Australian Government
Australian Transport Safety Bureau

Aerodrome design standards and the Bulla Road Precinct development at Essendon Fields Airport

Essendon Fields Airport, Victoria

ATSB Transport Safety Report
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Addendum

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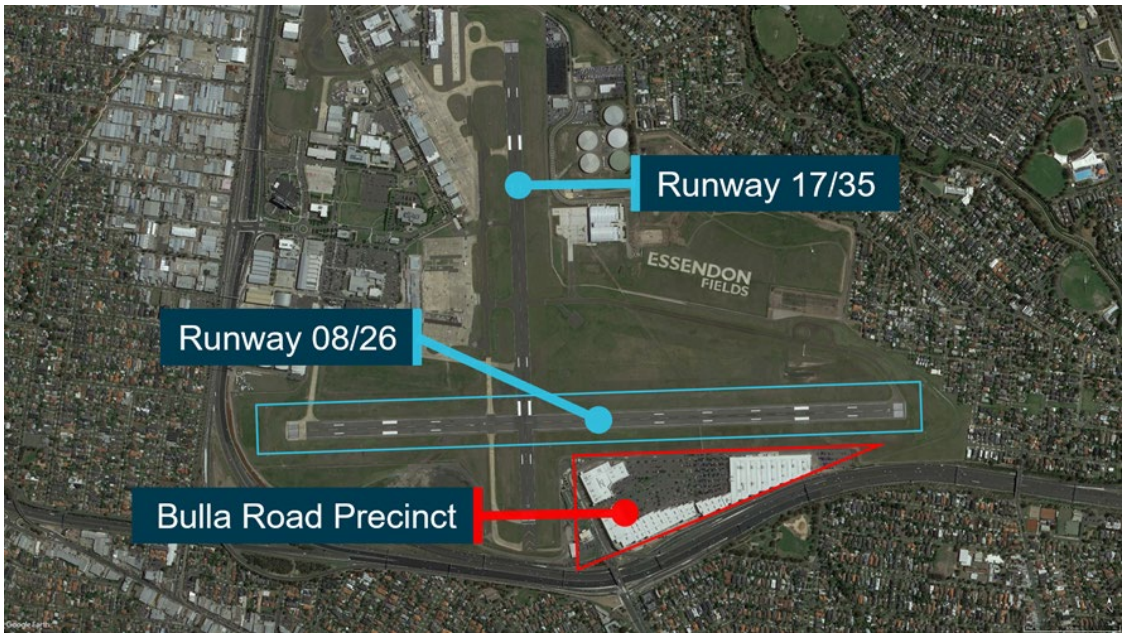
Executive summary

Introduction

Essendon Airport was a Commonwealth Government owned and operated airport when it was established in the 1920s. In 2001, it was leased to a private operator, Essendon Airport Pty Ltd (EAPL) and later became Essendon Fields Airport. Over its history, there have been changes to the aerodrome standards that specified the design of surfaces around runways that managed the location and height of buildings. There were changes applied to the dimensions of those surfaces at the airport. In addition, land was developed around the runways, with the primary development being the Bulla Road Precinct (Direct Factory Outlet centre) in 2005 outlined in red in Figure ES1 below.

Figure ES1: Essendon Fields Airport, March 2021



Source: Google Earth, annotated by the ATSB

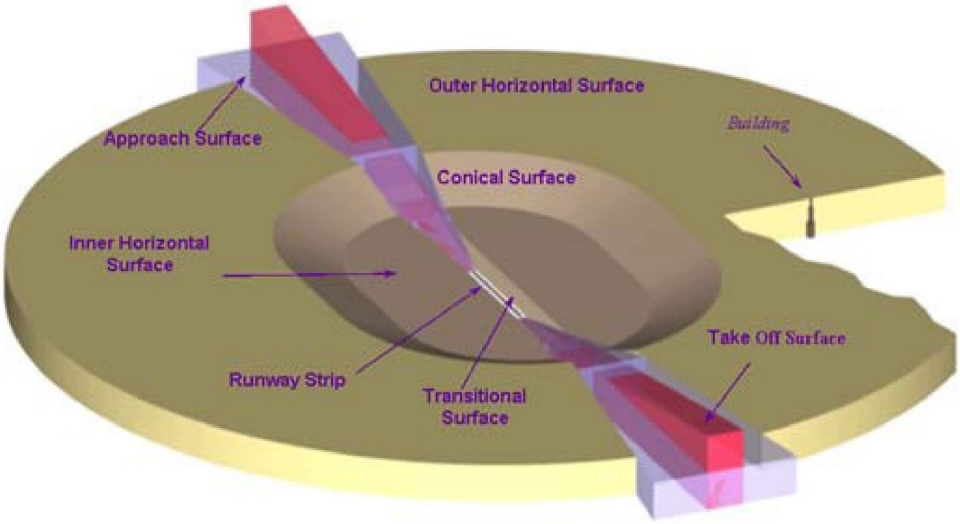
The surfaces required by the aerodrome standards the investigation was concerned with were the runway strip and the obstacle limitation surfaces (OLS). The International Civil Aviation Organization (ICAO) published international standards and recommended practices for the establishment of these surfaces. Australian aerodrome standards, administered by the Civil Aviation Safety Authority (CASA), are derived from these international standards.

The runway strip was an area of land around the paved runway, which generally prohibited fixed structures (the blue outline for runway 08/26 in Figure ES1). The width of the runway strip, which was a focus in this investigation, provided protection to reduce the risk of damage to aircraft veering off the runway or flying over it during take-off and landing. There was a graded portion that provided the primary protection for veer-off. Runways allowing for an instrument approach[1] provided for an extended 'fly-over' area either side of the graded portion.

[1] An instrument approach operation describes the operation of an aircraft with reference to navigation guidance information. The operation must be in accordance with an authorised instrument approach procedure. An instrument approach procedure was a series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix or, where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed thereafter, if a landing is not completed, to a position at which holding or en route obstacle clearance criteria apply (Civil Aviation Safety Authority, 2019).

The OLS were imaginary surfaces associated with the runway, which identified the lower limits of the aerodrome airspace above which objects become obstacles (Figure ES2). An obstacle (or proposed obstacle) was referred to CASA for a risk assessment to determine whether to prohibit or allow the obstacle, but with risk mitigators such as lighting and notification to pilots.

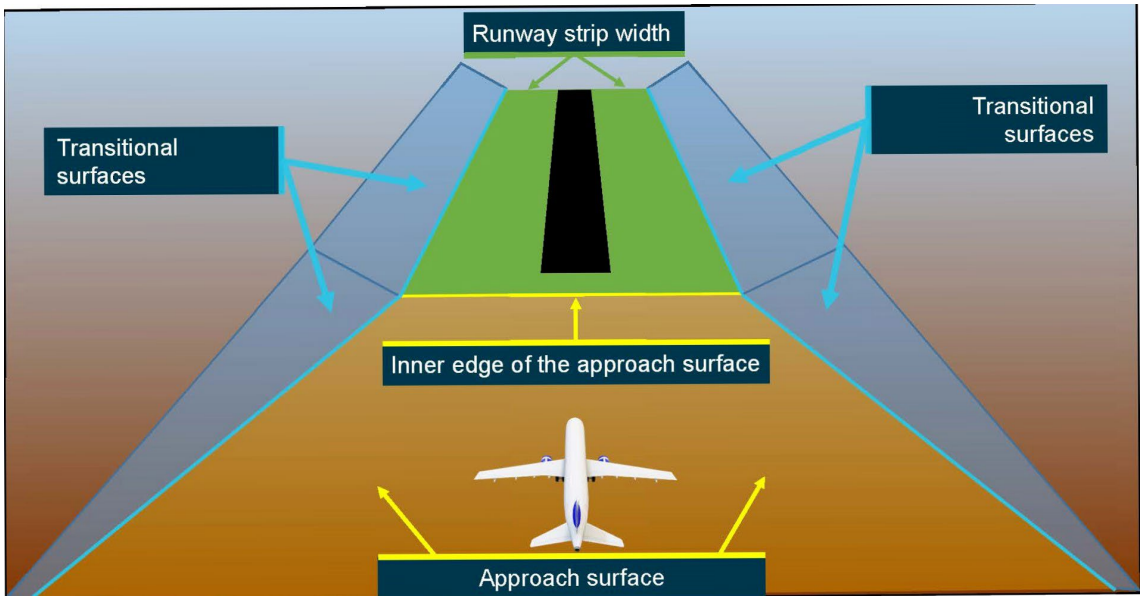
Figure ES2: Typical obstacle limitation surfaces configuration



Source: Civil Aviation Safety Authority (2019a)

The OLS discussed in this report are the approach and transitional surfaces relevant to runways used for the approach to land (Figure ES3). Together they provided protection from obstacles to aircraft experiencing a lateral deviation during a visual approach or the visual segment of an instrument approach. This included protection during a missed approach or go-around**.**

Figure ES3: The primary surfaces considered in this investigation



Source: ATSB

Changes in the 1970s

Runway 08/26 at the airport was used by aircraft conducting precision approaches[2] with an instrument landing system (ILS)[3] from the runway 26 end. Between 1970 and 1971, international and domestic air services were transferred from Essendon Airport to the new Tullamarine Airport (known today as Melbourne Airport). With reference to the aerodrome standards applicable at the time, which had different requirements for precision approach runways without international operations, the width of the runway 08/26 strip (outlined in blue in ES1) was narrowed from 300 m to 180 m. The OLS were also brought closer in towards the runway. The effect of this was that buildings could be placed higher and closer to the runway without a requirement for an assessment of risk.

2000s and development of the Bulla Road Precinct

In 2001, prior to the airport being leased, the part of the OLS for runway 26, called the approach surface, was widened so that the inner edge associated with the end of the runway strip increased from 180 m to 300 m. This was consistent with the aerodrome standards in effect at the time and administered by CASA, which no longer distinguished design requirements based on whether there were international operations using the runway. For a precision approach runway, the design requirements were based on the code of aircraft for which the aerodrome operator had declared the facilities available. Runway 26 at Essendon Fields Airport was declared as a code 4 precision approach runway.[4] It should be noted, however, that due to an operational weight limitation under aircraft noise regulations, the runway was unlikely to have been used by the larger code 4 aircraft.

The dimensions of the runway strip and the other parts of the OLS were also determined by the code categorisation of the runway. The aerodrome standards required a 300 m wide runway strip for a code 4 precision approach runway. However, the aerodrome operator continued to publish a 180 m strip width. There was no documentation from 2001 available to the investigation from EAPL or CASA explaining the basis for the decision to do this from that time.

When EAPL took over the lease of the airport they sought approval for a master plan for the airport and then a major development plan to develop the Bulla Road Precinct. The plans were required by the *Airports Act 1996* which applied to federally leased airports and was administered by the then Department of Transport and Regional Services (the Department).[5] It was during that process that questions arose about the requirements in the standards for part of the OLS called the transitional surface. The transitional surface splayed upwards and outwards from the side of the runway strip and the side of the approach surface. In relation to runway 26, if it was based off the 300 m inner edge of the approach surface and the requirements for a standard runway strip width (300 m), the buildings for the proposed development would have infringed the transitional surface and required an assessment for risk. If it was based off the 180 m strip width, the building would not infringe the surface. The diagram below (Figure ES4) illustrates the position of part of the transitional surface for a 180 m strip width (left) and a 300 m strip width (right).

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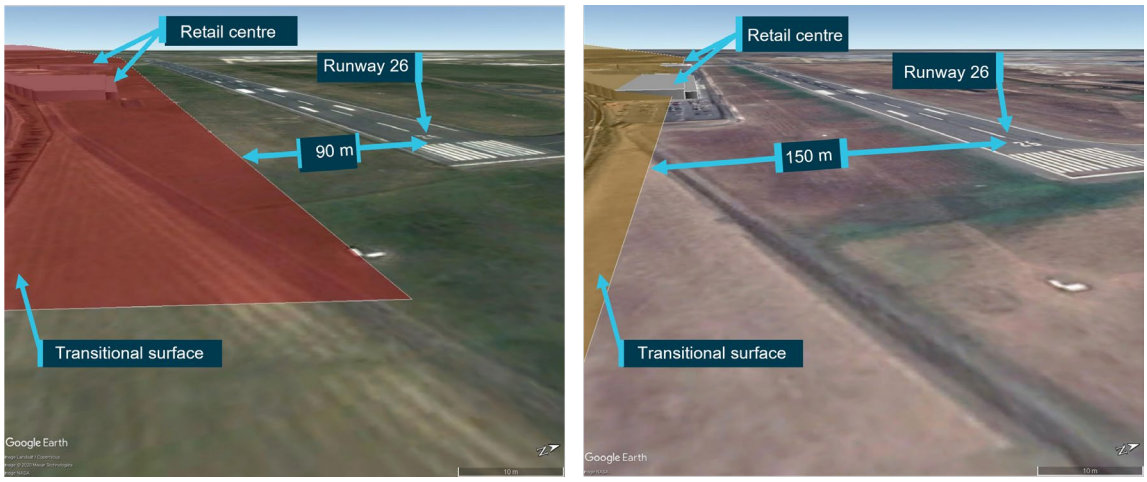
2 At the time, an instrument approach procedure based on navigation systems designed for 3-dimensional instrument approach operations, using both lateral and vertical navigation guidance (International Civil Aviation Organization, 2018b). Changes to terminology are discussed in the body of the report.

3 A precision instrument approach system, which normally consists of the following electronic components: very high frequency localiser and marker beacons, and an ultra-high frequency glideslope.

4 Code numbers ranged from 1 to 4 based on the take-off runway length requirements of the aircraft at maximum take-off weight. Code 4 aircraft ranged from smaller aircraft such as McDonnell Douglas DC9-30 to the more common Airbus A320-200 and Boeing B737. At the higher end of the category was an Airbus A380.

5 Now the Department of Infrastructure, Transport, Regional Development, Communications and the Arts.

Figure ES4: Transitional surface for a 180 m runway strip width (left) and a 300 m strip width (right)



Source: Google Earth, modified by the ATSB

In 2003, a CASA officer provided EAPL with a letter stating that the transitional surface could be based off the 180 m published runway strip. EAPL prepared the major development plan for the Bulla Road Precinct on this basis. Normally CASA would comment on a draft of the plan after it had been submitted to the Department but did not do so in this instance. The Bulla Road Precinct was subsequently developed in 2005 with EAPL advising that it did not infringe the transitional surface. On this basis, EAPL did not seek approval for it from the Secretary of the Department under Part 12 of the Airports Act and regulations which, for federally leased airports, required assessments for intrusions into prescribed airspace. Prescribed airspace included airspace above the OLS. The Part 12 approval process was separate from the major development plan process.

Civil Aviation Safety Authority audits in 2012 and 2014

In 2012, and then again in 2014, CASA made audit findings that the 180 m runway 08/26 strip width was not compliant with the aerodrome standards applicable at that time, which required a 300 m strip width. The basis of the findings was that there was no record on how the 180 m runway strip had originated, nor were there records as to the previous standard under which that measurement was authorised and could be maintained. (In submissions in response to drafts of this report CASA advised that these should have been issued as administrative non-compliances). In response to the findings, EAPL submitted safety cases to CASA with assessments of risk for the Bulla Road Precinct development and maintaining the 180 m runway strip width and associated transitional surface. CASA determined there were inadequacies with the risk assessments.

