Measurement of the safety key performance indicator and safety performance indicators in the SES Performance and Charging Scheme

Supporting Material for the implementation and measurement of the safety key performance indicator (SKPI) and safety performance indicators (SPIs) for the Third Reference Period (RP3) of the SES Performance and Charging Scheme (Commission Implementing Regulation (EU) 2019/317)

RP3 Safety – Supporting Material Part (B)

The Supporting Material provides guidance developed under EASA RMT.0723 appropriate to the requirements of the SKPI of RP3 of the SES Performance and Charging Scheme as provided for under Commission Implementing Regulation (EU) 2019/317. It corresponds to the final result of EASA NPA 2019 -10 following the public consultation – published as Commission Guidance.

Disclaimer

Acceptable Means of Compliance (AMC) and Guidance Material (GM) contained in this Supporting Material have not been adopted by the European Aviation Safety Agency Safety (EASA). Hence, the terms used in this Supporting Material should not be understood as corresponding to the terminology applied to the EASA rules/soft law.

Contents

I General

GM1 SKPI — General

A. Purpose

This Annex contains the supporting material for measuring the safety key performance indicator (SKPI) and safety performance indicators (SPIs) in accordance with Commission Implementing Regulation (EU) 2019/317[1] (the performance and charging scheme Regulation) for the Third Reference Period (RP3).

B. Objective

The objective of this Annex is to establish the method for the measurement and verification of the SKPI and SPIs under the performance scheme Regulation:

(a) Effectiveness of safety management (EoSM) by ANSPs, which should be measured through a periodic answering of the questionnaires whose content is provided in the Appendix to AMC2 SKPI, GM3 SKPI and GM4 SKPI. The questionnaires, as completed by the ANSP subject to evaluation, and distributed in accordance with the performance and charging scheme Regulation, should be verified as detailed in AMC2 SKPI and GM4 SKPI;

(b) Monitoring of separation minima infringement and runway incursion occurrence rates, which should be measured as detailed in AMC3 SPI and GM5 SPI;

(c) Monitoring of the use of automatic safety data recording systems for monitoring and recording of separation minima infringements and runway incursions by the ANSPs, which should be measured as detailed in AMC4 SPI and GM6 SPI; and

(d) Monitoring of the air traffic flow management (ATFM) over-deliveries, which should be measured as detailed in AMC5 SPI and GM7 SPI.

[1] Commission Implementing Regulation (EU) 2019/317 of 11 February 2019 laying down a performance and charging scheme in the single European sky and repealing Implementing Regulations (EU) No 390/2013 and (EU) No 391/2013 (OJ L 56, 25.2.2019, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1566812543741&uri=CELEX:32019R0317).

C. Definitions and acronyms

Definitions

'Best (good) practice' is a method, initiative, process, approach, technique or activity that is believed to be more effective at delivering a particular outcome than other means. It implies accumulating and applying knowledge about what is working and what is not working, including lessons learned and the continuing process of learning, feedback, reflection and analysis.

'Risk' refers to safety risk and means the combination of the overall probability or frequency of occurrence of a harmful effect induced by a hazard and the severity of that effect.

'Safety culture' means the shared beliefs, assumptions and values of an organisation and is part of the organisational culture.

Acronyms	
ACC	area control centre
AMC	acceptable means of compliance
ANS	air navigation service
ANSP	air navigation service provider
APP	approach control unit
ATC	air traffic control
ATCO	air traffic control officer
ATFM	air traffic flow management
ATM	air traffic management
ATS	air traffic services
ECCAIRS	European Coordination Centre for Accident and Incident Reporting Systems
ECR	European Central Repository
EoSM	effectiveness of safety management
ERCS	European Risk Classification Scheme
FAB	functional airspace block

IFR	instrument flight rules
GM	guidance material
KPI	key performance indicator
MO	management objective
MS	Member State
MTCD	medium-term conflict detection
NSA	national supervisory authority
NSA Coordination Platform	NCP
Operational Risk Baseline	It relates to the top safety objective of an organisation “to ensure that its contribution to the risk of aircraft accidents is minimised as far as is reasonably practicable” (from IR (EU) 2017/373 ATS.OR.200 (2) (iii)).
PRB	Performance Review Body
RAT	risk analysis tool
RI	runway incursion
Risk control framework	The combination of all reactive, proactive and predictive measures and actions within the ANSP to collectively and continuously manage identified risks/hazards. (from IR (EU) 2017/373 ATS.OR.200 (2))
RP	reference period
RMZ	radio mandatory zone
SA	study area
Safe Production	Decision making that occurs in any part of the organisation that considers the effects that the decision may have on safety, including the resulting reallocation of resources to or from safety.
SKPI	safety key performance indicator
SLA	service level agreement
SMI	separation minima infringement

SMS	safety management system
SPI	safety performance indicator
TMA	terminal manoeuvring area
TMZ	transponder mandatory zone
TWR	tower control unit
UAC	upper area control centre
VFR	visual flight rules

II Effectiveness of the safety management KPI at ANSP level

AMC1 SKPI Measurement of the effectiveness of safety management (EoSM) at ANSP level — General

GENERAL DESCRIPTION

The EoSM indicator should be measured by verified responses to questionnaires as contained in this Annex. For each question, the response should indicate the level of implementation, characterising the level of performance of the reporting organisation.

EFFECTIVENESS LEVELS AND EFFECTIVENESS SCORE

When answering the questions, one of the following levels of implementation, A to D, should be selected:

Level A is 'Informal arrangements'

Level B is 'Defined'

Level C is 'Managed'

Level D is 'Assured'

The specific requirements to achieve each level, A to D, is indicated for every question, as contained in this Annex. An effectiveness level should be selected only if all the elements described in the questionnaire as described in the Appendix to AMC2 SKPI, GM3 SKPI and GM4 SKPI are fully observed by an ANSP. If an ANSP has identified elements in various adjacent effectiveness levels, then it should take a conservative approach and select the lower effectiveness level for which all elements are covered.

Based on the responses, an overall effectiveness score should be derived from the effectiveness levels selected by the ANSP against each question as described in AMC2, Section B.

GM2 SKPI Measurement of the effectiveness of safety management (EoSM) at ANSP level — General

A study area (SA) has been derived and adapted for each of the elements of the safety management system (SMS) as described in ICAO Annex 19, and has been aligned as far as reasonably practicable with Commission Implementing Regulation (EU) 2017/373[2].

