NorthSky Aviation Consultancy by RMX

OPERATIONAL RISK DECISION SUPPORT

Safe operating capacity at smaller aerodromes

A reproducible, barrier-based method — an anonymised worked case

Version	Version 1.2.1
Date	23 September 2026
Status	Clean revised issue
Publication status	Published for method transparency.
Prepared by	NorthSky Aviation Consultancy

Scope of this document

This document provides operational risk decision support. It does not constitute regulatory approval, aerodrome licensing, certification, compliance verification or an authority determination.

Contents

1 Executive brief

An annual movement number is demand, not capacity. Safe operating capacity depends on how demand concentrates into busy periods, how long aircraft remain in the circuit and on the runway, how predictable the traffic picture is, and whether the barriers relied on in the safety case continue to work.

This paper uses four complementary methods: circuit occupancy, occurrence history, runway occupancy time (ROT), and Human Factors Integration (HFI). The methods are integrated through release gates rather than averaged: a strong runway result cannot cancel an unresolved human-performance hazard.

The September 2026 source update changes the worked case materially. The applicable annual-to-peak conversion is the fully parameterised seasonal chain, not the former annual-hours shortcut. The primary rare-event criterion is $P(X \geq 3)$, while $P(X \geq 4)$ is secondary. The corrected green/yellow boundary is 12,433 movements and the yellow/red boundary is 20,232. At 15,500 movements, λ is approximately 1.02, $P(X \geq 3)$ approximately 8.4%, and $P(X \geq 4)$ approximately 2.0%. The result is low yellow and acceptable only under active ALARP management and the stated barriers. [S2]

2 Why annual totals mislead

Two aerodromes can record the same annual movements and present different exposure. One may spread traffic evenly; another may concentrate training sorties into short weather windows. One may have known, coordinated school traffic; another may mix students, visitors, helicopters and non-radio traffic. The annual total must therefore be translated into the period in which pilots actually experience concurrency.

NorthSky's Safe Movement Numbers tool screens whether arrangements supporting an existing traffic level appear proportionate. It intentionally does not calculate or approve a movement number. A full assessment requires local traffic and peak data, circuit residence times, runway occupancy, occurrence evidence, barrier testing and a documented risk decision. [S10]

3 The four methods

Circuit occupancy converts annual movements to a peak-hour rate and estimates the probability that a selected number of aircraft are simultaneously present. It is an exposure indicator, not a direct collision-risk calculation.

Occurrence analysis tests whether outcomes and precursors are consistent with the model. A year without a serious event is not proof of safety. The corrected source value is eight serious airspace occurrences in 2023. [S2]

ROT tests the physical system. The case aerodrome's harmonised rates are about 42 movements per hour for RWY 05 and 15 per hour for the conservative RWY 23 backtrack case. These are checks, not authorised rates. [S2]

HFI addresses traffic-picture complexity, including the "2+1" scenario: two known aircraft may be manageable, while an unexpected or non-radio aircraft can cause a disproportionate workload increase.

4 From annual to peak

The corrected chain is: annual movements × 60% summer share ÷ 153 summer days × 1.5 busy-day factor × 1.15 peak-hour factor ÷ 12 operating hours. The hourly rate is multiplied by the seven-minute circuit residence time and divided by 60 to produce λ. [S2]

For the primary event, $P(X \geq 3) = 1 - e^{(-\lambda)}(1 + \lambda + \lambda^2/2)$. At $\lambda = 1.019$, the result is 8.4%. The secondary $P(X \geq 4)$ adds $\lambda^3/6$ to the cumulative term and gives 2.0%.

5 The two limits

The two-aircraft restriction is a self-imposed management control adopted to align the operation with the CAA risk appetite. In the controlled source package, OCC limits simultaneous planned pattern lessons to two, while the model treats three or more total circuit aircraft as the primary rare event. The two-aircraft control is not a physical capacity result, a CAA-calculated threshold or a universal standard.

A scheduling cap constrains planned demand. The probability model estimates total occupancy, including traffic outside the dominant operator's schedule. If the operator formally changes the total-aircraft circuit ceiling to two, the event definition and annual equivalents must be rerun before use.

6 Sensitivity and uncertainty

The supplied Monte Carlo file contains 10,000 simulated capacity outputs. Recalculation gives a median of about 15,507, mean 16,206 and central 95% interval of approximately 9,525–27,104 movements. The wide, right-skewed distribution demonstrates sensitivity; it does not provide 95% assurance that 15,500 is safe.

The CSV contains only capacity_adj. It does not include sampled inputs, distribution definitions, correlations, random seed or executable model. Output percentiles are reproducible, but the generating process is not yet independently reproducible. [S3]

7 When Poisson is insufficient

Poisson assumes independent arrivals within the analysed period. Training schedules, common weather windows and repeated circuits may create clustering and cause the model to understate tail occupancy. Analysts must compare predicted and observed occupancy, assess over-dispersion and use an empirical or clustered-arrival model where necessary.

Decision statement

For the case aerodrome, 15,500 movements per year remains the recommended management limit under the current operating concept. It is not a universal safe number and it is not green. It is a conditional low-yellow decision supported by PPR, OCC scheduling, circuit controls, monitoring and escalation triggers.

