passengers must be prepared for the process, e.g., removing glasses or hats, while still in line, using multilingual staff, digital displays, or QR codes.

3.2 Data-driven management in real time

Previously, airport control rooms often only reacted when a queue became visually noticeable or when complaints were made. In the EES era, that is already too late. Because backups build up in a cascading manner due to long processing times, airports must transition from reactive to proactive, predictive management.

Historical data and pure flight schedule data are no longer sufficient. They cannot reflect the actual dynamics within the terminal, such as delayed feeder flights or unforeseen passenger structures on specific routes. What is required is a digital twin of the current terminal status. To make the efficiency of EES zones measurable and manageable, control rooms must expand their dashboards to include specific key performance indicators.

KPI		Operative Relevance
Queue Length	The physical length of the queue in meters or the total number of people.	This defines the risk of "overspill" into other terminal areas, such as the blocking of escape routes.
Waiting Time	The exact duration from the passenger's arrival in the zone until they leave the EES counter.	This is a critical factor for the passenger experience and compliance with Service Level Agreements.
Throughput	The number of successfully processed passengers per kiosk/counter per hour.	This reflects efficiency and exposes technical malfunctions or slow processing workflows.

4. Technological Solution: Leveraging Video Analytics

Beyond a certain passenger volume, the operational challenges of the EES can no longer be managed through purely organizational measures. Sustaining high staffing levels for passenger routing and kiosk assistance generates substantial ongoing costs. At the same time, expanding terminal facilities physically is extremely time-consuming, expensive, and often architecturally unfeasible.

The key to overcoming the EES bottleneck lies in real-time data. By leveraging AI-based video analytics, such as Isarsoft Perception, airports can transform their existing camera infrastructure into a precise, automated management tool for terminal operations.

> Salzburg Airport uses Isarsoft to anonymously track EES passenger waiting times, providing detailed insights into process durations. The data is used to analyze and optimize arrivals area workflows.
>
> Alexander Münch, Head of IT

4.1 Using the existing camera infrastructure

AI-powered video analytics starts exactly where the infrastructure already exists with the airport's security and surveillance cameras, unlike hardware solutions or structural investments.

By applying modern AI algorithms to existing video streams, visual tracking is fully automated. The software continuously "sees" and analyzes the passenger flow, translating the video footage into anonymous metadata and feeding it directly into central airport management systems. This provides the terminal with a digital nervous system that detects bottlenecks before they become visible to the human eye in the control room.

EES Optimierung am Salzburg Airport:

Objective:
To analyze and optimize the EES process for the winter season.

Result:
After 4 weeks, precise throughput times and a complete mapping of passenger flows were achieved at approximately ⅓ of the cost compared to a sensor-based solution.

Implementation:

1. Tracking of transfer buses upon arrival and assignment to the respective flight number.
2. Counting of deboarding passengers and assignment to the flight.
3. Calculation of EES throughput times by re-identifying passengers at the end of the process.

Salzburg Airport W.A.MOZART

Read the full case study

4.2 Video Analytics with EES

Measurement of wait and throughput times
The software automatically tracks when a passenger enters and exits the EES zone with up to 90% accuracy, calculating the overall throughput time. If the average processing time increases, an alarm is triggered.

Occupancy and crowd density
Isarsoft monitors tightly confined EES zones using virtual zones within the camera view. If the critical number of people per square meter is exceeded, the system reports the overcrowding to security staff.

Predictive early warning systems and alarms
Beyond live monitoring, Isarsoft Perception utilizes the captured data for forecasting. If the EES queue is projected to reach its capacity limit within 15 minutes, the software generates an alarm.

4.3 Data privacy as core feature

The introduction of innovative solutions at airports in Europe often fails due to strict data privacy hurdles and internal compliance requirements. The protection of passenger identities during EES entry must be guaranteed at all times. For video analytics software, this is made possible through anonymized video streams and the exclusive processing of metadata.

At Isarsoft, data privacy and information security are not an afterthought, but built into the software as a core feature. Since biometric profiles are never created, stored, or cross-referenced at any point, the technology is 100% GDPR-compliant. The voluntary ISO 27001 certification further accelerates legal and operational approvals for airport management. The following measures are implemented for data privacy:

1. No biometric data
2. Pixelation and Bluring in real time
3. Irreversible anonymization
4. Static exclusion zones

ISO 27001 CERTIFIED

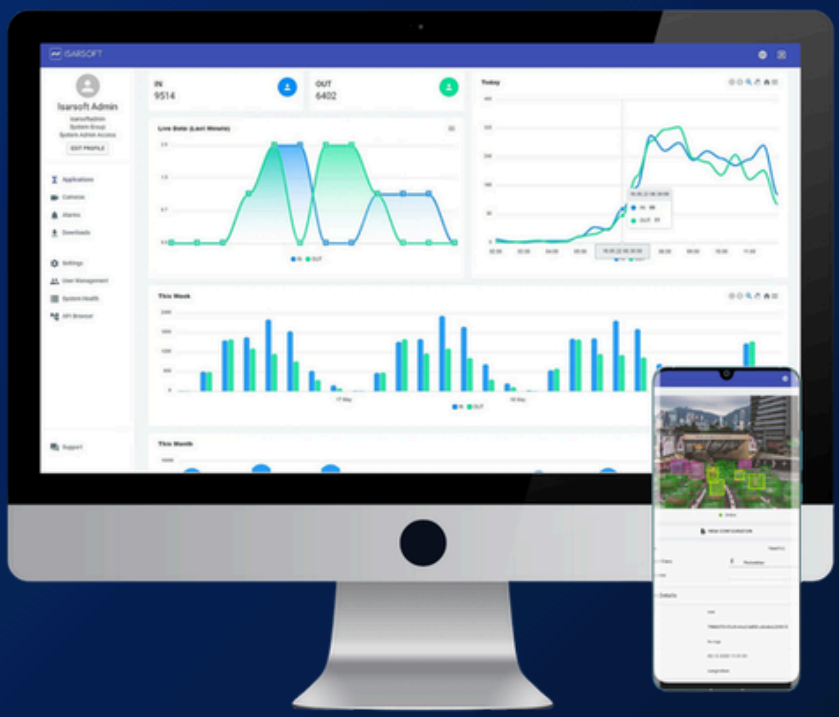
GDPR COMPLIANT

MADE IN GERMANY

About Isarsoft

Based in Munich, Isarsoft has been making a name for itself since 2019 as a reliable partner in the field of video analytics. Its mission: to leverage the potential of existing security camera systems using artificial intelligence.

Known for reliability, flexibility, user-friendliness, and a wide range of integration options, Isarsoft helps airports optimize operational processes, enhance safety, and boost customer satisfaction. Starting with passenger counting, its portfolio today includes more than 10 use cases, such as queue management, object detection, foot traffic analysis, demographics, and much more. For Isarsoft, every camera counts—whether in retail, at airports, in public transport, urban planning, logistics, or cultural institutions.



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