For each SA, a question (or a set of questions) has been derived and the levels of effectiveness have been described. The available levels of effectiveness, and their intended meaning, are as follows:

[2] Commission Implementing Regulation (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulation (EC) No 482/2008, Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377 and amending Regulation (EU) No 677/2011 (OJ L 62, 8.3.2017, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1566813407294&uri=CELEX:32017R0373)

1. Level A — Informal arrangements: SMS processes and/or requirements have not been agreed at the organisation level; they are either not routinely undertaken or depend on the individual assigned to the task.
2. Level B — Defined: SMS processes and/or requirements are defined but not yet fully implemented, documented or consistently applied.
3. Level C — Managed: SMS processes and/or requirements are fully documented and consistently applied.
4. Level D — Assured: Evidence is available to provide confidence that SMS processes and/or requirements are being applied appropriately and are delivering positive, measurable results.

The questionnaire has been elaborated using the CANSO Standard of Excellence (SoE) as the basis and adapting it to the needs of the performance and charging scheme Regulation. Modifications have been minimised, in order to deviate as little as possible from the CANSO SoE questionnaire. Nonetheless, some differences have been introduced. The main deviations with respect to the CANSO SoE are as follows:

1. Study areas 6, 8, 9, and 10 of the SoE have been removed, as there are no corresponding requirements in the SMS components required by Commission Implementing Regulation (EU) 2017/373;
2. Maturity level E (Optimised) is not used, because this level is intended to set international best practices. Achieving level E in every ANSP or across every study area is unrealistic, and therefore is not targeted;
3. Study area 18 has been added as an optional component to capture how the ANSP deals with safety interdependencies, and trade-offs, serving as a proxy of the system resilience of the organisation;
4. Study area 1, safety culture, has been completely redrafted to be fit for purpose.

EASA and the Performance Review Body (PRB) will monitor the performance of ANSPs regarding this indicator based on the received answers and on the results of the verification process by national supervisory authorities (NSAs) as presented in Figure 1 in AMC2 SKPI, Section C.

The questionnaire's sole intent is to monitor the performance (effectiveness) of ANSPs regarding ATM/ANS safety management.

In order to facilitate this process for stakeholders, the questionnaire will be made available via an online tool, which will allow respondents to complete and submit their responses to the questionnaires.

ANSPs are expected to provide evidence-based answers to these questionnaires, and a dedicated 'Justification and evidence' field together with a verification field have been provided to facilitate the validation of the claimed level by the NSA. In line with the responsibilities inherent in the system, the NSA of each Member State is responsible for verifying the ANSP responses and for submitting those responses per the requirements given in Commission Implementing Regulation (EU) 2019/137.

The response levels assessed in the completed EoSM questionnaires should be used with the sole purpose of generating recommendations and associated plans for the improvement of safety

management. These response levels should not be used to generate findings in the context of standardisation or oversight inspections.

In accordance with the standardisation principles at Member States, if during an oversight inspection a finding is raised by the NSA in relation to the ANSP responses to the EoSM questionnaire, corrective action by the ANSP is required. Further, where a finding identifies that any of the questions in the EoSM questionnaire is scored higher than it should be, the score should be corrected and lowered to the appropriate level of implementation.

The outcome of oversight is not designed to be used for corrections of the scores towards a higher level of implementation.

AMC2 SKPI Measurement of the effectiveness of safety management (EoSM) at ANSP level

The answers to the questionnaire should be used to measure the level of effectiveness in achieving the management objectives defined in this AMC.

For each question, ANSPs should provide their NSA/competent authority with information on the level of effectiveness (or level of implementation) and evidence to justify their answer as indicated below.

The questionnaire, which should be filled in by the ANSPs, is detailed in the Appendix to AMC3 SKPI, GM3 SKPI and GM4 SKPI.

A. Components, study areas (SAs)

According to Commission Implementing Regulation (EU) 2019/317, the indicator is stated as follows: 'The minimum level of the effectiveness of safety management to be achieved by air navigation service providers certified to provide air traffic services. This KPI shall be measured by the level of implementation of the following safety management objectives:'
For the sake of coherence in describing the EoSM in this document and the components of the ICAO Safety Management Framework, these safety management objectives are hereinafter referred to in this AMC as 'components', and they are as follows:

(a) safety policy and objectives;

(b) safety risk management;

(c) safety assurance;

(d) safety promotion;

(e) safety culture.

Each component addresses a set of SAs as follows:

- Component 1: Safety culture
  - SA:

    Development of a positive and proactive organisational culture

- Component 2: Safety policy and objectives

- SAs:
  - Safety policy
  - Safety accountabilities
  - Coordination of emergency response plan
  - Safety management system documentation

- Component 3: Safety risk management
  - SA:
    - Risk management process

- Component 4: Safety assurance
  - SAs:
    - Safety reporting
    - Safety surveys and audits
    - Safety performance monitoring
    - Management of change
    - Continual improvement of the SMS

- Component 5: Safety promotion
  - SAs:
    - Training and education
    - Safety communication

The SAs are further broken down into questions for which the ANSP respondents are expected to choose a level from the predetermined list of maturity levels that best describes the performance of the organisation with respect to the aim of that question. Organisations are reminded that in order to qualify for the chosen maturity level, all requirements as listed in the question must be met. The maturity level of an SA should be assigned considering the minimum maturity level achieved among the questions in that SA. Similarly, the maturity level of a component should be assigned considering the minimum maturity level achieved among the SAs in that component.

B. Scoring

In order to be able to measure quantitatively the overall effectiveness of safety management of the ANSP, the answers to the questions should be quantified.

The responses provided by the ANSP on their questionnaires are assigned a numerical value from 1 to 4, corresponding to levels A to D. Level E is not assessed and has no value assigned. Each question has the same weight over the final overall score. The numerical value of each question should be added from the questionnaire responses and the final overall EoSM score is calculated as a percentage of the maximum score value possible.