Changes in 2015

However, while there were inadequacies with the risk assessments, CASA considered there was enough information to promulgate CASA instrument 153/15. This instrument required EAPL to publish the strip width as 300 m, consistent with the strip width requirements in the aerodrome standards in 2015. The instrument approved obstacles, including the Bulla Road Precinct development, on the published 300 m runway strip. The instrument also required risk mitigators for the obstacles being marking and lighting of the buildings and notification of their presence in the Aeronautical Information Publication (En Route Supplement Australia).

2019 grandfathering to 1970s standards

In March 2019, EAPL notified all aircraft operators and tenants of the airport of the intent to return the publication of the runway 08/26 runway strip width to 180 m. This was to be achieved by ‘grandfathering’ the strip width dimension against the requirements of the standards that existed in the early 1970s. Grandfathering permitted a deviation from the current standards provided

compliance was maintained against the previous standards being grandfathered to, with documentation in the aerodrome operator's operating manual. An assessment of risk was not required.[6]

CASA accepted that the conditions for grandfathering of the runway strip width had been met. In May 2019, CASA repealed instrument 153/15. The November 2019 edition of the En Route Supplement Australia stated the runway 08/26 strip width was 180 m, and reference to the previously reported obstacles was removed. EAPL had also indicated that they grandfathered the transitional surface, returning it to the position on the left of Figure ES4. The buildings no longer intruded through that part of the OLS.

While EAPL stated they had grandfathered the runway strip and the transitional surface, they did not grandfather the runway 26 approach surface inner edge. That dimension remained 300 m consistent with compliance with the current aerodrome standards.

Assessment of risk

Prior to completing the actions associated with grandfathering, EAPL prepared a safety assessment in the form of a safety case. EAPL produced the safety case in accordance with its own safety management system stating its basis was that changes to aerodrome standards over time required a 300 m strip width while runway 08/26 had been operating for decades with a 180 m runway strip width. The basis for the safety case was a 'non-compliance with a changed regulatory standard'.

CASA was not informed that the safety case had been produced and CASA did not enquire about one, noting the grandfathering provisions did not require a risk assessment. However, the safety case did state that it was available for scrutiny by CASA if required.

The safety case assessed risks to aircraft operations managed by the runway strip width and the transitional surface. This included the risk of aircraft veering off the runway during take-off or landing, and the risk of a collision in an instrument missed approach.

The safety case took into account the weight limitation that restricted the type of aircraft operating at Essendon Fields Airport, and reviewed accident and incident data for those aircraft. The safety case also referred to the landing minima[7] ensuring aircraft were clear of obstacles for an instrument missed approach. However, lateral deviation data on approach below the landing minima was not included in the safety case. An aerodrome consultant engaged by the ATSB indicated that this data would be relevant but challenging for an aerodrome operator to obtain and assess. The weight limitation and landing minima were factors that CASA also referenced in statements made about the runway being safe for the operations at Essendon Fields Airport. Based on the safety case, EAPL concluded that reverting to a 180 m wide runway strip for runway 08/26 provided an acceptable risk rating that was tolerable in accordance with its safety management system.

During the period of this investigation, ICAO had established a taskforce to review the OLS. The taskforce reviewed approach trajectory data below 500 ft on instrument runways in the United States. The data, encompassing lateral deviations at the threshold and during a missed approach, suggested that 'obstacle free surfaces' could be established with the dimensions of the inner edge of the approach surface reduced and the transitional surfaces brought in closer to the runway. Potentially, the inner edge of the approach surface could be 155 m for an aircraft like the Fokker

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[6] Copies of parts of the earlier standards from the 1970s had been obtained by EAPL in the process of the ATSB conducting this investigation.

[7] The height at which the pilot flying instrument approach procedures must have adequate visual reference to continue the descent to landing.

F100 for which runway 26 was available.[8] At the time this report was published ICAO had written to contracting States to propose changes to the international standards with adoption to be in 2028.

There was also a responsibility on pilots and aircraft operators to make decisions about the safety of a runway. Both EAPL and CASA were of the view that all the information required for pilots to decide on the suitability of runway 08/26 was readily available, with information on the 180 m runway strip width and aerodrome reference code (code 4) published in the En Route Supplement Australia. However, CASA also published an advisory circular stating that notification of the design criteria for facilities was relevant to pilot and aircraft operators making decisions. There was no information about the design criteria for the 180 m runway strip width from the Aerodrome Engineering Instructions (the standard the runway was grandfathered against) and neither was there any requirement to publish these details.

What the ATSB found

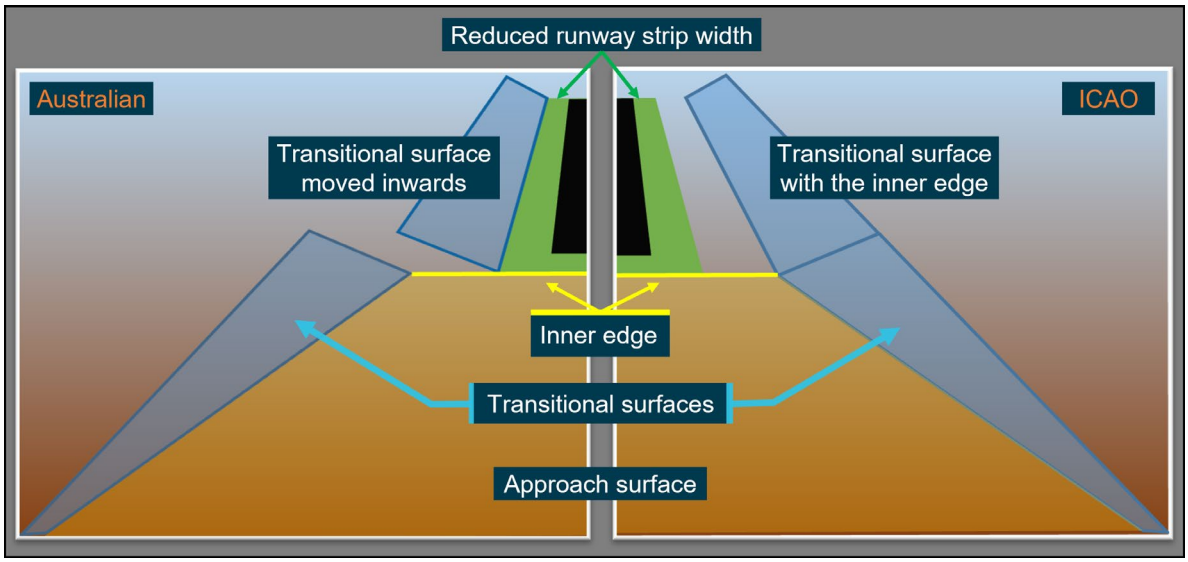
Transitional surface under Australian and international standards

The ATSB found that there could be differences in the wording and interpretation of the international standards and the Australian aerodrome standards. This included the alignment of the inner edge of the approach surface with the runway strip width and the structure of the transitional surface. CASA advised the ATSB that they should be aligned. However, CASA also stated there was no specific requirement for this in the Australian standards. If the dimension of the runway strip width was less than the inner edge of the approach surface, the part of the transitional surface alongside the strip would become misaligned with the part alongside the approach surface, as shown in Figure ES5 (left).

In contrast, the ICAO Secretariat provided the ATSB with an interpretation of the international standards advising that, irrespective of the reasons to reduce the runway strip width, a reduction should not dictate or change the provisions related to the OLS. The Secretariat's interpretation of the ICAO standards was that the lower edge of the transitional surface was governed by the dimension of the inner edge of the approach surface, which had the same width as that of a standard runway strip. However, it was observed by the ATSB that this would create an unexplained space between the side of the published runway strip with its reduced dimensions and the lower edge of the transitional surface (Figure ES5 right).

[8] Other 'obstacle evaluation surfaces' were proposed for instrument approach runways that would have an approach surface with a 300 m inner edge and a transitional surface based from this dimension. Penetrations of these surfaces would trigger an assessment to consider such things as whether the landing minima needed to be raised to maintain clearance from obstacles for the instrument approach.

Figure ES5: Transitional surface with a runway strip width less than the current standard



Source: ATSB

Neither ICAO or CASA published guidance in support of their stated expectations for interpretating the standards as described above. However, ICAO noted that there was an opportunity to consider guidance with work that was occurring by the taskforce on reviewing the standards for the OLS.

2005 publication of the 180 m strip width

CASA advised the ATSB in the course of this investigation in 2019 that the runway 08/26 strip width should have been subject to administrative grandfathering, documenting the basis for the 180 m strip width to the aerodrome standards from the 1970s when newer standards came into effect in 1987. The ATSB found that, since 1972, successive aerodrome operators had published a 180 m strip width for runway 08/26. However, in 2005, when the Bulla Road Precinct was developed, it was unlikely that the aerodrome standards against which the strip width was based had been adequately determined to assure compliance against those standards.

By comparison, the OLS for runway 26 were likely being maintained in accordance with the standards applicable in 2005. Consistent with those standards, the approach surface had a 300 m inner edge as required for a code 4 precision approach runway. The transitional surfaces were being maintained in accordance with the interpretation of the standards given by the CASA officer in 2003 that allowed for the misalignment of the surface as described above.

Application of the Airports Act

Aerodrome operators applied the Australian aerodrome standards to establish the OLS. However, the Airports Act and Australian Airports (Protection of Airspace) Regulations referenced international standards published by ICAO for establishing the OLS for determining prescribed airspace. Noting the advice of ICAO Secretariat, the ATSB found that these standards may be applied differently with respect to the structure of the transitional surface. It was understood though that the provisions of the Airports Act and Regulations for building control around federally leased airports operated in addition to, and not instead of the safety standards administered by CASA.

With respect to the absence of CASA's comment on the major development plan for the Bulla Road Precinct, the ATSB found that, in 2004, the Department of Transport and Regional Services did not have an agreed assurance framework with CASA for assessing the safety information in draft major development plans. This increased the risk of plans being approved with incorrect dimensions for runway facilities and obstacle limitation surfaces.

However, the ATSB found that the absence of any comment from CASA was unlikely to have affected the outcome of the planning process. Further, the finding about assurance processes was from a point in time in 2004. The finding did not reflect assurance processes that the Department and CASA state have been in place since and that were confirmed in correspondence in 2019.

2019 grandfathering

CASA maintained that the runway 08/26 strip width was appropriately 'grandfathered' when a version of the Australian aerodrome standards, the Manual of Standards Part 139 - Aerodromes, came into effect in 2003. CASA's view was that the strip width had been in compliance with the older standards from the 1970s when Essendon became a domestic airport and that it had remained in compliance.

Similarly, EAPL maintained that the runway width had not been changed since the 1970s (during Government ownership and since privatisation in 2001) and was still 180 m, and the original standards applied. EAPL further stated steps taken in April 2019, amending the aerodrome manual and seeking revocation of the instrument 153/15, was done with the approval of CASA. EAPL advised that CASA accepted the grandfathering in 2019 and has continued to accept the grandfathering in subsequent aerodrome certification approval and audit processes.

However, the ATSB established that, in 2019, there was uncertainty with how the grandfathering provisions of the Manual of Standards Part 139 could be applied to a runway strip width that had been published as compliant with the current standards when instrument 153/15 was enacted. Further, there was ambiguity in the older standards being applied with respect to non-scheduled international operations conducting precision approaches. It was unclear how CASA had addressed these matters when they accepted the grandfathering and the publication of the 180 m strip width.

The ATSB also noted that the transitional surface had not been grandfathered to the 1970s standards. As the approach surface retained its 300 m inner edge, the transitional surface was being maintained in accordance with the interpretation of the current standards that allowed for the misalignment of the surface.

The Manual of Standards Part 139 did not require submission of a safety case to CASA for them to consider when accepting the grandfathering. However, although CASA did not expect it, a safety case was prepared by EAPL in accordance with its safety management system. The ATSB found that greater safety assurance could have been provided for the changes in 2019 for runway 08/26 by CASA's consideration of the safety case.

It was understood that a regulator would not, as a matter of course, review an aerodrome operator's safety assessment done in accordance with its safety management system. However, this finding was made in the context of the acceptance of grandfathering in this case not being a normal application of the grandfathering standards. EAPL had produced 2 safety cases previously, which had been reviewed by CASA with some criticism. Further, the application of the grandfathering provisions in these circumstances resulted in changes related to the strip width and OLS, which did not normally occur with the acceptance of grandfathering.

Assessment of risk

CASA's position was that a risk assessment was not required for the 180 m runway 08/26 strip width and associated change to the transitional surface based on the risk being accepted with the application of the grandfathering provisions in 2019. The ATSB found that the policy permitting grandfathering, conservative aerodrome design principles, the graded portion of the runway strip, aircraft weight limitations, and the raised landing minima were mitigating factors for maintaining the runway 08/26 strip width less than that required by the aerodrome standards in 2019 and location of the associated transitional surfaces. However, while not preventing the acceptance of risk, the risk assessments previously undertaken by EAPL and statements made about safety by CASA regarding these changes did not consider all the relevant risk information.

This finding was made with reference to the consideration of accident and incident data being restricted to a limited number of aircraft types for which runway 26 was used. The ICAO taskforce review of lateral deviation data informed this investigation but would not have been available at the time grandfathering took place in 2019. The investigation commented further on matters concerning building-induced windshear and turbulence, identifying objects for the purpose of determining the landing minima, and publication of information to pilots. While commenting on these matters and making a finding that not all relevant risk information had been considered, there was no finding that EAPL had been non-compliant with the applicable standards.

However, the ATSB did find there was limited guidance from ICAO and CASA on risk considerations for the OLS around the runway strip protecting aircraft during the approach to land. There was an opportunity to provide greater clarity on the application of the surfaces through the work of the ICAO OLS taskforce and the proposed revisions to the aerodrome standards.

What has been done as a result

As a result of this investigation, in February 2020, the then Department of Infrastructure, Transport, Regional Development and Communications advised the ATSB that they had exchanged letters with CASA to confirm ongoing arrangements for CASA's review of airport planning documentation. The Department did not believe there was uncertainty around the designation of prescribed airspace with respect to references to international standards in the Airports (Protection of Airspace) Regulations. However, the Department did note that the regulations were due to sunset on 1 April 2025 and were being reviewed. The Department indicated that they would consider whether there was any need to clarify the regulations.

Unrelated to this investigation, an ICAO taskforce had been reviewing the international standards and recommended practices for establishing the OLS. At the time of publication of this report, ICAO had written to contracting States to propose changes with adoption for 2028. The ICAO Secretariat advised that, ICAO does not see an obvious gap or safety issue related to the existing provisions for the transitional surface and runway strip. However, ICAO is in the process of conducting a holistic review of OLS provisions. Review of guidance material to facilitate OLS implementation is also being carried out. This ongoing work could assist States in avoiding any possible misinterpretation of the aerodrome standards and facilitate effective implementation.

During the course of the investigation, action was taken to 'grandfather' the runway 08/26 strip width to the standards EAPL and CASA advised was the basis for the 180 m strip width. Both EAPL and CASA have maintained that there was an acceptable level of safety and that information was appropriately published for pilots and aircraft operators to make their own decisions about the use of the runway. The ATSB has discussed these views in the report without undertaking a separate assessment of risk, which was outside the scope of this investigation and not the responsibility of the ATSB.

Safety message

The control of obstacles (such as buildings) in the vicinity of aerodromes is a matter of interest for many stakeholders. They include pilots and aircraft operators, aerodrome operators, local councils and communities, the aviation regulator and air traffic service provider and other Commonwealth and State government agencies. Obstacle restriction areas and the OLS are intended to be used to ensure the safety of aircraft when those aircraft are manoeuvring on the ground, taking off, landing or flying in the vicinity of the aerodrome. This investigation highlights the complex nature of airport planning and aerodrome safeguarding with the many factors that need to be considered to ensure an acceptable level of safety.