8 Capacity concepts

Concept	Question	Evidence
Physical	What can runway/taxiway process?	ROT, exits, backtrack, fleet mix
Operational	What can procedures organise?	PPR, scheduling, controls, radio practice
Safe operating	What is tolerable and ALARP?	Four methods, uncertainty, barriers, accountable decision

9 Worked conversion

Step	15,500 example	Result
Summer movements	15,500 × 0.60	9,300
Average summer day	9,300 ÷ 153	60.8
Busy summer day	60.8 × 1.5	91.2
Peak hour	91.2 × 1.15 ÷ 12	8.74 movements/h
Expected occupancy	8.74 × 7 ÷ 60	$\lambda = 1.019$

10 Risk bands

Band	Primary criterion	Case aerodrome equivalent	Meaning
Green	$P(X \geq 3) < 5\%$	Below 12,433	Normal assurance still required.
Yellow	5%–15%	12,433–20,232	Tolerable only with justified barriers and active ALARP.
Red	Above 15%	Above 20,232	Do not rely on current concept without further measures.

These annual equivalents are not transferable. Another aerodrome must derive local peak factors, residence time, event definition, criteria and barriers.

11 Anonymised worked case

Annual	λ	P(X ≥ 3)	P(X ≥ 4)	Band
12,433	0.818	5.0%	1.0%	Boundary
15,500	1.019	8.4%	2.0%	Low yellow
18,000	1.184	11.7%	3.2%	Yellow
20,232	1.331	15.0%	4.6%	Boundary
21,000	1.381	16.2%	5.2%	Red
22,000	1.447	17.8%	5.9%	Red

The evidence supports retaining 15,500 only as a conditional management limit. The concession figure of 22,000 is red and is not supported as a current safe operating level by this method. [S2]

12 Barrier assurance

Barrier	Function	Evidence
PPR/MyPPR	Makes planned demand visible	Coverage, exceptions, actual-versus-planned peaks
OCC scheduling	Caps planned lessons	Rosters, exceedances, interventions
Circuit controls	Constrains complexity	Observed concurrency and rule currency
Procedures	Improves predictability	Audits, deviations, briefings
Radio discipline	Supports traffic picture	Blocked calls and phraseology observations
Escalation	Prevents drift	Monthly decisions and closure

13 Applying the method elsewhere

1. Define the decision and movement-counting rule.
2. Reconcile traffic sources.
3. Build a local annual-to-peak chain from measured data.
4. Measure circuit residence time and uncertainty.
5. Define the concurrency event and distinguish controls from capacity findings.
6. Calculate both tails and test assumptions.
7. Analyse occurrences by severity, exposure and barrier state.
8. Measure ROT by configuration.
9. Run HFI scenarios including unknown/non-radio traffic.
10. Integrate evidence through release gates.
11. Record the ALARP decision and revalidation triggers.

14 Minimum monitoring

Indicator	Purpose	Trigger
Monthly/rolling movements	Demand drift	Forecast exceedance
Peak hour	Tests conversion	Observed peak above input
Maximum circuit occupancy	Tests model	Repeated criterion events
Unknown/non-radio traffic	2+1 complexity	Independent trigger
Serious occurrences	Outcome assurance	Immediate review
PPR/schedule deviations	Barrier performance	Repeated bypass
ROT	Physical assurance	Configuration change

15 Decision and limitations

For the case aerodrome, 15,500 is supported only under the stated barriers and active low-yellow ALARP management. For another aerodrome, the transferable product is the process, not the number. Every input must be sourced, calculations rerunnable, assumptions tested, barriers assured and residual risk accepted by the accountable operator.

16 Version 1.2.1 change record

Update	Effect
Seasonal Way A adopted	Removed 2,200-hour shortcut
P(X ≥ 3) primary; P(X ≥ 4) secondary	Removed ambiguity
Thresholds replaced	12,433 and 20,232
15,500 reclassified	Low yellow, not green
Control hierarchy clarified	Two lessons is management control
Supporting data harmonised	ROT 42/15, HFI 0.5, eight serious events
Monte Carlo provenance added	Output reproducible; generation open
Anonymisation and v1.2.1 corrections	Aerodrome identity, ICAO code and case-specific source references removed for publication. P(X >= 4) at 12,433 corrected to 1.0%. Publication status line added.

17 Controlled sources

ID	Source
S1	Assessment of safe movements at the case aerodrome, v1.2, 29 March 2026 (confidential client report; aerodrome identity withheld for publication).
S2	Change note v1.3, 24 August 2026; prevails over S1 where inconsistent.
S3	Monte Carlo sensitivity CSV, 10,000 capacity_adj outputs.
S4	Operational Concept for the case aerodrome, v1.0 (confidential client document; anonymised for publication).
S5	Risk Analysis for the case aerodrome, v1.0 (confidential client document; anonymised for publication).
S6	Internal Audit for the case aerodrome, 2025 v1.2 (confidential client document; anonymised for publication).
S7	Occurrence investigation report held by the client (reference withheld to preserve anonymisation).
S8	Published AIP aerodrome entry for the case aerodrome (reference withheld to preserve anonymisation); current issue to be verified locally.
S9	Regulatory correspondence held by the client (case references withheld to preserve anonymisation; matter since resolved).
S10	NorthSky Safe Movement Numbers screening tool v0.9; advisory screening only.