Questions	Maturity level				
	A	B	C	D	E
SA1-Q1	1	2	3	4	n/a
SA1-Q2	1	2	3	4	n/a
SA1-Q3	1	2	3	4	n/a
SA2-Q1	1	2	3	4	n/a
SA2-Q2	1	2	3	4	n/a
SA3-Q1	1	2	3	4	n/a
SA3-Q2	1	2	3	4	n/a
SA3-Q3	1	2	3	4	n/a
SA4-Q1	1	2	3	4	n/a
SA5-Q1	1	2	3	4	n/a
SA5-Q2	1	2	3	4	n/a
SA5-Q3	1	2	3	4	n/a
SA7-Q1	1	2	3	4	n/a
SA7-Q2	1	2	3	4	n/a
SA7-Q3	1	2	3	4	n/a
SA11-Q1	1	2	3	4	n/a
SA12-Q1	1	2	3	4	n/a
SA13-Q1	1	2	3	4	n/a
SA13-Q2	1	2	3	4	n/a
SA14-Q1	1	2	3	4	n/a
SA15-Q1	1	2	3	4	n/a
SA15-Q2	1	2	3	4	n/a
SA16-Q1	1	2	3	4	n/a
SA16-Q2	1	2	3	4	n/a
SA17-Q1	1	2	3	4	n/a
SA17-Q2	1	2	3	4	n/a
SA17-Q3	1	2	3	4	n/a
SA17-Q4	1	2	3	4	n/a

Mathematically, the effectiveness score for an ANSP 'j' is calculated as follows:

$$S_j = \frac{100 * \sum_{k=1}^{q} r_k}{4 * 28}$$

Where:

- S_j is the effectiveness score of the ANSP
- r_{kj} is the numeric value of the response of an ANSP to question k
- q is the number of questions for which responses were provided by the ANSP
- Q is the total number of questions in the EoSM questionnaire, i.e. 28

C. Mechanism for verification

The verification of the ANSP questionnaires by the NSA/competent authority should take place before the questionnaires and their results are submitted to EASA. The verification mechanism is presented in Figure 1.

ANSPs should assign a focal point for the purpose of the verification process.

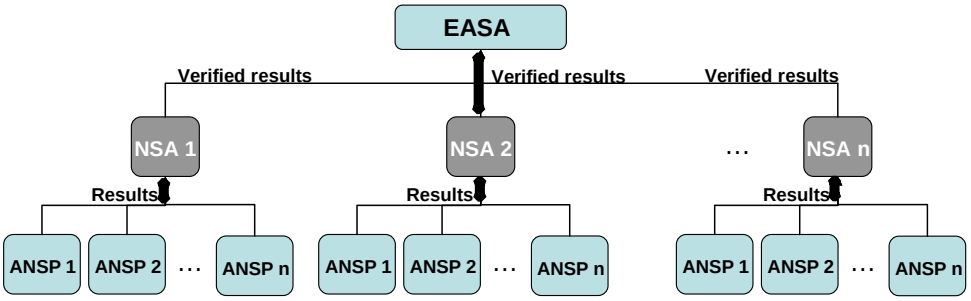


Figure 1: Representation of the verification mechanism

The competent authority/NSA may allocate the detailed verification task to a qualified entity.

GM3 SKPI Measurement of the effectiveness of safety management (EoSM) at ANSP level — Interdependencies

The questionnaire has been supplemented with a new component that captures how the ANSP manages interdependencies and trade-offs between safety and other business objectives. The main question to address is how the organisation assigns and distributes resources to ensure safe provision of ATS. This component is not targeted.

- Component 6: Interdependencies, resilient system performance, buffers and trade-offs
  - SA Managing the interdependencies of complex operational environments and competitive business models

GM4 SKPI Measurement of the effectiveness of safety management (EoSM) KPI — ANSP level — Verification mechanism

A. VERIFICATION OF THE ANSP EoSM BY THE NSA/COMPETENT AUTHORITY

When verifying the EoSM questionnaires completed by an ANSP, the competent authority/NSA may organise bilateral interview sessions. In these interview sessions, the NSA coordinator may ask the ANSP focal point some additional questions and request some additional evidence in order to verify the correctness of the answers provided for the questionnaire.

It is the responsibility of the ANSP to complete the ANSP-level effectiveness-of-safety-management (EoSM) questionnaire and for the NSAs to verify the evidence submitted. When answering the questions, one out of four (from A to D) levels of implementation is to be selected. The ANSPs will select the implementation level that best describes their organisation, and provide evidence and a justification in support of the level selected.

In order to ensure consistent interpretation of the questions, Table A presents a set of generic principles that are applicable to each maturity level, throughout the questionnaire.

Table A: Generic principles for each implementation level

Level A — Informal arrangements	Level B — Defined	Level C — Managed	Level D — Assured
SMS processes and/or requirements have not been agreed at the organisation level; they are either not routinely undertaken or depend on the individual assigned to the task.	SMS processes and/or requirements are defined but not yet fully implemented, documented or consistently applied.	SMS processes and/or requirements are fully documented and consistently applied.	Evidence is available to provide confidence that SMS processes and/or requirements are being applied appropriately and are delivering positive, measurable results.

In addition, examples of expected outcomes for each question that align with each implementation level, together with additional explanations, are provided at the end of each SA group, where necessary, in the Appendix to AMC3 SKPI, GM3 SKPI and GM4 SKPI.

Respondents are reminded that the answers should be conservative and ALL required elements have to be in place for a certain level. This includes the generic elements from Table A, as well as the particular elements suggested by the questionnaire in the Appendix to AMC3 SKPI, GM3 SKPI and GM4 SKPI. Even if a certain level has only one or two elements still missing, then the lower level with all elements in place have to be selected.

B. COORDINATION BETWEEN THE COMPETENT AUTHORITIES/ NSAs FOR THE VERIFICATION OF THE ANSPs

The competent authorities/NSAs might need better coordination between them in the verification process in order to achieve consistent and comparable results at European level. One potential solution could be the extension of the terms of reference for the NSA Coordination Platform (NCP) in the field of harmonisation of the verification mechanism of the SKPI at ANSP level.

Notwithstanding the above and notwithstanding the fact that NSAs may delegate the verification task to a qualified entity, the responsibility for verification of the SKPI measurement at ANSP level lies with the competent authority/NSA.

III Safety performance indicators (SPIs)

AMC3 Safety performance indicators (SPIs) for the monitoring of separation minima infringements (SMIs) and runway incursions (RIs)

A. SAFETY IMPACT

For the determination of the occurrences with 'safety impact' that are used for monitoring runway incursions (RIs) and separation minima infringements (SMIs), only a subset of the occurrences that may represent a risk to aviation safety should be selected.

The indicators set out in point 1.2(a) and 1.2(b) of Section 2 of Annex I should include occurrences whose safety risk grade is red or amber in the European Risk Classification Scheme (ERCS) matrix. These are the indicators at Member State level.

The indicators set out in point 1.2(c) and 1.2(d) of Section 2 of Annex I should include occurrences whose risk analysis tool (RAT) ground severity classification is A, B, or C. These are the indicators at airport or ANSP level.

B. EXPOSURE DATA

For the calculation of indicators, the Network Manager should provide to the European Commission controlled flight hours within the Member States' boundaries and controlled flight hours by the ATS units.

The ANSPs should provide to the European Commission IFR and VFR movements at airports.