Aerodrome planning and aerodrome safeguarding can be further complicated when applying aerodrome standards with changing design criteria over a long historical period, as was the case at Essendon Fields Airport. It is even more challenging when there are incomplete records, limited guidance on how design criteria relates to risk, and changing interpretations of standards. These

factors affect the confidence stakeholders have in the assurance being provided that the standards and the manner in which they are being applied provide an acceptable level of safety. It is important that relevant information and expertise is available to support the decision-making process.

The investigation further emphasised the need for robust assurance frameworks to be in place between government agencies that have complementary regulatory responsibilities for aerodrome safety under different legislation. Without such assurance frameworks there is an increased risk of decisions being made using incorrect information with potential adverse effects on safety.

Contents

1. Background and scope

Background

In February 2017, a Beechcraft B200 King Air aircraft impacted a building in the Bulla Road Precinct after taking off from Essendon Fields Airport, Victoria on runway 17. This was the subject of ATSB investigation (AO-2017-024). The location of the buildings was not contributory to the accident and it was unlikely that they had an influence on the severity of the accident. However, it was during the course of the investigation that the ATSB noted that buildings in the Bulla Road Precinct breached obstacle limitation surfaces (OLS) for runway 08/26 (as declared between 2015 and 2019).

Scope

The ATSB commenced this investigation into the building approval process for the Bulla Road Precinct. It was during the course of this investigation that the ATSB obtained evidence of historical uncertainty with respect to compliance against the aerodrome standards for the dimensions of the runway strip surfaces for runway 08/26 and 17/35. The dimensions of the runway strip could affect the location of the OLS and the need to subject developments to an assessment. The Bulla Road Precinct development was affected by the location of the OLS for runway 08/26. While there was also historical uncertainty with respect to compliances for runway 17/35, an analysis of the aerodrome operator's compliance with aerodrome standards for that runway was out of scope for this investigation.

Drafts of this report were released to directly involved parties in 2018, 2019 and 2022 for review. Around the time the 2019 draft was released, the ATSB became aware that the aerodrome operator had sought to 'grandfather' the runway strip and part of the OLS for runway 08/26 to the requirements of historical aerodrome standards from the 1970s. As there had been uncertainty around the standards the aerodrome operator was obliged to comply with, the ATSB broadened this investigation to include the grandfathering.

At the same time, based on the varying views of the directly involved parties on the subject matter presented in previous versions of the draft report, the ATSB recognised the need to obtain additional evidential material and undertake further analysis. The investigation has involved historically complex material with the application of Australian and international aerodrome design standards dating back to before the 1970s. The International Civil Aviation Organization, which develops the international standards from which the Australian standards are derived, has established a taskforce to review and propose revisions to the OLS. The taskforce has said that the purpose of some of the surfaces is unclear and that they no longer reflect the performance characteristics of modern aircraft. It has taken the investigation time to overcome the challenges of limited information available from historical periods to support the analysis.

After the release of the 2019 draft report, which focussed on the building approval process for the Bulla Road Precinct, stakeholders sought an explanation from the ATSB of the consequences of any compliance matters with the current standards. Other than in the case of effective grandfathering, it is the aerodrome operator that is responsible for assessing risk when there is a departure from the design requirements in the aerodrome standards. This will be done in the context of advice and guidance received from the aviation regulator. Undertaking the risk assessment was not the responsibility of the ATSB and was outside the scope of this investigation. This investigation reviewed statements and assessments of risk made by the regulator and aerodrome operator about the safe operation of runway 26 to determine whether they had adequately encompassed all the relevant risk information for the runway strip and OLS.

Report outline

The nature of airport[9] planning and airspace protection around airports is a complex topic. The complexity is heightened by the long history of events and changes to aerodrome standards relevant to this investigation at Essendon Fields Airport. To achieve the above scope and account for this complexity, the report has been structured into chapters based on key topics as follows. Chapters include the factual evidence and information required to understand the safety analysis; the safety analysis, which provides the arguments that lead to the findings identified during the investigation; and the relevant findings for that chapter.

- Chapter 1 provides the background and scope.
- Chapter 2 provides a timeline of the key events that had occurred since the establishment of Essendon Fields Airport, which will be discussed in further detail throughout the report.
- Chapter 3 details the history of Essendon Fields Airport since it was established in 1919, the nature of operations, runway facilities, aircraft weight restrictions, and basic information regarding the Bulla Road Precinct.
- Chapter 4 explains the legislative framework and key concepts frequently referenced throughout the report. This includes a description of the applicable legislation and standards, aerodrome design, runway strip composition and width, and the airspace surfaces protecting aircraft operations around airports.
- Chapter 5 summarises the changes to the published dimensions of the runway 08/26 strip width and associated OLS at Essendon Fields Airport since 1960 as well as changes to the landing minima.
- Chapter 6 explores the historical uncertainty around the applicable standards and dimensions of the runway 08/26 strip width and location of the OLS transitional surface. This context is the lead up to the approvals of the Essendon Fields Airport master plan and major development plan for the Bulla Road Precinct outside the runway 08/26 runway strip width published as 180 m.
- Chapter 7 addresses the uncertainty in the Airports (Protection of Airspace) Regulations 1996 for determining ‘prescribed airspace’ and examines the legislative assurance framework applicable for the approval and construction of buildings around airports under the *Airports Act 1996* and regulations.
- Chapter 8 details the process leading up to the enactment of a legislative instrument for runway 08/26 relating to the approval of the Bulla Road Precinct buildings on a runway strip that the Civil Aviation Safety Authority required to be published with a 300 m width. This chapter also examines Essendon Airport Pty Ltd’s use of grandfathering provisions (with Civil Aviation Safety Authority’s acceptance) to return to a published 180 m runway strip width and locate part of the transitional surface against that width.
- Chapter 9 reviews the risks associated with the protections provided by the runway strip and transitional surfaces. The focus of the review is the extent to which relevant information was taken into account for informing the risk assessments and statements about risk.

[9] The terms ‘airport’ and ‘aerodrome’ are used interchangeably throughout the report.

2. Timeline of key events

Table 1 provides a summary of the key events that occurred from the establishment of Essendon Fields Airport until 2019. These events provide context for the discussions in the following chapters.

Table 1: Timeline of key events

Date	Event
1921	Essendon Airport was established as a Commonwealth owned and operated airport.
1950s	Essendon Airport (later known as Essendon Fields Airport) was officially designated as an international airport.
1970-1971	Domestic regular public transport and international flights transferred from Essendon to Tullamarine (Melbourne Airport). The runway 08/26 strip width was reduced from 300 m to 180 m.
2001	The inner edge of the runway 26 approach surface (part of the obstacle limitation surfaces) was changed from 180 m to 300 m.
2001 – 2002	The Commonwealth owned company holding the airport lease was acquired by Edgelear Pty Ltd. In 2002, the company holding the lease became Essendon Airport Pty Ltd (EAPL).
2003	The EAPL airport master plan was approved, which included a proposal for a retail centre at the Bulla Road Precinct, alongside runway 08/26.
	The Civil Aviation Safety Authority (CASA) provided advice to EAPL indicating that the part of the transitional surface (another part of the obstacle limitation surface) alongside the runway 08/26 strip was based on the published 180 m strip width (while the inner edge of the approach surface had to be 300 m for runway 26). This information was used by EAPL in their major development plan for the Bulla Road Precinct.
2004	The major development plan was approved by the Minister for Transport and Regional Services. The Bulla Road Precinct was located proximate to runway 08/26 to avoid infringing a transitional surface and strip width based on 180 m.
2005	Construction of the retail centre commenced. A significant part of the development was completed and opened to the public in October 2005.
2012	A routine CASA surveillance audit identified that the dimensions of the runway 08/26 strip width and associated transitional surface had not demonstrated compliance with the aerodrome standards for the runway strip width.
2013	EAPL submitted a safety case to CASA seeking an exemption to the aerodrome standards, which was later withdrawn by EAPL.
2014	Another CASA audit resulted in a non-compliance notice being issued to EAPL against the unresolved issue with the runway strip width and transitional surface. CASA indicated that either, the runway had to be compliant with the aerodrome standard; or EAPL were to apply for an exemption; or downgrade the classification of the runway; or 'grandfather' the runway against historical aerodrome standards.
	EAPL submitted another safety case to CASA.
2015	CASA issued instrument 153/15 to EAPL. This required runway 08/26 to have a published strip width of 300 m, and any obstacles that penetrated the obstacle limitation surfaces to be illuminated and notified in the En Route Supplement Australia for pilot/aircraft operator awareness. With the 300 m strip width, the northern portions of buildings from the retail centre infringed the transitional surface and were now considered obstacles.
	EAPL complied with the instrument, and the dimensions of the published runway strip width and transitional surface were consistent with the aerodrome standards applicable at that time.
2019	EAPL stated in their aerodrome manual that the runway 08/26 strip width had been grandfathered against the *Airport Engineering Instructions* (1970). The width was returned to 180 m and the part of the transitional surface alongside the strip was moved inwards with this change. The inner edge of the approach surface for runway 26 remained at 300 m.
	CASA accepted the grandfathering and revoked instrument 153/15. With the 180 m strip width, the retail centre no longer infringed the transitional surface. The lighting and notification requirements were subsequently removed.

3. Essendon Fields Airport and the Bulla Road Precinct

Essendon Fields Airport

History

Located about 10 km to the north-north-west of Melbourne City, Essendon Airport was established in 1919. In 1921, it became a Commonwealth owned and operated airport. From the early 1950s, it was officially designated as an international airport and remained the primary airport for Melbourne up until the early 1970s.

Between 1970 to 1971, international and domestic air services for Melbourne were transferred to the airport at Tullamarine (known today as Melbourne Airport). Essendon's role changed to a general aviation airport. Essendon Airport continued to maintain its navigation aids, and instrument approach and departure procedures to allow aircraft to operate safely by day and night, and in all weather conditions.

In September 2001, Edgelear Pty Ltd acquired the Commonwealth owned corporation (Essendon Airport Ltd) that held the lease for the airport. The corporation was converted into a private company, Essendon Airport Pty Ltd (EAPL). The licence to operate the airport was transferred to EAPL in June 2002. The operator later changed the airport name to Essendon Fields Airport.

Nature of operations

Operations at the airport had evolved to include regular passenger transport operations, charter (domestic and international) and tourist flights, airfreight, and aircraft maintenance. It was also the base for emergency services fixed-wing aircraft and helicopters for police, air ambulance, and firefighting aircraft operations. For context, in 2021, there were 46,920 aircraft movements recorded at the airport by Airservices Australia. Of this, about 56% were aircraft with a maximum take-off weight less than 7,000 kg, 30% were helicopters, and 13% were aircraft with maximum take-off weight over 7,000 kg.[10] Weight restrictions at the airport are discussed below.

Runway facilities

In its current configuration, the airport had a north-south runway, designated as 17/35, and an east-west runway, designated as 08/26 (Figure 1). Runway 08/26 was 1,921 m long and 45 m wide. Runway 17/35 was 1,503 m long and 45 m wide.

An instrument landing system (ILS)[11] approach aid to runway 26 was commissioned prior to international and domestic operations being moved from the airport in the early 1970s. An ILS provided pilots with both vertical and horizontal guidance flying an instrument approach procedure[12] to enable a safe landing during instrument meteorological conditions.[13] The ILS was

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10 Airservices Australia airport movement data is only recorded during hours of tower operation. Therefore, 'actual movements at non H24 locations may be higher than published' (Airservices Australia, 2022). There were no movements for aircraft with a maximum take-off weight over 136,000 kg.

11 A precision instrument approach system, which normally consists of the following electronic components: very high frequency localiser and marker beacons, and an ultra-high frequency glideslope.

12 A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix or, where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed thereafter, if a landing is not completed, to a position at which holding or en route obstacle clearance criteria apply (Civil Aviation Safety Authority, 2019).

still operational at the time of publication of this report. Under the aerodrome standards, runway 26 was required to be classified as a precision approach (Category I) runway[14] until 2020. Changes to the standards, in effect in 2020, meant that the runway could be classified as a non-precision approach runway (EAPL confirmed that it had adopted this classification for runway 26).[15] While the ILS was still available for use as precision instrument approach aid, the change in classification of the runway was a result of the advent of new navigation technologies and definitional changes associated with the height of the landing minima (the height at which a pilot needed to make a decision to continue the approach with visual references to the runway). The concepts and changes to definitions in the standards affecting instrument approaches are discussed in Chapter 4.

Weight restrictions

The Air Navigation (Essendon Fields Airport) Regulations 2018 operated to manage noise emissions at the airport, rather than safety. Specifically, the objective of the regulations was to 'minimise the impact of aircraft noise on the community surrounding Essendon Fields Airport through the imposition of a curfew between 11pm and 6 am and restrictions on certain aircraft operations at all times'. There was a general maximum take-off weight limitation of 45,000 kg with some aircraft being able to operate up to 50,000 kg. The 2018 regulations replaced an earlier set of regulations from 2001, providing the 50,000 kg weight increase to accommodate newer, but larger high performance business jets using the airport, such as the Bombardier Global 8000 and Gulfstream G650 aircraft. EAPL published the weight limitation in the En Route Supplement Australia.

The Bulla Road Precinct

Development of the Bulla Road Precinct, which contained a retail shopping centre, was commenced in 2005 and was located on 16.5 hectares in the south-east corner of Essendon Fields Airport (Figure 1). It was adjacent to the intersection of Bulla Road and the Tullamarine Freeway, and to the south-east of the intersection of runways 08/26 and 17/35.

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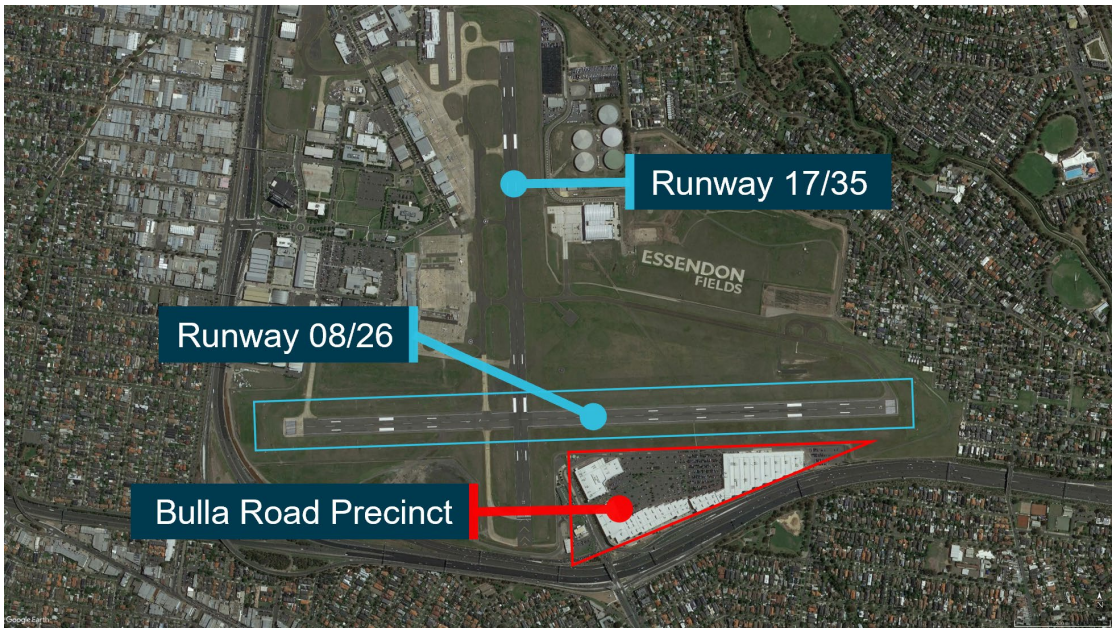
[13] Instrument meteorological conditions: weather conditions that require pilots to fly primarily by reference to instruments, and therefore under instrument flight rules, rather than by outside visual reference. Typically, this means flying in cloud or limited visibility.