C. DATA REPORTING AND DATA SOURCE

For the calculation of the indicators related to SMIs and RIs within the scope of Commission Implementing Regulation (EU) 2019/317, Member States should provide the occurrence data making use of the existing safety occurrence data reporting mechanism under Regulation (EU) No 376/2014[3] and submitted to the European Central Repository (ECR).

ANSPs and NSAs should ensure that the information provided through occurrence reporting under Regulation (EU) No 376/2014 contains the information needed to compute the performance indicators for monitoring SMIs and RIs. In particular, they should ensure that the following information is coded and reported:

- For monitoring SMIs:
  - unambiguously identify the safety occurrences that are SMIs;
  - when the SMI occurred at the arrival or departure at an airport, the location indicator of the airport where it took place;
  - The ATS unit name, airspace type, class and FIR/UIR name;

[3] Regulation (EU) No 376/2014 of the European Parliament and of the Council of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation, amending Regulation (EU) No 996/2010 of the European Parliament and of the Council and repealing Directive 2003/42/EC of the European Parliament and of the Council and Commission Regulations (EC) No 1321/2007 and (EC) No 1330/2007 (OJ L 122, 24.4.2014, p. 18) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1566816757728&uri=CELEX:32014R0376).

- information on whether, in the judgement of the investigators of the occurrence, the ATS or CNS contributed to the SMI, either directly or indirectly or none, as appropriate;
- RAT ground severity associated to the SMI, as obtained by the application of the RAT methodology by the ANSP;
- ERCS risk grade associated to the SMI, as obtained by the application of the ERCS methodology by the State.

— For monitoring RI:

- unambiguously identify the safety occurrences that are RIs;
- location indicator of the airport where the RI took place;
- the ATS unit name, airspace type, class and FIR/UIR name;
- information on whether, in the judgement of the investigators of the occurrence, the ATS or CNS contributed to the RI, either directly or indirectly or none, as appropriate;
- RAT ground severity associated to the RI, as obtained by the application of the RAT methodology by the ANSP; and
- ERCS risk grade associated to the RI, as obtained by the application of ERCS methodology by the State.

When receiving from EASA an analysis report of the reported occurrence data measuring these performance indicators for the preceding year (January–December), the NSAs should:

- validate the numbers presented in the report and advise of any identified discrepancies, together with supporting evidence;
- respond to all the observations in the report; and
- send a confirmation of the numbers presented and responses to the observations to EASA by the end of May each year.

GM5 Safety performance indicators (SPIs) for the monitoring of separation minima infringements (SMIs) and runway incursions (RIs)

The purpose of this GM is to explain the safety performance indicators, the data requirements and the process by which the number of SMIs and RIs will be measured.

A. RUNWAY INCURSION (RI)

The definition of RI is provided in Article 2(19) of Commission Implementing Regulation (EU) 2019/317, which is the same definition as that adopted by ICAO. It is repeated here for ease of reference:

‘“runway incursion” means any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft;’

In order to determine whether an event is a runway incursion or not, the following explanation is provided:

— the ‘incorrect presence’ is defined as the unsafe, unauthorised or undesirable presence, or movement of an aircraft, vehicle, or pedestrian, irrespective of the main contributor (e.g. ATC, pilot, driver, technical system).

The ‘protected area of a surface designated for the landing and take-off of aircraft’ is defined as a minimum the physical surface of the runway and the strip distance out to the holding point appropriate to the visibility conditions at the time of the event.

The RIs included in the indicator are those that occur at the airports included by the Member States in their performance plans, where the airports to be considered are specified. Article 1(3) of Commission Implementing Regulation (EU) 2019/317 establishes the minimum list of airports as those airports in the territory of the Member State with 80 000 IFR movements or more. Additional airports may be included in the performance plans according to Article 1(4) of the same Regulation.

B. SEPARATION MINIMA INFRINGEMENT (SMI)

SMI is defined in Article 2(20) of Commission Implementing Regulation (EU) 2019/317, which is in line with industry practices. It is repeated here for ease of reference:

‘“separation minima infringement” means a situation in which prescribed separation minima were not maintained between aircraft;’

It is important to note that both horizontal and vertical separation needs to be lost to trigger an SMI. It is understood that the infringement of the separation standard is between aircraft that are flying under the ATC services of the responsible ANSP.

The SMI-related indicator covers aircraft in en-route, terminal and airport control zones. When the infringement occurs around an airport, only those occurrences attributed to the terminal navigation services around airports that are included in the Member States’ performance plans are included. Article 1(3) of Commission Implementing Regulation (EU) 2019/317 establishes the minimum list of airports as those airports in the territory of the Member State with 80 000 IFR movements or more. Additional airports may be included in the performance plans according to Article 1(4) of the same Regulation.

C. LOCAL LEVEL versus UNION-WIDE LEVEL

SPIs for the monitoring of SMIs and RIs at local level are established in Annex I, Section 2, point 1.2, paragraphs (a), (b), (c) and (d) of Commission Implementing Regulation (EU) 2019/317. They include indicators at Member State, ANSP and airport level. They are reproduced here for ease of reference:

'(a) The rate of runway incursions at airports located in a Member State, calculated as the total number of runway incursions with a safety impact that occurred at those airports divided by the total number of IFR and VFR movements at those airports.'

The indicator set out in paragraph (a) is aggregated at airport level. It includes all RIs that have been reported under Regulation (EU) No 376/2014, independently of the main contributor, i.e. individuals, air operators, aerodromes, or ANSPs. As such, this indicator aims to capture trends in RIs at Member State level.

'(c) The rate of runway incursions at an airport calculated as the total number of runway incursions with any contribution from air traffic services or CNS services with a safety impact that occurred at that airport divided by the total number of IFR and VFR movements at that airport.'

The indicator set out in paragraph (c) is aggregated at airport level. It includes only a subset of RIs that have been reported under Regulation (EU) No 376/2014 for which the ANSP was identified as having a contribution, either direct or indirect. This indicator aims to capture trends in RIs under the influence of the provider of ATC at the airport concerned.

'(b) The rate of separation minima infringements within the airspace of all controlling air traffic services units in a Member State, calculated as the total number of separation minima infringements with a safety impact that occurred in that airspace divided by the total number of controlled flight hours within that airspace.'

The indicator set out in paragraph (b) is aggregated at Member State level. It includes all SMIs that have been reported under Regulation (EU) No 376/2014, independently of the main contributor, i.e. air operators or ANSPs. This indicator captures all SMIs that occur within the geographical boundary of a Member State, irrespective of which ANSP is providing the ATC service.

'(d) The rate of separation minima infringements within the airspace where the air navigation service provider provides air traffic services, calculated as the total number of separation minima infringements with any contribution from air traffic services, or CNS services with a safety impact divided by the total number of controlled flight hours within that airspace.'

The indicator set out in paragraph (d) is aggregated at ANSP level. It includes only a subset of SMIs that have been reported under Regulation (EU) No 376/2014, for which the ANSP was identified as having a contribution, either direct or indirect. This indicator captures all SMIs that occur in the area where an ANSP provides its ATC services.

SPIs for the monitoring of SMIs and RIs at Union level are established in Annex I, Section 1, point 1.2, paragraphs (a) and (b). These indicators are determined as the local-level indicators defined in point 1.2(a) and 1.2(b) of Section 2 and differ from them only in the level of aggregation.

D. SAFETY IMPACT

It is anticipated that Member States will classify occurrences in terms of safety risk according to the common European Risk Classification Scheme (ERCS) that the European Commission intends to adopt by means of implementing acts, as prescribed in Article 7 of Regulation (EU) No 376/2014.

ERCS considers four levels of risk associated to occurrences, namely: 'not safety related', 'low', 'medium', or 'high'. Each level is coloured in the ERCS risk matrix: green for 'not safety related' and 'low' risk occurrences, amber for 'medium' risk occurrences, and red for 'high' risk occurrences. The occurrences with safety impact considered in the computation of indicators for monitoring RIs and SMIs at Member State level refer to those that have been classified as 'medium' (amber) and 'high' (red) ERCS risk grade of the ERCS matrix.

It is anticipated that ANSPs will classify occurrences in terms of severity according to the RAT methodology. This methodology classifies the severity of occurrences into five categories: 'serious incident' (A), 'major incident' (B), 'significant' (C), 'not determined' (D), and 'no safety effect' (E). The occurrences with safety impact considered in the computation of indicators for monitoring RIs and SMIs at ANSP level refer to those classified as ATM ground severity A, B, and C.

The application of severity classification using the RAT methodology was formally introduced within the ATM performance scheme Regulations for RPs 1 and 2. At the end of RP2, the target for the application of severity classification using the RAT methodology by ANSPs was set to 100 % application for all reported SMIs and RIs with ATM ground severity A, B, and C, and it is anticipated that ANSPs will continue to apply it to these occurrences. In order to calculate the correct score and perform a proper analysis of the occurrence, it is good practice to determine both the ATM overall and ATM ground scores.

E. ATS/CNS CONTRIBUTION

There are two indicators, set up in points 1.2(c) and 1.2(d) of Section 2, that consider only those occurrences where, during the occurrence investigation, the ATS or CNS services contributed to the occurrence. This contribution is considered to be any causal or aggravating factor from the ATS or CNS ground services to a situation, in the air or on the ground, where an aircraft/vehicle/person has lost the required safety margins.

In contrast, cases where there is no 'ATS or CNS services contribution' are: when the investigation shows evidence that there was no kind of causation/contribution/aggravation from the ATS or CNS ground services; and there was at no point in time any chance for the ATS or CNS ground services to detect and resolve a sudden/potential conflict in advance of a loss of required safety margins.

F. EXPOSURE DATA

The indicators for monitoring SMIs and RIs are normalised using the following exposure data:

For RIs, the number of IFR and VFR movements at the airport is calculated with the sum of take-offs and landings performed under both IFR and VFR at that airport. Complete exposure data cannot be obtained from the Network Manager, which includes mainly IFR movements but a small portion of VFR flights. The Network Manager figures need to be complemented by the VFR traffic from the ANSP's tower and airports.

For SMIs, the number of controlled flight hours is measured as hours of flight under IFR that are under the separation control of ANSPs. The Network Manager is best placed to consistently report flight hours of ANSPs across Europe. As some ANSPs provide cross-border services, the measure of flight hours is based on two different measurements depending on the indicator. The indicator in paragraph (b) of Section 1 of Commission Implementing Regulation (EU) No 2019/317 is calculated using flight hours within the Member States' boundaries, while the indicator in paragraph (d) of Section 1 of the same Regulation is calculated using flight hours controlled by a given ANSP.

G. CODING PRACTICE IN ECCAIRS AND DATA COLLECTION PROCESS

All ATM-related safety occurrences are required to be reported to the European Central Repository (ECR) under Regulation (EU) No 376/2014. It is anticipated that the common and specific mandatory data fields applicable to the occurrence will have been completed, in accordance with Annex I to that Regulation. As a minimum, the specific mandatory data fields should include those for aircraft-, air navigation services- and aerodrome-related occurrences.

For the purposes of reporting under the performance scheme Regulation and for the facilitation of the computation of performance monitoring indicators, the following fields need to be coded for each occurrence record to provide the necessary information to allow proper computation of the indicators. The below fields are intended to be used for data extraction from the ECR and computation of the monitoring indicators for monitoring SMIs and RIs.

Within ECCAIRS 5, the following additional fields need to be completed, as appropriate:

Attribute ID	Description	Possible values	Remarks
1049	Applicability SES performance scheme	Yes/No/Unknown	This attribute provides an immediate indication that the occurrence falls within the scope of the performance scheme, and will facilitate data extraction. Failing to code it will require airport information to discriminate whether the occurrence falls within the scope of the performance scheme.
5	Location indicator	A four-letter code group formulated in accordance with the rules prescribed by ICAO	This attribute identifies the airport where the occurrence took place. It is a mandatory data field for RIs. For SMIs, it is also needed as it may serve as filter to detect whether the occurrence falls within the scope of the performance scheme.
1109	ERCS risk grade	Low (green), medium (amber) , high (red)	This attribute provides information about the risk of the occurrence. It is used to identify those occurrences with safety impact at Member State level.
1095	ERCS score	Row/column of the ERCS risk matrix	This attribute provides information about the risk of the occurrence. It is used to identify those occurrences with safety impact at Member State level.
1074	Ground severity	A, B, C, E, D, N	This attribute provides information about the severity of the occurrence. It is used to identify those occurrences with safety impact at ANSP level.
390	Event type	Predefined type of event, i.e. consequential	This attribute provides information on the type of occurrence to compute SMIs and RIs. It is a common mandatory data

		events, equipment, operational, personnel, organisational or unknown	field. For the performance scheme, Level 4 should be provided as follows: For identifying RIs, the following event should be coded: Operational Aircraft flight operations Incursions Runway incursion by a person; Runway incursion by a vehicle/ equipment; or Runway incursion by an aircraft For identifying SMIs, the following event should be coded: Operational Aircraft flight operations Airborne conflict Separation minima infringement

EASA will retrieve the data available in the ECR in order to calculate preliminary figures for the SPIs for monitoring SMIs and RIs. Member States will receive an analysis report sent by EASA based on the data submitted and coded by them, containing the number of applicable occurrences in their territory in the previous year (January–December). Observations related to the data extraction may be included. Member States will review this analysis report, confirm the occurrence numbers presented in the report, and respond to the observations.