[14] Prior to 2020, for a precision approach category I runway such as runway 26 was, a runway intended for the operation of aircraft using instrument approach procedures (see footnote 1212) served by ILS and visual aids intended for operations with a decision height (see footnote **Error! Bookmark not defined.**) not lower than 200 ft and either a visibility not less than 800 m, or a runway visual range not less than 550 m. Runway visual range referred to the range over which the pilot of an aircraft on the centreline of a runway can see the runway surface markings, or the lights delineating the runway or identifying its centreline (Civil Aviation Safety Authority, 2003).

[15] As defined in standards from 2020, a non-precision approach runway was a runway intended for the operation of aircraft using instrument approach procedures served by visual aids and non-visual aids, intended for landing operations following an instrument approach with a minimum descent height or decision height at or above 250 ft in runway visibility of not less than 1,000 m (Civil Aviation Safety Authority, 2019a).

Figure 1: Essendon Fields Airport, March 2021



Source: Google Earth, annotated by the ATSB

4. Key concepts

Introduction

The following is a summary of the key concepts frequently referenced throughout the report. This includes knowledge of the international and domestic framework for specifying aerodrome design requirements, the various ground and airspace surfaces used to protect aircraft around airports, and runway categories, composition and dimensions.

Applicable legislation and standards

Aerodrome standards

The International Civil Aviation Organization (ICAO) promulgates standards and recommended practices, which countries contracting (referred herein as contracting States) to the Convention on International Civil Aviation (Chicago Convention) are expected to follow. Annex 14 to the Chicago Convention (ICAO Annex 14) contained standards and recommended practices for aerodrome design and operations.

Subject to any differences that Australia may have lodged with ICAO, these design requirements have primarily been incorporated into regulations and standards made under Australia's *Civil Aviation Act 1988* (Civil Aviation Act), which was administered by the Civil Aviation Safety Authority (CASA). As of 2020, design requirements were incorporated into the Part 139 (Aerodromes) Manual of Standards 2019 (Part 139 MOS 2019) made under the Civil Aviation Safety Regulations 1998. Prior to the Part 139 MOS 2019, the requirements were incorporated into the following standards relevant to the time periods referenced in this report:

- the Manual of Standards Part 139 – Aerodromes (MOS Part 139) (effective 2003–2020)
- the Rules and Practices for Aerodromes (RPAs) (effective 1987–2003)
- the Airport Engineering Instructions (APEIs) (effective prior to RPAs estimated 1960s–1987).

The design requirements in the standards included those for the runway facilities and surfaces for the protection of airspace. The surfaces for the protection of airspace were the obstacle limitations surfaces (OLS). However, obstacle protection for aircraft was also a required consideration in instrument approach procedure design, as established under Part 173 of the Civil Aviation Safety Regulations and ICAO Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS). These concepts are explained further below.

Airports Act and regulations

Separate to the requirements of the Civil Aviation Act, federally leased airports like Essendon Fields Airport, were subject to the planning requirements under the *Airports Act 1996* (Airports Act).[16] These requirements were in place to, among other objectives, promote the efficient and economic development and operation of airports. Essendon Airport Pty Ltd (EAPL) was required under the Airports Act to have an *airport master plan* (addressing future land uses, types of permitted development, and noise and environmental impacts) approved by the Minister responsible for the Act. For a major airport development such as the Bulla Road Precinct, they were required to have an approved *major development plan*. The planning documentation for the airport and the Bulla Road Precinct development considered in this investigation was submitted for approval between 2002 and 2004 to the then Minister for Transport and Regional Services.

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[16] The versions of the Airports Act considered in the context of this investigation were those in force between 2003 and 2004 when approval was sought by EAPL for an airport master Plan (2003) and a major development plan for the Bulla Road Precinct (2004).

In addition, Part 12 of the Airports Act, together with the Airports (Protection of Airspace) Regulations 1996, established a framework for the protection of airspace at, and around federally leased airports. This was achieved through the declaration of certain airspace to be 'prescribed airspace' and seeking to limit activities that affected that airspace (controlled activities). These terms were defined as:

- **Prescribed airspace:** Airspace that was to be protected where it was in the interests of the safety, efficiency, or regularity of existing or future air transport operations into, or out of an airport. This related to the airspace above any part of either an OLS or PANS-OPS surface for the airport or any other airspace established in a declaration under regulation 5 relating to the airport.
- **Controlled activities:** Activities that resulted in intrusions into prescribed airspace, such as the construction of buildings or other structures, required approval from the Secretary of the Department under the Act and regulations. The regulations established the system under which an application to conduct controlled activities was assessed and either approved or refused.

Risk controls for identifying and managing intrusions into the airspace above the OLS and PANS-OPS surfaces were also contained in the regulations and aerodrome standards made under the Civil Aviation Act. However, for federally leased airports, Part 12 of the Airports Act (and the regulations) was the primary legislation through which approvals were sought to construct buildings impacting prescribed airspace encompassing OLS and PANS-OPS. Decisions were made considering the interests of the safety, efficiency, or regularity of existing or future air transport operations into or out of the airport.

Aerodrome design

Aerodrome reference code

In the 8th edition of ICAO Annex 14 (1983), ICAO adopted the use of an aerodrome reference code (ARC) system using aircraft data to design airports. The ARC was used in the Australian RPAs, MOS Part 139 and the more recent Part 139 MOS 2019.

The ARC included a code number and letter, which was used to ensure the aerodrome facilities were suitable for the aircraft that were intending to operate at the aerodrome (International Civil Aviation Organization, 2018a). The code linked the aerodrome design criteria for the runway, runway facilities, and the OLS to the operational and physical characteristics of an aircraft type. The aerodrome operator was required to nominate the design criteria for each facility so that pilots and aircraft operators could make informed decisions about the use of the facility.

The code number was related to the aircraft's performance characteristics (aeroplane reference field length for take-off)[17] and the letter referred to the aircraft's dimensions (wingspan and the outer main gear wheel span) (International Civil Aviation Organization, 2018a). The Part 139 MOS 2019 separated out the wingspan and outer main gear wheel span elements of the code. The most significant element of the code that is discussed in this investigation is the code number, which ranged from '1' to '4', where larger aircraft would be a code '4'.[18] This code applied to the design requirements for the runway facilities (including the runway and runway strip) and the OLS.

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[17] The minimum field length required for take-off at the maximum certificated take-off weight, sea level, standard atmospheric conditions, still air and zero runway slope, as shown in the aeroplane flight manual or equivalent data from the manufacturer. Field length means balanced field length, if applicable, or take-off distance in other cases.

[18] Code 4 aircraft ranged from the lightest being the McDonnell Douglas DC9-30 to the more common Airbus A320-200 and Boeing B737. At the higher end of the category was an Airbus A380.

Runway 08/26 at Essendon Fields Airport was categorised by the aerodrome operator as a code 4 runway.

Aerodrome design under the Airport Engineering Instructions (APEIs)

The APEIs, which preceded the RPAs, did not use the ARC to design runway facilities and the OLS. Rather, the runway strip width and parts of the OLS were designed taking into account (among other factors), aircraft weight, whether the runway was a precision approach, and the likelihood of international operations. The presence of international operations was a consideration for compliance with the design requirements set out in the ICAO standards.

From an international law perspective, countries were only bound by the Chicago Convention and Annexes where there was an international connection. Annex 14 applicability provisions covered aerodromes in public use in accordance with the requirements of Article 15 of the Convention. Article 15 related to use of public airports by aircraft from other contracting States.

Instrument approach runways

A runway's strip width and associated OLS dimensions were determined by whether or not the runway has an instrument approach attached, and if so, the type of instrument approach. Due to accuracy limitations associated with various instrument approach navigation aids, as well as flight operations limitations, strip widths were wider for a runway with an instrument approach, consistent with the aerodrome reference code designation for the runway. The OLS around the runway strip had broader dimensions as well, based on the code designation and it being an instrument approach.

Instrument approach runways were classified as a precision approach runway or non-precision approach runway. Under MOS Part 139, precision approach runways were largely distinguished based on the availability of an instrument landing system (ILS) (which provided 3D vertical and lateral guidance). Non-precision approach runways were classified based on the availability of other accepted directional guidance, which may have only been for the lateral movement of the aircraft.

Advances in technology and the advent of performance-based navigation[19] led to changes in classifications for instrument approach procedures and runways. Considerations were centred around the accuracy of 3D navigation guidance, decision height, and runway visibility requirements with the approach procedure being flown. An ILS is still a precision approach aid. Under the new Part 139 MOS 2019, a runway providing an ILS, which has supporting infrastructure, and a decision height below 250 ft, could be classified as a precision approach runway. If the decision height was 250 ft or more, then the runway would be classified as a non-precision approach runway, as was the case for runway 26 at Essendon Fields Airport under the newer standards.

Runway strip composition

The runway strip was a rectangular surface area that surrounded the runway. It was part of the obstacle restriction area that also included the runway end safety areas, clearways, and taxiway strips. Objects, except for approved visual and navigational aids, were prohibited from being located within the obstacle restriction area without specific approval from CASA (Civil Aviation Safety Authority, 2019).

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[19] The performance-based navigation concept specifies that aircraft navigation system performance requirements be defined in terms of accuracy, integrity, continuity, availability and functionality required to achieve a navigation application. The navigation application identifies the navigation requirements for an air traffic service route and instrument procedures used by pilots and air traffic controllers. The navigation application is dependent on the navigation aid infrastructure (Civil Aviation Safety Authority, 2021b).

The purpose of the runway strip was to provide protection for an aircraft during runway operations, such as during a take-off or landing. This was intended to reduce the risk of damage to aircraft running off the runway (runway excursion),[20] and provide protection from obstacles for an aircraft overflying the runway at low-level, such as during a rejected landing (missed approach, go-around or balked landing) (International Civil Aviation Organization, 2018a).

When a runway was served by an instrument approach (non-precision[21] and precision approaches), the strip requirements included a graded area[22] around the runway and associated stopways[23] (if applicable), and a flyover area for managing these risks. A non-instrument runway only required the graded portion.

Figure 2: Runway strip composition

Source: Civil Aviation Safety Authority (2019a)

The design element that was the focus of this investigation was the runway strip width (including the graded area and the flyover area). ICAO Doc 9981, *Procedures for Air Navigation Services – Aerodromes*, stated that 'particularly, the graded portion of the runway strip is provided to minimize the damage to an aeroplane in the event of a 'veer-off' during a landing or take-off operation' (International Civil Aviation Organization, 2020d). Under MOS Part 139 and the latter Part 139 MOS 2019, the graded portion of the strip width was required to be not less than 150 m for an instrument approach runway such as runway 26 at Essendon Fields Airport.

Table 2 below sets out the requirements under the different historical standards for determining the overall strip width (graded portion and flyover) for a runway where aircraft conducted instrument approaches using the ILS.

[20] Runway excursion: when an aircraft runs off the end of the runway (overrun) or the side of the runway (veer-off).

[21] A non-precision approach is a 2-dimensional instrument approach, which utilises lateral navigation guidance only (International Civil Aviation Organization, 2018b).

[22] Graded areas must be relatively flat, free from pooling water and generally be able to minimise hazards arising from differences in the load-bearing capacity of aircraft which the runway is intended to serve, in the event of an aircraft running off the runway (Civil Aviation Safety Authority, 2019a).

[23] Stopway is a defined rectangular area on the ground at the end of the take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off (Civil Aviation Safety Authority, 2019a).

Table 2: Runway strip width dimensions as required by the aerodrome standards

Australian standard	Standard runway strip width (m)	Runway type
APEI (1960s – 1987)	1,000 ft (~300 m)	For international precision approach landings.
	500 ft plus 50 ft either side for a flyover area – 600 ft (~180 m)	This applied to international aircraft operations other than those involving precision approach aids, and domestic operations where the maximum all up weight of an aircraft was greater than 50,000 lb (22,680 kg) except the Douglas DC-4 aircraft.
Note: Refer to Appendix A for an extract of the APEIs. The wording in the extract was open to interpretation. The ATSB noted the interpretation of the standards by CASA and EAPL is as described above for the distinction between international precision approach operations and other types of operations.		
RPAs (1987–2003)	300 m	For a code 3 or 4 precision approach runway or non-precision approach runway (only where the runway width is 45 m or more for a non-precision approach).
MOS Part 139 (2003–2020)	300 m	For a code 3 or 4 precision approach or non-precision approach runway (only where the runway width is 45 m or more).
Part 139 MOS 2019 (2020–)	280 m	For a code 3 or 4 precision approach or non-precision approach runway.
International standard	**Standard runway strip width (m)**	**Runway type**
ICAO Annex 14 (1999)	300 m	For a code 3 or 4 precision approach or non-precision approach runway (it was only a recommended practice for non-precision approach runways).
ICAO Annex 14 (2018)	280 m	For a code 3 or 4 precision approach or non-precision approach runway (it was only a recommended practice for a non-precision approach runway).

Under the RPAs, MOS Part 139, Part 139 MOS 2019 and ICAO Annex 14, practicability considerations could be taken into account when considering whether the full dimensions of the strip width could be maintained. This is discussed further below (refer to section titled *Runway strip width less than the current standard and effect on the* transitional surface). It is also discussed in other chapters, along with the various means for an accepted non-compliance with the standards outlined in Table 5, with respect to how the standards were applied for runway 08/26 at Essendon Fields Airport.

Safeguarding airports

Obstructions in the vicinity of airports have the potential to create safety hazards for an aircraft and its occupants. The Australian Federal Government has provided background material on the risks to aircraft presented by obstacles (National Airport Safeguarding Advisory Group, 2012):

> Intrusions into operational airspace affect airport operations. The operational efficiency of safe operations at airports is affected by geographical features such as surrounding hills and artificial structures and activities such as those [that cause turbulence or the emission of steam, other gas, smoke, dust or other particular matter]. Tall structures and other activities that intrude into operational airspace have the potential to lower safety levels of aviation operations at airports. If these activities are not regulated, the aviation safety regulator may have to mitigate risk by placing restrictions on operations at affected airports.