AMC4 Safety performance indicator (SPI) on automated safety data recording systems

ANSPs should report to their competent authorities at the beginning of the application period and subsequently on an annual basis, the use of automatic safety data recording systems for the monitoring and recording of SMIs and RIs.

Where automated safety data recording systems have been implemented, ANSPs should also answer the following questions:

(a) What safety data is captured by the automated safety data recording systems?

(b) How is the data captured used in support of the safety risk management framework?

(c) How are just-culture organisation principles applied in gathering and using the safety data recorded?

(d) How is the monitoring of data sources organised and how is it ensured that available data sources are utilised in a coherent way?

(e) How is the data combined to provide the explanatory power to understand the context that led to safety occurrences and anticipate emerging risks?

(f) How is the information from safety data analyses fed forward to risk assessment processes and to designers of future systems?

(g) How is the information disseminated inside and outside the organisation?

(h) Have obstacles of a technical, operational or cultural nature been identified that prevented the realisation of the full potential of a data-driven safety decision-making process? What are the main issues when using automated safety data recording systems?

GM6 Safety performance indicator (SPI) on automated safety data recording systems

A. General

The performance indicator on automated safety data recording systems (where implemented) in point 1.2(e) in Section 2 of Annex I is defined as:

'[...], the use of these systems by the air navigation service providers, as a component of their safety risk management framework, for the purposes of gathering, storing and near-real time analyses of data related to, as a minimum, separation minima infringements and runway incursions.'

Beyond a narrow interpretation of the indicator as supporting a pure binary assessment of the performance, the indicator should be understood as an initiative to foster a proactive approach to safety management, one looking closely at day-to-day performance and including measures other than occurrences to anticipate risk. This is in line with Recommendation 7.1/1 — Data-driven decision-making from the thirteenth ICAO Air Navigation Conference (ANC) to facilitate '[...] data-driven decision-making in support of safety intelligence to support safety risk management'.

This guidance material aims to assist Member States, NSAs and ANSPs in using automated safety data recording systems in the implementation of data-driven safety decision-making processes. The monitoring of this indicator during RP3 will provide key information to the forthcoming development of standardised risk-based decision-making policies and best practices for the design and parameterisation of safety-monitoring tools and models.

B. Digitalisation and moving towards an early-warning capability for ATM

Together with the massive amount of safety-related information that aviation generates today, as well as the increasingly rare accidents and serious incidents from which to learn and mitigate, goes the potential for a fundamental change in the mindset towards a more proactive, meaning-anticipative, collaborative, meaning-sharing, and performance-based approach to safety management. With the impending rise of information technology and overall digitalisation and rising automation of ATM, the pace of data creation can only increase. Obviously, data mining does not replace the technical and operational competencies of the ATM community and while it reduces uncertainty, it does not eliminate it, but it contributes to create safety intelligence. In particular, data helps in identifying and investigating the weak signals that could eventually result in catastrophic events.

Therefore, today, the usage of automated safety data recording systems paves the way towards an early-warning capability for ATM with the aim to:

— detect unsafe trends and implement changes that remove these threats before a serious event or worse happens;

— react within a particular timescale that depends on the rate of trend progression;

— not raise 'false alarms', nor lead to disproportionate focus on low-priority issues, or lead to unanticipated side effects; and

— reach all those needed to ensure an aviation-system-wide reaction if the problem is generic, or localised reaction if it is a localised issue.

C. Functional model

The sequence of steps or functions (building upon automated safety data recording systems) that are needed for an early-warning function for ATM are as follows:

— monitoring of data sources in ATM in a systematic and coherent way, in particular with respect to the specification of surrogates for accidents and incidents and setting of triggers for identifying adverse events and signals;

— filtering, i.e. determining what is a 'signal' and what is 'noise', using statistical and risk-based criteria for deciding when to further analyse a potential trend or key occurrence;

— trend identification to determine the exact nature of the safety issue;

— getting sufficient understanding to estimate the risk priority and to prepare for mitigation measures. This should ensure that disproportionate focus does not occur, and that undesirable side effects are not generated. 'Deconstructing' the data should rely on a technical-/operational-centred approach to ensure the right balance between a current issue and others that are pending;

— developing mitigation measures to deal with the issue and prevent its recurrence and/or propagation;

— disseminating and engaging, i.e. letting the right people know;

— verifying and confirming that the problem has gone away building upon the never-ending stream of data while paying due attention to the potential 'Hawthorne effect', which means the attention paid to an issue may mean it disappears for a time, then resurfaces;

— documenting thereby ensuring that the whole process for an identified issue has been recorded so that if it recurs or a similar problem arises, the safety 'thinking' and analysis is available for future users/analysts. Documentation at this level also allows deeper 'learning' to occur, e.g. across issues. A larger picture may emerge. It would also save time and resources if problems resurface or 'mutate' into related problems; and

— feeding forward the information from analyses to the risk assessment processes and to designers of future systems.

D. Fundamental components

Four fundamental components in the usage of automated safety data recording systems in support of the 'safety risk management', 'safety achievement', 'safety assurance', and 'safety promotion' elements of the SMS are:

1. the involvement of data analysts, data scientists, predictive modellers, statisticians and other analytics professionals to structure and analyse growing volumes of data to uncover information including hidden patterns, unknown correlations, etc.;
2. the interactive visualisation of the structured safety data to support the safety, technical and operational analyses;
3. the involvement of safety, operational and technical expertise to comprehend the data and prioritise the actions needed to ensure safe ATM operation; and
4. the gathering of the safety data and information in a just-culture organisational environment.

AMC5 Safety performance indicator (SPI) for monitoring ATFM over-deliveries

At ATC sector level, the ATFM over-deliveries (OVD) safety performance indicator should be calculated as the ratio of 20-minute slices with over-delivery aircraft in the ATFM regulated sector versus the total number of 20-minunte slices during the ATFM regulated duration. To determine whether an hourly slice is over-delivered, the number of actual flight entries in the regulated sector (NB_FLT_ACTUAL) should be compared with the regulated flight rate for the same time interval (REG_RATE) that is imposed in the ATFM regulation. When the actual entries are above 110 % of the regulated rate, then the slice should be considered over-delivered. The definition should exclude the regulation with a zero rate (e.g. airspace closures) as it makes the comparison meaningless.

The Network Manager (NM) should report to EASA at the beginning of the application period and subsequently, on an annual basis, the OVD SPI aggregated at each ACC and SES areas. The time interval to monitor is each entire year. To aggregate the OVD SPI for the combination of geographical area and yearly interval, the total number of slices with over-delivery are divided by the total number of slices for the regulations within the reporting scope.

GM7 Safety performance indicator (SPI) for monitoring ATFM over-deliveries

A. Definition

The purpose of this guidance is to explain the ATFM OVD SPI, its calculation and how it will be monitored.

The OVD SPI is defined in Annex I, Section 3, point 2.2 as:

'The ATFM over-deliveries above the capacity limits of a sector declared by the air navigation service provider where ATFM regulations are imposed, calculated as follows:

(a) the ratio between the time that the number of flights exceeds by more than 10% the capacity limits of a sector declared by the air navigation service provider where ATFM regulations are imposed, and the total time where ATFM regulations are imposed, calculated for the whole calendar year and for each year of the reference period;

(b) for the purposes of this indicator, the regulated time is divided in overlapping hourly slices at every 20-minutes interval.'

An ATFM regulation is a traffic flow measure that aims to protect a node that may potentially be overloaded by limiting the maximum rate of aircraft entering the node. The ATFM regulation is requested by affected ANSPs whenever expected demand exceeds available capacity of the node and will affect a number of flights that enter the node in a time period. Flights entering a regulated sector during the regulation period are subject to that regulation and may be assigned ATFM slots by the Network Manager. An ATFM regulation is, therefore, characterised by a regulated time duration, by the acceptable rate of flights that enter the regulated sector, and the flights affected, also known as traffic volume (TV).

The traffic volume is created based on either a sector in the airspace, in which case falls within the scope of the indicator definition, or a significant point in the airspace or an airport/group of airports, which falls/fall outside the scope.

In order to determine the total regulated time for an ATFM regulation applied on a traffic volume, the method considers the interval between the regulation start time and regulation end. The regulation end is defined as:

1. either the last regulation end time indicated when a regulation is created and at subsequent extensions, if any, when the regulation is not cancelled;
2. or the time at which the regulation was cancelled, when this happens before the declared regulation end time.

The regulated time is further divided in 'overlapping hourly slices at every 20-minute intervals'.

For example, a regulation starting at 10:40 and ending at 11:40 will have 7 overlapping hourly slices defined as illustrated in Figure 2:

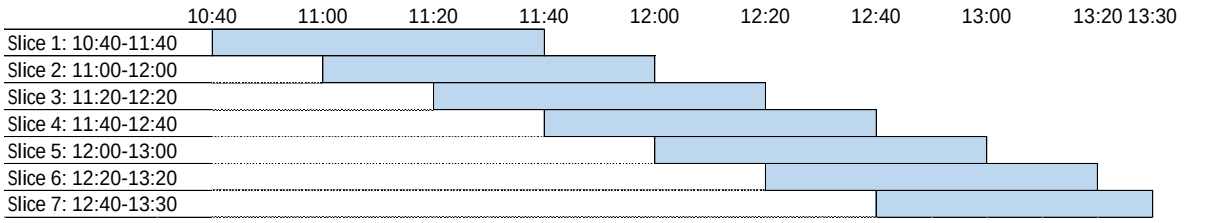


Figure 2: Example of hourly slices of 20-minute intervals of a regulated sector

The last slice is the first hourly slice reaching the regulation end; in the example above it is the 12:40 to 13:30 (this is the only slice that can be less than 1 hour).

B. Example of the OVD calculation indicator

Figure 3 is an example of an ATFM regulation that was imposed over a certain sector with a regulated rate of 35 flights/hour. The ATFM regulation duration applied from 10:40 until 13:30. The orange bars in the graph depict 20-minute slices that were over-delivered, while the green bars depict 20-minute slices where the actual flight entries were below the regulated rate. In this example, the OVD indicator value is OVD = 3/7 = 42.9 %.

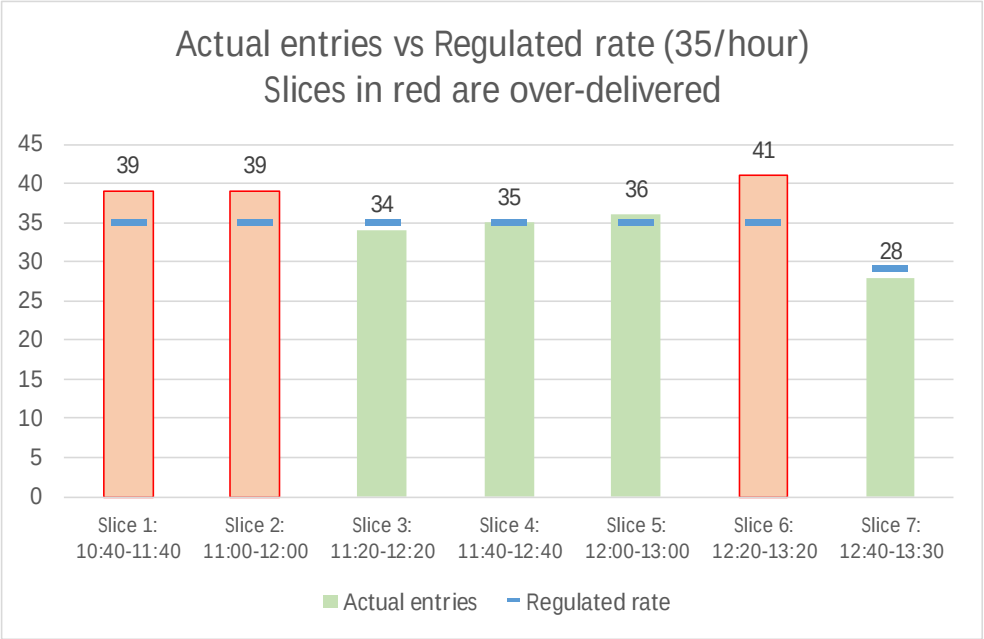


Figure 3: Example of over-deliveries in 20-minute intervals in a regulated sector

The number of actual flight entries in the TV for each 20-minute slice is calculated from the current tactical flight model (CTFM) profile generated by the NM system (whenever a flight fulfils that the CTFM entry time ≥ slice start time and the CTFM entry time < slice end time). To this, a correction will be applied for the airspace un-anticipated flights[4] that, although geographically are crossing the

[4] Airspace un-anticipated traffic are flights that are not planned to enter the TV based on the last filed flight plan but that are actually entering the TV by deviating from flight plan.

regulated sector, from an operational perspective are not under the control of that sector (non-operational un-anticipated traffic). The objective is to avoid 'false positives', i.e. situations when an over-delivery seems to have occurred while in reality there was none[5]. This categorisation will be implemented in the NM reporting system during RP3.