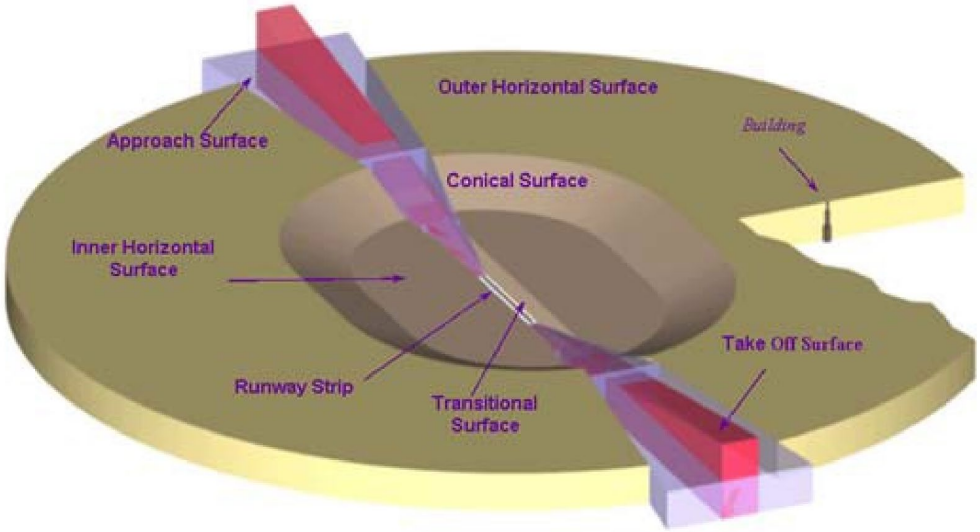
Two sets of protective imaginary surfaces have been established to manage the risks associated with obstacles in operational airspace. These are the OLS and PANS-OPS surfaces.

Obstacle limitation surfaces

Purpose of the surfaces

The CASA aerodrome standards defining the different surfaces of the OLS are adapted from the standards and recommended practices in ICAO Annex 14. The OLS are a series of conceptual (imaginary) surfaces associated with each runway at an aerodrome, which identify the lower limits of the aerodrome airspace above which objects become obstacles and must be assessed as hazards to aircraft operations. The various OLS surfaces could extend out to 15 km from the aerodrome. Figure 3 below shows a typical OLS configuration.

Figure 3: Typical obstacle limitation surfaces configuration



Source: Civil Aviation Safety Authority (2019a)

According to ICAO, the broad purpose of the OLS was to (International Civil Aviation Organization, 1983):

> …define the volume of airspace that should be kept free from obstacles in order to minimise the dangers presented by obstacles to an aircraft, either during an entirely visual approach or during the visual segment of an instrument approach.

Australian guidance published as part of the *National Airports Safeguarding Framework*[24] has similarly stated the OLS (National Airport Safeguarding Advisory Group, 2012):

> …should be kept free of obstacles to aircraft operations being conducted under VFR [visual flight rules] or during the visual stages of IFR [instrument flight rules] operations.

For pilots operating under instrument flight rules,[25] the PANS-OPS surfaces (described below) provided obstacle clearance protection during the final approach segment of an instrument approach procedure down to the decision height/landing minima (that is, the height at which the pilot must have adequate visual reference to continue the descent to landing). Below the landing minima, in the visual segment of the approach, obstacle clearance protection was provided by

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[24] The *National Airports Safeguarding Framework* provided guidance on planning requirements for developments that affected aviation operations, such as building activity around airports that may penetrate operational airspace. The framework was developed by the National Airports Safeguarding Advisory Group and published by the Department.

[25] Instrument flight rules (IFR): a set of regulations that permit the pilot to operate an aircraft in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules (VFR). Procedures and training are significantly more complex as a pilot must demonstrate competency in IMC conditions while controlling the aircraft solely by reference to instruments. IFR-capable aircraft have greater equipment and maintenance requirements.

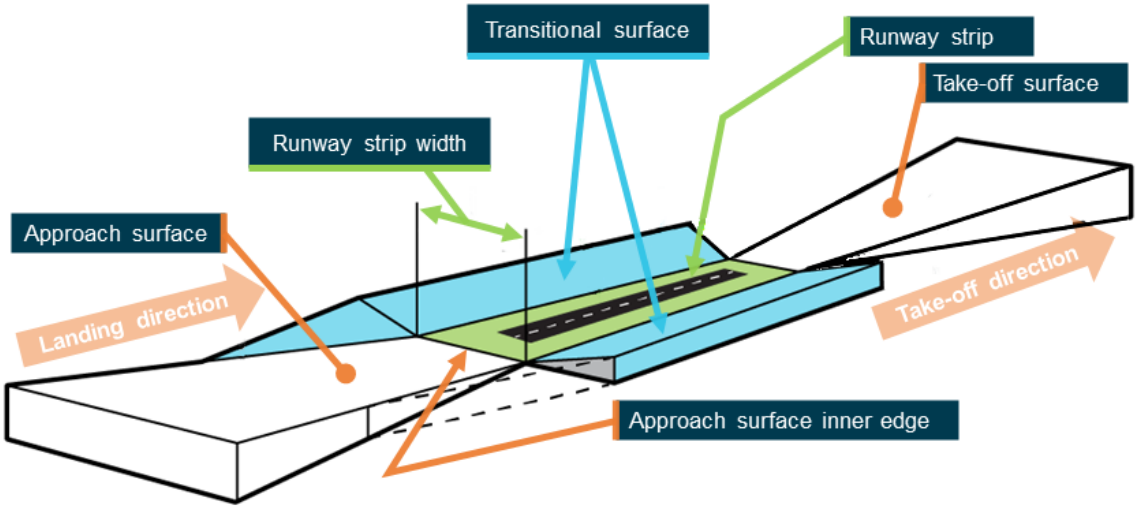
the OLS.[26] The aerodrome operator had the responsibility for establishing the OLS for a runway in accordance with the standards.

Part 12 of the Airports Act regime (for federally leased airports) and the CASA aerodrome standards did not place an absolute prohibition on obstacle intrusions into the OLS. Rather, they required referral to CASA for an assessment of the objects as intrusions and their effect on the safety of aircraft operations.

For this investigation, due to the proximity of the Bulla Road Precinct buildings, the OLS components immediately adjacent to the runway were most relevant. In particular, the approach and transitional surfaces, which have been subject to published changes in their dimensions on runway 08/26. Figure 4 shows the runway strip in green, surrounded by the approach (white), transitional (blue) and take-off (white) obstacle limitations surfaces.

[26] Note, an additional PANS-OPS surface, the visual segment surface, protected aircraft from obstacles prior to landing, while the pilot transitioned from flying on instruments to using the visual references available at the aerodrome.

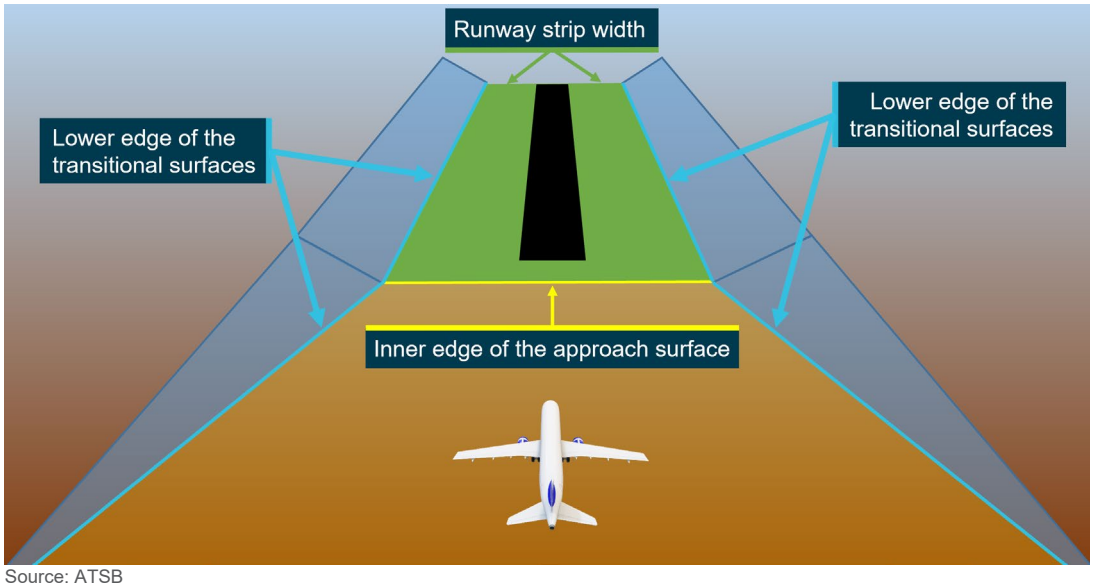
Figure 4: Runway strip width and the connected obstacle limitation surfaces[27]



Source: ATSB

Key terms relating to the OLS affected by changes to runway 08/26 at Essendon Fields Airport are shown in Figure 5 below.

Figure 5: Key terms used in the report



Source: ATSB

How the approach and transitional surfaces work together

The approach surface and the transitional surface are shown in Figure 4 and Figure 5 above. The approach surface is shown as inclined planes extending upward and outward from the end of the runway strip. The transitional surface is shown as planes extending upward and outward from the sides of the approach surface and runway strip. The dimensions of the inner edge of the approach surface and runway strip width can affect the location of the lower edges of the transitional surface.

[27] The diagram is not an accurate representation of all surfaces. For a precisions/non-precision approach runway the inner edge for the take-off surface will be less than the width of the runway strip, which is determined by the runway approach category.

Following the 38th ICAO Assembly[28] in 2013, ICAO established the Obstacle Limitation Surface Task Force (OLSTF)[29] to review the effectiveness of the OLS in providing protection to aircraft (At the time of publication, ICAO had submitted proposals developed by the OLSTF to contracting States for consideration). One of their tasks was to advise on the purpose of the existing surfaces and the role they played in managing risk to aircraft operations.

In a discussion paper presented to the OLSTF members, historical material was reviewed, which demonstrated the approach and transitional surfaces were meant to work together to provide protection to aircraft from obstacles (International Civil Aviation Organization, 2020b). ICAO *Doc 9137 – Airport Services Manual* (International Civil Aviation Organization, 1983) explained the surfaces worked together to define:

> … the volume of airspace that should be kept free from obstacles to protect an aeroplane in the final phase of the approach-to-land manoeuvre. Their slopes and dimensions will vary with the aerodrome reference code and whether the runway is used for visual, non-precision or precision approaches.

The OLSTF reviewed earlier versions of ICAO Annex 14 (4th, 5th and 6th editions) where the intent of the transitional surface was described as:

> The transitional surface establishes the heights above which it may be necessary to take one or more of the following actions: restrict the creation of new obstructions; remove objects or mark objects in order to ensure a satisfactory level of safety and regularity for aircraft flying at low altitude and displaced from the runway centre line in the approach, or missed approach phases.

Noting the above 2 quotes, the OLSTF indicated that, together:

> …the approach and transitional surfaces aim at protecting approaches and missed approaches; they should guarantee that an aircraft is safe both in the approach to land and in the missed approach manoeuvres.

Along with the approach surface, the transitional surface should provide protection for any lateral (from the runway centreline) and/or vertical (height above the threshold) deviations of the aircraft as the pilot is approaching the runway (below the landing minima) attempting to land. When an aircraft that is flying over the runway strip deviated laterally from the centreline during landing or a missed approach, the approach surface no longer provided obstacle protection. Rather, the runway strip and the transitional surface running alongside the runway strip provided this protection.

CASA did not provide any specific guidance on the purpose of the transitional surface. However, they confirmed in correspondence with the ATSB in 2020 that the surface was:

> …one component of the Obstacle Limitation Surfaces (OLS) that provides protection to visual flight rules aircraft or aircraft flying the visual segment of an instrument flight procedure from obstacles. Any proposed structures that may infringe the OLS must be assessed for the potential to create a risk to the safety of aircraft operations.

Construction of the approach surface

Extracts from the MOS (both MOS Part 139 (2003) and Part 139 MOS 2019) definition of the approach surface relevant to the discussion in this investigation are:

> The approach surface is an inclined plane, or combination of planes, which originate from the inner edge associated with each runway threshold, with two sides originating at the ends of the inner edge.

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[28] The Assembly is comprised of all contracting States of ICAO and meets not less than once in 3 years.

[29] The taskforce was established by the ICAO Secretariat in 2014 and its first meeting was in 2015. The taskforce consisted of international experts from civil aviation authorities, air navigation service providers, aerodrome operators, regulators, professional aviation associations and aviation consultants.

The inner edge associated with each runway threshold has a specified length, and is located horizontally and perpendicular to the runway centreline, at a specified distance before the threshold.

The two sides diverge uniformly at a specified rate from the extended centreline of the runway.

The dimensions for the inner edge of the approach surface required by the various standards were consistent with the requirements for the dimensions of the runway strip width. The dimensions relevant to the discussion in this report on the classification of runway 26 at Essendon Fields Airport are shown in Table 3.

Table 3: Approach surface inner edge dimensions

Australian standard	**Inner edge dimensions (m)**	**Runway type**
APEI (1960s-1987)	1,000 ft (~300 m)	For international precision approach landings.
	600 ft (~180 m)	For domestic precision approach landings.
RPAs (1987-2003)	300 m	For a code 3 or 4 precision approach runway or non-precision approach runway (only where the runway width is 45 m or more for a non-precision approach).
MOS Part 139 (2003-2020)	300 m	For a code 3 or 4 precision approach runway or non-precision approach runway (only where the runway width is 45 m or more for a non-precision approach).
Part 139 MOS 2019 (2020-)	280 m	For a code 3 or 4 precision approach or non-precision approach runway.
International standard	**Inner edge dimensions (m)**	**Runway type**
ICAO Annex 14 (1999)	300 m	For a code 3 or 4 precision approach runway or non-precision approach runway (it was only a recommended practice for non-precision approach runways).
ICAO Annex 14 (2018)	280 m	For a code 3 or 4 precision approach or non-precision approach runway or non-precision approach runway (it was only a recommended practice for non-precision approach runways).

Construction of the transitional surface

Table 4 provides a summary of the definitions for the transitional surface across the varying standards. The definitions do not provide a specific dimension to locate the lower edge of the transitional surface. Rather, they work by referencing the approach surface and runway strip.

Table 4: Definitions of the transitional surface

Australian standard	Date	Definitions (quoted)
APEI	1970s	A complex surface along the side of the runway strip and part of the side of the approach surface. The inclined planes comprising the transitional surfaces shall slope upwards and outwards until they intersect with the horizontal surface. The gradient of these inclined planes shall be 1 in 7 from the edges of the approach surfaces and from lines originating at the ends of the inner edge of each approach area drawn parallel to the runway centre line in the direction of landing.
RPAs MOS Part 139 Part 139 MOS 2019	1989 2003 2020	The transitional surface comprises inclined planes which originate at the lower edge from the side of the runway strip (the overall strip), and the side of the approach surface which is below the inner horizontal surface, and finishes where the upper edge is located in the plane of the inner horizontal surface (see Figure 3). The transitional surface slopes upwards and outward at a specified rate [1 in 7 for a precision approach/non-precision approach code 4 runway like runway 08/26] and is to be measured in a vertical plane at right angles to the centreline of the runway.
International standard	**Date**	**Definitions (quoted)**
ICAO Annex 14	1983 -	A complex surface along the side of the strip and part of the side of the approach surface, that slopes upwards and outwards [1 in 7 rate] to the inner horizontal surface. Characteristics - The limits of a transitional surface shall comprise: a) a lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centre line; and b) an upper edge located in the plane of the inner horizontal surface.

ATSB observation

The ATSB noted a key difference between the international (ICAO Annex 14) and Australian definitions of the transitional surface. For ICAO, the location of the transitional surface alongside the approach surface and the runway strip was to be referenced to the inner edge of the approach surface (which had a defined dimension). This was replicated in the Australian APEIs. However, in the RPAs, MOS Part 139 and Part 139 MOS 2019, the inner edge of the approach surface was not mentioned. Rather, this Australian definition created separate planes for the transitional surface with one originating from the side of the approach surface and the other originating from the side of the runway strip.

Alignment of the surfaces

As shown in Table 2 and Table 3 the strip width dimensions were the same as the inner edge of the approach surface for the designated aerodrome reference code under the RPAs, MOS and ICAO Annex 14. This provided for alignment between the surfaces, including the transitional surface, which was defined by reference to the strip width and the approach surface. The alignment with a standard construction of the surfaces, using the aerodrome reference code requirements, is shown in Figure 5.

When interpreting the Australian standards (in the RPAs, MOS Part 139 and Part 139 MOS 2019), CASA advised the ATSB in November 2019 that the transitional surface was based on the actual runway strip width (published by the aerodrome operator) and the inner edge of the approach surface, and that the inner edge was to be consistent with the strip width. This view

was reiterated by CASA in December 2020, where they stated to the ATSB that the runway strip width and inner edge of the approach surface must be identical to establish the transitional surface. These views were inconsistent with earlier advice given by CASA to the ATSB in 2018 that said:

> It could be interpreted that the current and former MOS did not and does not take account into consideration instances where the approach surface inner edge and the overall runway strip are not consistent on a case by case basis.

On 8 November 2022, in response to this draft report, CASA advised the ATSB that:

> …the transitional surface and the inner edge of the approach surface must be consistent with the actual RWS [runway strip] width.
>
> However, there is currently no explicit requirement in Australia's standards that the transitional surfaces and approach inner edges are connected.

In September 2020, the ICAO Secretariat[30] provided the ATSB with a view on the alignment of the surfaces in ICAO Annex 14. They advised that the OLS were specified in a manner that allowed the surfaces to be 'connected geometrically'. Noting that the transitional surface extended down the side of the approach surface and then along the length of the runway strip, parallel to the runway centreline, ICAO indicated that:

> …it can be said that the location of the lower boundary [edge] of a transitional surface is governed by the dimension of the inner edge of the approach surface, which has the same dimension as that of a standard runway strip.

ATSB observation

The approach and transitional surfaces worked together to provide obstacle protection to aircraft in the final stages of the approach to land and during a missed approach. The ICAO Secretariat advised that this would be achieved using their interpretation of the standard in ICAO Annex 14 with the surfaces aligned by the inner edge of the approach surface. Advice provided by CASA acknowledged the Australian standards may allow for misalignment on a case-by-case basis. However, they have also advised that the transitional surfaces and inner edge of the approach surface must be consistent with the actual (published) runway strip width.

Runway strip width less than the current standard and effect on the transitional surface

As mentioned in Table 2, the Australian and international aerodrome standards specified the required runway strip width dimensions for a precision approach/non-precision approach runway. In some instances, if an aerodrome operator believed the aerodrome could not accommodate a full strip width, the operator may have sought to publish a strip width less than the standard if it was not practicable to provide for a full strip width. Alternatively, an aerodrome operator may have applied an older standard with less strip width requirements under grandfathering provisions. The capacity for an aerodrome operator to maintain a strip width less than the current standards in Australia is discussed in Chapters 6 and 8 with respect to the configuration of the runway strip and associated OLS for runway 08/26.

To understand whether the transitional surface would be affected by a reduction in the runway strip width, the ATSB sought advice from CASA and ICAO. In 2020, CASA indicated that, in accordance with the Australian standard, the transitional surface would 'automatically' move inwards when the runway strip width was reduced (the reduced strip width being the 'actual strip width' published by the aerodrome operator). On 8 November 2022, in response to a draft of this report, CASA further advised that the inner edge of the approach surface must have the same dimensions as the strip width although they indicated that an aerodrome operator may choose to

[30] The ICAO Secretariat is the administration within ICAO supporting the interactions of member (contracting) states, researching and advising on air transport policy and standardisation of innovations in air transport.

adopt more conservative dimensions for the approach surface. As noted above, CASA had also stated there was no explicit requirement that the transitional surfaces and inner edge of the approach surface were connected.

The ICAO Secretariat's advice to the ATSB noted that in ICAO Annex 14, the lower edge of the transitional surface was governed by the dimension of the inner edge of the approach surface, which had the same width as that of a standard runway strip and stated:

> OLS are imaginary surfaces and not physical ones. When the strip width is reduced, the lower/grounded boundary [lower edge] of the transitional surface should be an imaginary line along the length of a standard strip parallel to the runway centreline.
>
> Irrespective of the reasons to reduce the runway strip width, a reduction of runway strip should not dictate or change the provisions related to OLS.

The ICAO Secretariat's view was that the intended location of the lower edge of the transitional surface was from the inner edge of the approach surface along what a standard runway strip should be (based on the standard), not what was published as the actual runway strip width.

On 8 November 2022, in response to this draft report, CASA advised the ATSB that they consider the actions ICAO took to reduce the runway strip width in the ICAO Annex 14 standards in 2018 (see Table 2) showed that the ICAO position was the same as CASA's. That is, the inner edge of the approach surface and the transitional surface must be the same as the runway strip width. CASA noted that ICAO had also reduced the inner edge of the approach surface in the standards to the same dimensions as the revised runway strip width (see Table 3). Consequently, the location of the transitional surfaces, which were referenced to the strip width and the inner edge of the approach surface (see Table 4), changed.

Chapter 9 discusses the ICAO amendments further.

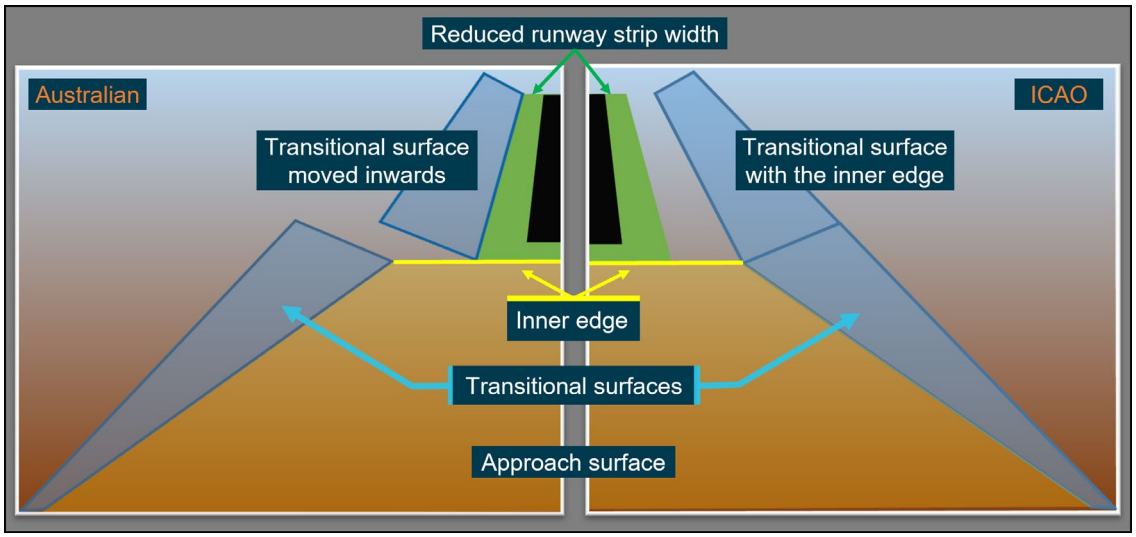
ATSB observation

The actions taken by ICAO in 2018 were changes to the dimensions in the standards. By contrast, in 2020, the ICAO Secretariat's advice to the ATSB was about the application of the standards as they were drafted.

The ATSB notes that, under ICAO Annex 14 the dimensions of the inner edge of the approach surface were determined by the aerodrome reference code applied to the runway and not by the dimensions of the runway strip width. This was similarly the case in the Australian standards for the RPAs, MOS Part 139 and Part 139 MOS 2019.

Figure 6 shows the effect on the transitional surface when the runway strip width at an airport's runway was less than that in the standards, while the dimension of the inner edge of the approach surface remained consistent with the standards (whether in compliance with the standards or by choice of the aerodrome operator). The left picture represents the effect based on the CASA interpretation of the Australian standards where the lower edge of part of the transitional surface moved inwards with the reduced strip width (the actual published runway strip width). The right picture depicts the ICAO Secretariat's interpretation of ICAO Annex 14 where the lower edge was based on the inner edge of the approach surface and running parallel to the runway along a line consistent with the dimensions of the runway strip in the standard.

Figure 6: Transitional surface with a runway strip width less than the current standard



Source: ATSB

The ATSB was not aware of any published guidance to support the interpretations of ICAO and CASA of their respective standards for the purpose of meeting expectations about alignment of surfaces. On 12 October 2022, in response to a draft of this report, the ICAO Secretariat advised:

> ICAO does not see an obvious gap or safety issue related to the existing provisions on transitional surface and runway strip. However, ICAO is in the process of a holistic review of OLS provisions. Review of guidance material to facilitate OLS implementation is also being carried out. The existing ICAO provisions on transitional surface and runway strip are clear. However, further guidance could be considered, as part of the above ongoing work to assist States in avoiding any possible misinterpretation and in facilitating the effective implementation of the relevant ICAO provisions.

The ATSB noted that, in the future, the OLSTF has proposed to remove the link between the OLS and the runway strip (see Chapter 9).

ATSB observation

Under the RPAs, MOS Part 139 and Part 139 MOS 2019, CASA interpreted the standard so that the lower edge of the transitional surface alongside the runway strip moved inwards when the strip width was reduced to less than that required by the standards. The part of the transitional surface alongside the approach surface would no longer be aligned if the dimension of the inner edge of the approach surface remained unchanged. CASA noted there was no explicit requirement in the Australian standards for alignment.

ICAO's interpretation of the ICAO Annex 14 standard would ensure the transitional surface did not move when the runway strip width was reduced. However, it was observed that this would create an unexplained space between the side of the published runway strip with its reduced dimensions and the lower edge of the transitional surface.

Neither ICAO nor CASA published guidance in support of their stated expectations for interpretating the standards. However, ICAO noted that there was an opportunity to consider guidance with work on reviewing the OLS.

Changes to the alignment of the transitional surface for runway 26 with variations in the published runway strip width and inner edge of the approach surface are discussed in subsequent chapters. Application of both the Australian standards and the international standards are also considered.

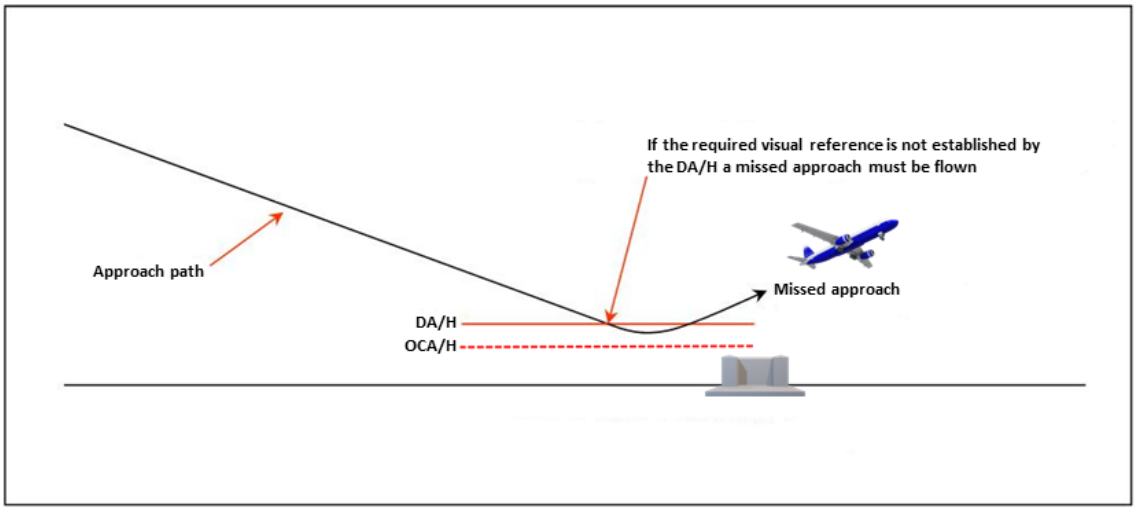
Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces

The PANS-OPS surfaces[31] were used to ensure that the required obstacle separation was achieved in the design of instrument approach procedures. The surfaces were generally above the OLS and were designed to safeguard an aircraft from collision with obstacles when the pilot was flying solely by instruments, in conditions of poor visibility (Department of Infrastructure, Transport, Regional Development and Communications, 2019). Various components of these surfaces were used to establish the 'lowest possible operating minima for instrument flight procedure' (International Civil Aviation Organization, 2020a). For precision approaches, such as the runway 26 instrument landing system approach at Essendon Fields Airport, these surfaces were complex.

Determining instrument approach landing minima for runway 26

Only an instrument flight procedure designer certified in accordance with Part 173 of the Civil Aviation Safety Regulations could design an instrument approach procedure for use at an aerodrome (certified designers include Airservices Australia and others). Figure 7 shows the basic structure of an ILS instrument approach, which was a type of precision approach and was in use for runway 26 at Essendon Fields Airport.

Figure 7: ILS missed approach



Source: Skybrary, modified by the ATSB

When conducting the ILS instrument approach towards the runway, the pilot follows the horizontal approach path provided by the localiser transmitter and descends along the vertical path provided by the glide slope transmitter to the decision altitude/height (DA/H) or landing minima (Figure 7). At the DA/H, if the pilot does not have the required visual cues necessary to continue the approach to land, a missed approach must be initiated. The decision altitude (DA) is referenced to mean sea level while the decision height (DH) is referenced to the runway threshold elevation.

The obstacle clearance altitude/height (OCA/H) is the lowest point at which a missed approach shall be initiated to ensure compliance with obstacle clearance criteria. That altitude/height was determined through identifying obstacles within specific airspace around the final approach path, the runway, and a specific segment of the missed approach path. When the highest obstacle

[31] Part 173 of the Civil Aviation Safety Regulations 1998 required the instrument flight procedures comprising the PANS-OPS to be designed in accordance with appliable standards set out in ICAO Doc 8168 (PANS-OPS) *Procedures for Air Navigation Service – Construction of Visual and Instrument Flight Procedures*.

was established, a margin for height loss to transition from an approach descent profile to a missed approach climbing profile is added, with the result being the OCA/H. A predetermined clearance margin is then added to the OCA/H, which establishes the approach's DA/H.

Commencing a missed approach at, or above the OCA/H ensured that (International Civil Aviation Organization, 1983):

> …even if the pilot has no outside visual reference to the ground at any point, the aeroplane will pass safely above all potentially dangerous obstacles. The pilot may descend below the OCA/H only if he [sic] has visually confirmed that the aeroplane is correctly aligned with the runway and that there are sufficient visual cues to continue the approach. The pilot is permitted to discontinue the approach at any point below the OCA/H, e.g. if the required visual reference ceases to be available. Such a late missed approach is called balked landing.

Should the pilot continue the approach to land from the DA/H, which was known as the visual segment of the instrument approach, obstacle clearance was partly assured by a PANS-OPS surface known as the visual segment surface. Further protection from obstacles was also provided by the ICAO Annex 14 OLS and related obstacle limitation and marking/lighting requirements. The relationship between the PANS-OPS and OLS was described as (International Civil Aviation Organization, 1983):

> …it must be stressed that a runway protected only by the obstacle limitation surfaces of Annex 14 will not necessarily allow the achievement of the lowest possible operational minima if it does not, at the same time, satisfy the provisions of the PANS-OPS. Consequently, consideration needs to be given to objects which penetrate the PANS-OPS surfaces, regardless of whether or not they penetrate an Annex 14 obstacle limitation surface, and such obstacles may result in an operational penalty.