The technical system of the NM generates and archives the data used for OVD monitoring:

1. regulated TVs and associated reference locations;
2. ATFM regulation start, end, and cancellation times;
3. regulated rates;
4. number of actual entries in the regulated TVs for each slice; the categorisation of non-operational un-anticipated traffic will be available during RP3.

C. Level of aggregation of the OVD indicator

The OVD indicator can be determined for any combination of geographical areas (TV, ACC, SES area, NM area) or time intervals (daily, monthly, yearly). To aggregate the OVD indicator for the combination of geographical area and time interval, the total number of slices with over-delivery are divided by the total number of slices for the regulations within the reporting scope.

Appendices

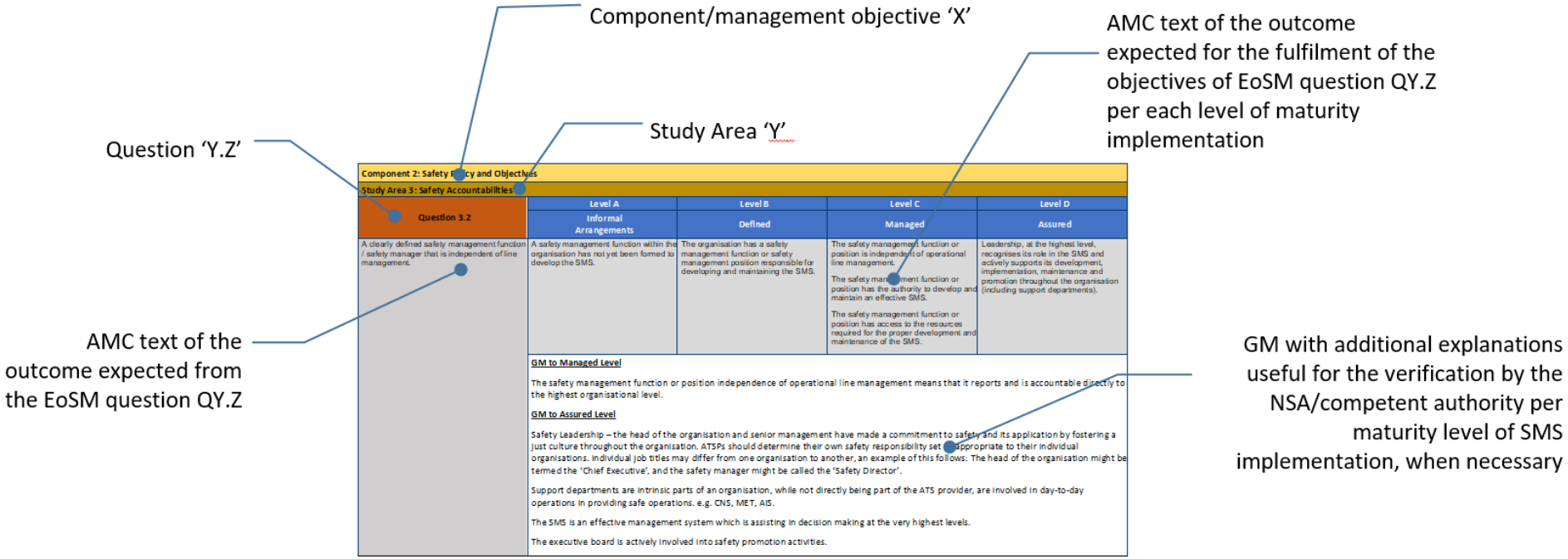
The appendix below will appear as a separate document (sub-NPA 2019-10(C)) to this Annex:

— Appendix to AMC3 SKPI, GM3 SKPI and GM4 SKPI — Questionnaire for the measurement of the effectiveness of safety management (EoSM) of ATS providers and associated guidance for verification by the NSA/competent authority

The Appendix contains the AMC of the outcomes expected in each EoSM question associated to the corresponding study area (SA) and component/management objective, together with the expected outcome of the fulfilment of the objectives of EoSM for each level of maturity implementation for each question. These AMC appear in the tables included in the Appendix coloured in the grey cells of those tables.

In addition, each question included in the tables contains guidance material with additional explanations, when necessary, useful for the verification by the NSA/competent authority. These GM appear in the tables included in the Appendix coloured in the white cells of those tables.

The following picture depicts the elements contained in each table:



Component 2: Safety Policy and Objectives				
Study Area 3: Safety Accountabilities				
Question 3.2	Level A Informal Arrangements	Level B Defined	Level C Managed	Level D Assured
A clearly defined safety management function / safety manager that is independent of line management.	A safety management function within the organisation has not yet been formed to develop the SMS.	The organisation has a safety management function or safety management position responsible for developing and maintaining the SMS.	The safety management function or position is independent of operational line management. The safety management function or position has the authority to develop and maintain an effective SMS. The safety management function or position has access to the resources required for the proper development and maintenance of the SMS.	Leadership, at the highest level, recognises its role in the SMS and actively supports its development, implementation, maintenance and promotion throughout the organisation (including support departments).

GM to Managed Level

The safety management function or position independence of operational line management means that it reports and is accountable directly to the highest organisational level.

GM to Assured Level

Safety Leadership – the head of the organisation and senior management have made a commitment to safety and its application by fostering a just culture throughout the organisation. ATSPs should determine their own safety responsibility set appropriate to their individual organisations. Individual job titles may differ from one organisation to another, an example of this follows: The head of the organisation might be termed the 'Chief Executive', and the safety manager might be called the 'Safety Director'.

Support departments are intrinsic parts of an organisation, while not directly being part of the ATS provider, are involved in day-to-day operations in providing safe operations. e.g. CNS, MET, AIS.

The SMS is an effective management system which is assisting in decision making at the very highest levels.

The executive board is actively involved into safety promotion activities.

Appendix to AMC3 SKPI, GM3 SKPI and GM4 SKPI — Questionnaire for the measurement of the effectiveness of safety management (EoSM) of ATS providers and associated guidance for verification by NSA/competent authority

Note: Please refer to Supporting Material Part (C)