Basic ILS surfaces

There were several methods for determining the OCA/H for an ILS based precision approach procedure, which involved progressively increasing the degree of sophistication in the treatment and accountability of obstacles (International Civil Aviation Organization, 2020c). The most sophisticated was the collision risk model, which was a computer program that established the numerical risk that could be compared to a target level of safety for aircraft operating to a specified OCA/H height (International Civil Aviation Organization, 2020c). Airservices Australia indicated this model was used at Essendon Fields Airport. All the methods relied on an assessment of obstacle data. This included data that came from consideration of obstacles that penetrated the 'basic ILS surfaces'. Essentially, these surfaces provided a simple form of obstacle protection for ILS operations.

These surfaces were determined in accordance with ICAO Doc 8168-OPS/611 Volume II (*Procedures for Air Navigation Services – Construction of the Visual and Instrument Flight Procedures*).[32] The surfaces corresponded to a subset of the OLS defined in ICAO Annex 14 (rather than the Australian aerodrome standards) for a code 3 or 4 precision approach runway. This included a component of the approach surface, runway strip, missed approach surface, and the extended transitional surface along the side of the approach and missed approach surfaces up to a height of 300 m above the threshold (International Civil Aviation Organization, 2020c). Penetrations of these surfaces, as well as consideration of obstacle density, could result in adjustments to the OCA/H (International Civil Aviation Organization, 2020c).

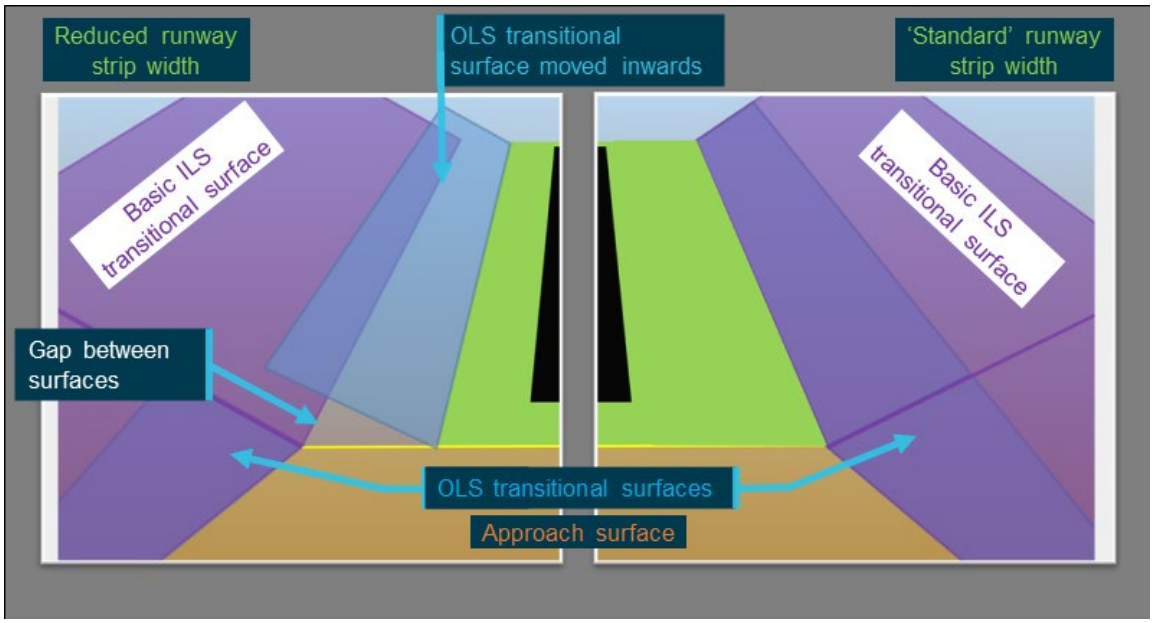
Effect of a reduced runway strip width on basic ILS surfaces

As discussed above, according to CASA's interpretation of the Australian aerodrome standards, the OLS transitional surface would move in towards the runway with a runway strip width less than the standard. However, while the basic ILS transitional surface (see Figure 8) was based

[32] The MOS Part 139, Part 139 MOS and the Airports (Protection of Airspace) Regulations 1996 stated that the PANS-OPS surfaces were to be determined in accordance with ICAO Doc 8168.

on an extension of the OLS transitional surface, the basic ILS transitional surface would not move with a change in the actual runway strip width. This was due to the basic ILS transitional surfaces using the dimension prescribed for a code 3/4 precision approach runway OLS in ICAO Annex 14 (where the transitional surface was static) rather than the Australian aerodrome standards. When the OLS transitional surface was moved using the Australian aerodrome standards, this created a gap between the basic ILS transitional surface and the relocated OLS transitional surface, as shown in Figure 8.

Figure 8: Effect on the OLS and basic ILS transitional surfaces with a reduced runway strip width (not to scale)



Source: ATSB

Monitoring obstacles and structures around aerodromes

For a runway with an instrument approach, the aerodrome operator was required to establish procedures to monitor for obstacles in relation to the OLS and the instrument procedures. While the aerodrome operator's monitoring obligations for the OLS were consistent across iterations of the Civil Aviation Safety Regulations 1998 and accompanying standards, the requirements for monitoring PANS-OPS surfaces (including the basic ILS) associated with the instrument procedures changed in the level of direction provided.

For a precision approach runway, under the regulations and MOS Part 139, the aerodrome operator was required to monitor any object that may penetrate the applicable OLS.[33] Under MOS Part 139 there were additional requirements for monitoring PANS-OPS surfaces for a non-precision approach runway.

The procedure designer was required to provide the aerodrome operator with 'diagrams and obstacle data sufficient to enable the aerodrome operator to fulfil obligations to report and monitor obstacles in the vicinity of an aerodrome as required under the regulations'.[34] Noting that for a precision approach runway the emphasis was on the aerodrome operator monitoring the OLS, there was no guidance for where changes to the OLS created a gap between the OLS transitional surface and the corresponding basic ILS surfaces.

[33] MOS Part 139 subsection 7.1.7.
[34] MOS Part 173 subsection 6.1.5.

The monitoring requirements with respect to precision approach and non-precision approach runways were clearer under the Part 139 MOS 2019 and regulations.[35] There was a specific direction for the aerodrome operator to monitor for infringements into the OLS and 'surfaces associated with any published terminal instrument flight procedures at the aerodrome (as defined by PANS-OPS)'.[36] There was an existing requirement in the regulations for the aerodrome operator to include procedures in the aerodrome manual to monitor for building developments within the horizontal limits of the OLS, and for new objects or developments in any other area nominated by the instrument procedure designer.[37]

ATSB observation

The basic ILS surfaces were based on the standard dimensions of the runway strip and the OLS in ICAO Annex 14. They were not determined by the dimensions in the Australian aerodrome standards or what an aerodrome operator published as the actual runway strip and OLS. Therefore, changes to the runway strip and/or OLS could result in a gap between the transitional surfaces components of the PANS-OPS basic ILS surfaces and the OLS surfaces. There was therefore the potential for penetrations of the transitional surface component of the PANS-OPS basic ILS surfaces to not be identified due to the obstacle monitoring requirements in the Australian aerodrome standards only applying to the OLS established in accordance with those standards.

35 Civil Aviation Safety Regulation 139.090 – in force F2020C00793.

36 Part 139 MOS subsection 11.06 Obstacle control.

37 Civil Aviation Safety Regulation 139.095 (a)(ii) Appendix 1 (l) – in force F2020C00596.

Acceptance of non-compliance with the aerodrome standards

As detailed above, aerodrome design requirements, including the dimensions of runway facilities and the OLS, were governed by the Australian aerodrome standards. If an aerodrome operator could not comply with these standards, there were different means by which CASA could accept the operation of a non-compliant facility or OLS. These are set out in Table 5 below with reference to the RPAs, MOS Part 139 and Part 139 MOS 2019, which were relevant to the period for this investigation. Appendix A contains extracts of the standards referenced.

Table 5: Means for accepting non-compliance with a standard

Non-compliance acceptance	Standards	Description
Grandfathering	RPAs MOS Part 139 Part 139 MOS 2019	A grandfathering provision allowed an aerodrome facility and/or OLS associated with the runway to remain compliant with the standards that preceded the current standard. An aerodrome operator could continue to comply with a historical rule or standard until the facility and/or OLS was replaced or upgraded. Under the RPAs, the grandfathering provision stated that there was no requirement for an aerodrome operator to apply RPA standards retroactively to an existing facility where such an application would involve significant cost. The ATSB could not determine from the wording of the RPAs whether a concession was required from CASA to grandfather an aerodrome facility. In contrast, under MOS Part 139 and Part 139 MOS 2019, there was no comparable requirement to consider cost or the equivalent of a concession such as an exemption. Grandfathering was achieved by the aerodrome operator identifying in the aerodrome manual the provisions of the historical standards it was applying to the facility and/or OLS. The aerodrome operator had to document a date by which the facility/OLS would become compliant.
Concession	RPAs	An aerodrome operator could apply to obtain a concession from CASA for a non-compliance with a standard. CASA could impose restrictions to ensure an equivalent overall level of safety to what was originally expected was achieved.
Exemption	MOS Part 139 Part 139 MOS 2019	An aerodrome operator could apply to CASA for an exemption for a non-compliance with a standard. The application for an exemption had to meet the requirements in Subpart 11.F of the Civil Aviation Safety Regulations 1998. The applicant had to detail any aircraft, aeronautical product, or kind of operation that would be affected by the exemption; the reasons why the exemption was necessary; and how they proposed to ensure that an acceptable level of safety would be provided when operating in accordance with the exemption. When assessing an exemption, CASA 'must regard the preservation of a level of aviation safety that is at least acceptable as paramount'. Exemptions ceased within 3 years. They could only be reissued if there was a change in circumstances that prevented compliance within the timeframe.
Authorisation	RPAs MOS Part 139 Part 139 MOS 2019	Some provisions within the standards provided CASA with the ability to authorise an aerodrome operator to conduct a task or operation in a specified way. CASA would consider whether there was an adverse effect on aviation safety and could impose conditions on the operator in the interests of safety and regularity of aircraft operations. Authorisations were not broadly available for operating non-compliant runway facilities and OLS. They were available for specific operating conditions such as authorising the presence of an obstacle on the runway strip.

Non-compliance acceptance	Standards	Description
Approval	Part 139 MOS 2019	Part 139 MOS 2019 introduced the ability for CASA to provide an approval for non-compliance with a standard. The aerodrome operator had to satisfy CASA that an approval would not have any adverse effect on aviation safety. Approvals could be time limited or enduring. The provision to obtain an approval was not available under the former MOS Part 139 or the RPAs (although approvals could be obtained for specific things like obstacles in the obstacle restriction area). However, a concession under the RPAs was not necessarily time limited, which meant a similar outcome to an approval could be achieved.
Practicability	RPAs MOS Part 139 Part 139 MOS 2019	Some provisions in the standards included practicability considerations for not meeting the standard. These are discussed in detail in Chapter 6 with respect to the runway strip width and the need to also obtain a concession/exemption.

ATSB observation

There were differing conditions attached to the varying means for accepting an aerodrome operator's non-compliance with a standard. All the means for obtaining acceptance, apart from grandfathering, required consideration of the safety effect by the regulator. Grandfathering was permitted by the standards without a formal requirement to seek approval from the regulator with consideration of the safety effect.

Finding

ATSB finding

The wording of the International Civil Aviation Organization (ICAO) Annex 14 and the Australian standards for the transitional surfaces was not clear on how they should be applied when the runway strip width (as permitted) was less than the standard. Both standards worked in practice where the strip width and associated OLS met the standard dimensions. However, the wording of the respective standards was open to different interpretations for addressing the misalignment between the runway strip width and the inner edge of the approach surface. Neither ICAO or the Civil Aviation Safety Authority provided guidance in support of their respective interpretations.

5. Summary of changes at Essendon Fields Airport

Introduction

The published dimensions of the runway 08/26 strip width and the associated obstacle limitation surfaces (OLS) at Essendon Fields Airport have changed over time. Table 6 below shows these changes along with the aerodrome reference code applicable at the time. The summary information in the table is derived from evidence detailed in Appendix B.

Table 6: Documented runway strip width, inner edge of the approach surface (for runway 26 only), and transitional surface dimensions for runway 08/26

Year	Aerodrome reference code	Runway strip width (m)	Approach inner edge (m)	Transitional surface (m)[1]	Source
1960	N/A	~300	Unknown	Unknown	Aerodrome landing chart
1972	N/A	180	180	90	Clearance surfaces chart
2000	4	180	180	Not stated	OLS survey, published data
2001	4	180	300	Unconfirmed	OLS survey, published data, Essendon Airport Ltd aerodrome manual
2003	4	180	300	90	OLS survey, Essendon Airport Proprietary Limited aerodrome manual, En Route Supplement Australia
2015	4	300	300	150	Civil Aviation Safety Authority, En Route Supplement Australia
2019	4	180	300	90	Essendon Airport Proprietary Limited aerodrome manual

[1] Stated as metres from the runway centreline.

Changes 1960 to 1972

As detailed in Chapter 4, the Airport Engineering Instructions (APEI) applied during the period 1960 to 1972 with different strip width requirements for aircraft engaged in international operations conducting precision approaches. The change to the runway strip width from 300 m to 180 m, between 1960 and 1972, occurred when international operations were transferred from Essendon Airport to Tullamarine Airport (refer to section titled *History* in Chapter 3). The inner edge of the approach surface and the transitional surfaces were aligned around a 180 m runway strip width.

Changes 2000 to 2003

A 2001 version of Essendon Airport Limited's aerodrome manual stated that the Rules and Practices for Aerodromes (RPAs) and the International Civil Aviation Organization Annex 14 were the applicable aerodrome standards for determining facilities (such as the runway strip) and the OLS. There was no mention of the APEIs.

Runway 26 was declared to be a code 4 runway. The runway strip width for runway 08/26 was published as 180 m. However, there was no explanation in the manual as to how that dimension was being maintained. The requirement in the RPAs for a code 4 runway was a 300 m strip

(unless a lesser strip width was accepted as per the requirements in the standards discussed in Chapter 6).

In 2001, the inner edge of the approach surface for runway 26 was changed from 180 m to 300 m through a survey of the OLS. The change was made with Essendon Airport Limited and the Civil Aviation Safety Authority (CASA) noting a 300 m inner edge was required in the RPAs for a code 4 precision approach runway.

There was no data available to the investigation to determine if any changes had been made in 2001 to the location of the transitional surfaces. The 2001 OLS survey diagram did not include the transitional surface. A later diagram in 2003 showed the lower edges of the transitional surfaces placed either side of the 180 m strip width. The other parts of the transitional surfaces were along the sides of the approach surface for runway 26 with a 300 m inner edge.

The runway strip width's compliance with the aerodrome standards and the construct of the transitional surface during this period is discussed in Chapter 6.

Changes in 2015

In 2015, CASA promulgated instrument 153/15 (refer to section titled *CASA instrument 153/15* in Chapter 8) The instrument required Essendon Airport Proprietary Limited (EAPL) to declare a 300 m runway strip width to make runway 08/26 compliant with the then applicable Manual of Standards Part 139 – Aerodromes (MOS Part 139). The location of the lower edge of the transitional surface alongside the runway strip width moved out with the change in dimension. The inner edge of the approach surface for runway 26 remained at 300 m.

Changes in 2019

In 2019, EAPL used 'grandfathering' provisions in the MOS Part 139 (refer to Chapter 8). They grandfathered the runway strip width and the transitional surface against the APEIs and changed the strip width back to 180 m. EAPL also moved the location of the transitional surface back in towards the runway against the reduced strip width. The inner edge of the approach surface for runway 26 remained unchanged at 300 m. CASA accepted EAPL's use of the grandfathering provisions and subsequently revoked instrument 153/15.

Changes to the landing minima

The ATSB sought advice from Airservices Australia in 2018 about adjustments to the landing minima. The decision altitude/height (DA/H) for a missed approach for an aircraft conducting an instrument landing system (ILS) approach on runway 26 had been raised above 200 ft (referenced to the runway threshold elevation) prior to proposals for the development of the Bulla Road Precinct. In 2003, the published ILS decision altitude (DA) and decision height (DH) was 490 ft and 251 ft respectively.

Between 2005 and 2008, the DA/DH was adjusted to accommodate the Eureka Tower building located at Southbank in Melbourne's city centre. Airservices Australia advised that the location of this building required a greater than normal climb rate during the first segment of the missed approach. An ILS chart dated June 2006 identified that, if an aircraft could achieve this higher climb rate, the DA/DH were 590 ft and 351 ft respectively, otherwise they were 640 ft and 401 ft. The chart also identified that, when an actual aerodrome QNH[38] from an approved source was used,[39] the DA/DH stated on the chart could be reduced by 100 ft. If used, this would result in a DA/DH of 490 ft and 251 ft for the greater climb rate missed approach, or 540 ft and 301 ft otherwise.

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[38] QNH: the altimeter barometric pressure subscale setting used to indicate the height above mean sea level.

[39] Airservices Australia Aeronautical Information Publication, ENR 1.5 – Holding, approach and departure procedures, section 5 - Application of aerodrome meteorological minima, subsection 5.3 - QNH Sources.

From around 2008, following confirmation of the height of the Eureka Tower, the DA/DH were restored to the previous values of 590 ft and 351 ft. The chart dated 5 November 2020 indicated the DA was the same but the DH was 350 ft.

6. Bulla Road Precinct approval

Introduction

Leading up to the approvals of the Essendon Fields Airport master plan (2003) and major development plan for the Bulla Road Precinct (2004), varying views had been expressed on the requirements for the runway 08/26 strip width and the associated transitional surfaces. This was relevant to the planning documents, as their dimensions and location determined how high and how close to the runway buildings and other structures could be established.

This chapter explores the historical uncertainty around the dimensions of the runway strip width and location of the transitional surface. This is then used to establish what assurance there was that the 08/26 runway strip width and obstacle limitation surfaces (OLS) complied with the applicable aerodrome standards when planning approval was obtained for the development and the buildings were constructed.

Licensing and certification status of Essendon Fields Airport

On 3 May 2003, the new Manual of Standards Part 139 - Aerodromes (MOS Part 139) of the Civil Aviation Safety Regulations 1998 came into effect. These regulations replaced the regulatory framework for aerodromes under former Part 9 of the Civil Aviation Regulations 1988. The status of the operator of Essendon Fields Airport, either as 'licensed' under Part 9 of the old regulations or 'certificated' under Part 139 of the new regulations, determined what aerodrome standards they were obliged to comply with. Table 7 sets out the aerodrome operator's status and what standards were applicable from 1998 to the application of MOS Part 139, supported by reference to the regulations and standards detailed in Appendix A.

Table 7: Licence/certification status of Essendon Fields Airport

Time period	Licence/certificate holder	Status	Aerodrome standard
2 July 1998–20 June 2002	Essendon Airport Limited	Licenced	Rules and Practices for Aerodromes (RPAs)
21 June 2002–2 May 2003	Essendon Airport Proprietary Limited	Licenced	RPAs
3 May 2003 –18 May 2005	Essendon Airport Pty Ltd (EAPL)	Transitional licence (refer below)	MOS Part 139 or the RPAs for the runway movement area (including runway strip) and OLS
19 May 2005–	EAPL	Certificated	MOS Part 139

The requirements of the new MOS Part 139 were applicable from May 2003 subject to transitional provisions for Part 139 of the Civil Aviation Safety Regulations. As Essendon Airport Pty Ltd (EAPL) did not apply for a certificate under the new regulations, they were taken to have a transitional licence. As a transitional licence holder, EAPL was treated as if they were certificated under the new regulations (refer to Appendix A for the applicable transitional provisions). However, while they held a transitional licence, they were not required to meet the standards in the MOS for the declaration of dimensions of facilities in the movement area (including the runway strip width) and the OLS, provided they met the requirements of Rules and Practices for Aerodromes (RPAs).

ATSB observation

During the period 3 May 2003 to 18 May 2005, EAPL had a transitional aerodrome licence and could continue to comply with the RPAs for the dimensions of the runway strip width and OLS. If they did not comply, EAPL had to meet the requirements of the new MOS Part 139.

Standards for the runway strip width, the approach surface, and transitional surfaces

Chapter 4 detailed the requirements in the aerodrome standards for determining the dimensions of the runway strip width (Table 2) and the inner edge of the approach surface (Table 3) for a code 4 precision approach runway. Under the RPAs and the MOS Part 139 (applicable for the period considered in this chapter) both surfaces were required to be 300 m. The requirements for locating the transitional surfaces in connection with the strip width and the approach surface were set out in Table 4. Under the RPAs and the MOS Part 139, the lower edge of the transitional surfaces originated from the side of the runway strip (the overall strip) and the side of the approach surface.

To maintain the runway strip or the OLS with dimensions less than the standards current at the time, an aerodrome operator was generally required to have done one of the following:

- grandfathered to the requirements of an earlier standard[40]
- complied with the practicability requirements for a lesser strip width (which could include a concession/exemption)
- otherwise obtained a concession/exemption from CASA.

Table 5 summarised these means for maintaining non-compliance with the RPAs and the MOS Part 139.

Reducing the strip width on practicability grounds

Both the RPAs and early versions of MOS Part 139 allowed for reductions of the runway strip width down to 150 m where it was not practicable to maintain a full strip width and subject to adjustments to the landing minima. There was no guidance accompanying the RPAs or early versions of MOS Part 139 that explained how to interpret the term ‘practicable’.

The term practicable in the Australian aerodrome standards is derived from a similar provision for the runway strip width in the international standards. The Secretariat for the International Civil Aviation Organization (ICAO) provided the ATSB with advice that the phrase ‘wherever practicable’, with reference to providing the full strip width required by the standards in ICAO Annex 14, was first introduced in 1958 to provide countries with reasonable discretion in applying the standard. The Secretariat gave the example of it being used where there was difficulty (such as from physical constraints) applying the standard to an aerodrome that was built before 1958. The Secretariat stated that contracting States were expected to interpret the provision in good faith.

There was some ambiguity as to whether an aerodrome operator was required to obtain a concession from CASA under the RPAs if the strip width was to be reduced on practicability grounds. As stated in Table 5, obtaining a concession would have meant that CASA would have considered whether an equivalent level of safety could be maintained with the concession. The alternative interpretation was that the aerodrome operator could determine whether it was practicable to maintain a full strip width in accordance with the standard without seeking a concession from CASA.

The RPAs contained both standards (mandatory requirements) and recommended practices. Concessions were only required against the standards. The RPAs advised that:

> Standards are phrased in the text as direct requirements, i.e. “is to” or “are to”. Recommended practices are phrased as discretionary matters, i.e. “should” or “may”.

[40] As shown in Table 5, the ATSB could not determine whether a concession was required under the RPAs for grandfathering. Under the MOS Part 139 it was clear that an exemption was not required.

The provisions in the RPAs used mandatory language in the section setting the dimensions for the strip width and discretionary language for reducing the strip width on practicability grounds:

> 7.17.6. A precision approach runway is to be centrally located within a runway strip consisting of a graded portion and a fly-over area such that the overall runway strip width is as shown in table 7-9
>
> **Table 7-9: Runway Strip Width for Precision Approach Runways**

Aerodrome facility reference code	Overall strip width
1,2	150 m
3,4	300 m

> 7.17.7. Where it is not practicable to provide the full runway strip width, a lesser graded only strip width not less than 90m for code 1 and 2 and 150m for code 3 and 4 respectively may be provided subject to landing minima adjustments.

The MOS Part 139 stated that a safety case (that is, a risk assessment) was required for the strip width to be reduced on practicability grounds. Further, it was clear that an exemption (Table 5) from CASA was also required. The wording of the exemption provision in MOS Part 139 stated that standards that included phrases such as 'if practicable' still required an exemption if aerodrome operators were to take 'advantage of the non-practicability of full compliance'. The provision detailing the requirements for obtaining a concession under the RPAs did not include the same clarifying statement.

Grandfathering

Table 5 of Chapter 4 provided a summary of the requirements for grandfathering. Further details of the grandfathering provisions in the RPAs and the MOS Part 139, applicable at the time the master plan and Bulla Road Precinct major development plans were being developed and approved, are provided below.

RPAs

> 1.6. It should be noted that there was no requirement for an aerodrome operator to apply RPA standards retroactively to an existing facility where such an application would involve a significant cost. However, the standards are to be applied to all new facilities and to every case of a major upgrade of an aerodrome facility. The aerodrome operator is to seek from CASA a written concession to cover the interim period prior to the existing facility being upgraded to meet the new standards, and details of the concession are to be noted in the aerodrome manual.

MOS Part 139

> 2.1.2.1 Standards are subject to change from time to time. In general, unless specifically directed by CASA, subject to Paragraph 2.1.2.3, existing aerodrome facilities do not need to be immediately modified in accordance with the new standards until the facility is replaced or upgraded to accommodate a more demanding aircraft.
>
> 2.1.2.2 Unless otherwise directed by CASA, an existing facility that does not meet the standard specified in this Manual must continue to comply with the standard that was applicable to it.
>
> 2.1.2.3 At a certified aerodrome, an existing aerodrome facility that does not comply with this MOS must be identified and recorded in the Aerodrome Manual, described in Chapter 3 must include the date or period when that facility was first introduced or last upgraded and an indication from the aerodrome operator of a plan or timescale to bring the facility in compliance with the MOS. As part of CASA audit, evidence to demonstrate efforts to implement plan or timescale may be required.

The Civil Aviation Safety Authority (CASA) advised the ATSB in 2019 that they considered the runway 08/26 strip width should have been subject to 'administrative' grandfathering against the Airport Engineering Instructions (APEIs) in 1987 when the Rules and Practices for Aerodromes (RPAs) came into effect. CASA considered that grandfathering would have documented the

operator's compliance with the APEIs forming the basis on which the operator declared a strip width of 180 m. There was no evidence available to the investigation of grandfathering prior to the approvals of the master plan and major development plan. During this period, CASA, EAPL and the Department of Transport and Regional Services (the Department) were seeking to determine compliance under the standards applicable at the time.

2003 Essendon Fields Airport master plan

As noted in Chapter 2, federally leased airports were required to have in place a master plan under the *Airports Act 1996*. After taking over the lease of Essendon Fields Airport, EAPL commenced preparations for developing the master plan. The plan, which detailed EAPL's direction for the future development of the airport, included references to the Bulla Road Precinct. It also mentioned reducing the dimensions of the runway 08/26 strip width and changing the location of the associated OLS.

Discussions about reducing the runway 08/26 strip width

In 2002, discussions were held between representatives of EAPL and CASA regarding EAPL's intention to reduce the runway 08/26 strip width and change the OLS. As such, on 11 June 2002, Airbiz (an aviation consultancy) wrote to CASA on behalf of EAPL with the following:

> As discussed, as part of the Draft Preliminary Master Plan being prepared in accordance with the *Airport's Act 1996*, it is the intention to reduce the strip width on Runway 08/26 to 150m and promulgate the Obstacle Limitation Surfaces (OLS) based from this width. It is also the wish of the airport owner for Airservices Australia to maintain an operating ILS [instrument landing system] on this runway, irrespective of the revised OLS.
>
> Your preliminary advice was that CASA's position is that under existing rules and practices (RPA's) one cannot operate an ILS off a 150m strip unless there is a practical reason (i.e., physical or technical) preventing it. You advised that a precision approach procedure requires protection from a 300m strip for a code 4 runway. Runway 08/26 at Essendon Airport is code 4 runway.
>
> You further advised that a request for approval for other reasons (eg, commercial reasons) represents a precedent which would need to be considered in Canberra. You invited me to write formally to CASA so that you may co-ordinate input from various relevant CASA departments as well as Airservices and DOTARS [the Department] to prepare a considered response.
>
> This letter therefore represents a formal request by Airbiz, on behalf of the Essendon Airport owner – Essendon Airport Pty Ltd, seeking feedback on the proposal to reduce the 08/26 runway strip to 150m. In particular, we request your opinion as to whether Airservices Australia can continue to operate the ILS (albeit with a raised "Decision Height") on a code 4 runway with the OLS protection promulgated from this 150m strip…

Following discussions with the Department and Airservices Australia, CASA wrote back to EAPL via Airbiz on 18 June 2002:

> I refer to your letter of 11 June 2002 outlining the proposal to reduce the existing Runway Strip (RWS) width from 300 to 150 metres wide and to base the origin of the Obstacle Limitation Surfaces (OLS) on the reduced RWS width.
>
> Runway (RWY) 08/26 is a Code 4, Precision Approach Category I RWY. Both the Rules and Practices for Aerodromes (RPA) and the International Standards and Recommended Practices for Aerodromes (Annex 14) mandate that a 300 metre wide RWS is the origin for the 1:7 side transitional surfaces.
>
> The CASA role is to regulate and secure compliance with the Australian aviation standards. Currently, at 300 metres width, RWS 08/26 meets the RPA standard. An exemption would be required for a RWS reduction from 300 to 150 metres. Generally, exemptions are only issued when there has been a change in the standard and the existing facility no longer meets the new standard. This is not so in the current proposal.

> An application for an exemption must be supported by a safety case. The safety case will need to address the following:
>
> (a) why a need to change the status quo;
>
> (b) measures to provide equivalent level of safety;
>
> (c) what impact a new reduced OLS will have on the Instrument Landing System facility and how it may affect Melbourne Airport;
>
> (d) as the RWS reduction will reduce the efficiency of the RWY, documentary evidence that all stakeholders (Airservices Australia; Department of Transport and Regional Services; aircraft operators; aircraft maintenance organisations; and any other Federal, State and Local Governments, etc.) have been consulted, and are supportive of, and at least not opposed to the proposal; and
>
> (e) if its intended to allow buildings and other development to be located closer to the RWY, measures to enforce obstacle marking, lighting and other activities that may create a hazard to aircraft navigation…

EAPL did not seek an exemption from CASA prior to submitting the draft master plan to the Department. However, in September 2002, EAPL provided CASA with a copy of the plan, which included the proposal to reduce the runway strip width. On 21 November 2002, CASA wrote back to EAPL directing them to the previous correspondence sent via Airbiz on 18 June 2002.

Submission of the draft master plan

EAPL submitted the draft master plan to the Department on 27 December 2002, which included the following advice about the proposed reduction of the runway strip width:

> Essendon Airport Pty Ltd is presently proposing a 150 m strip width for runway 08-26. This does not involve any change to the length or width of the pavement surface, only the width of the grassed area either side of the runway and the points from which the Obstacle Limitation Surface is calculated.

In further statements in the plan, EAPL said 'this was subject to resolution with CASA'. There were also inconsistent references to the current dimensions that the strip width was being reduced from. In one section, EAPL referred to the reduction to 150 m allowing 'an extra 75 m of room for development to occur close to the runway centreline'. To achieve this, the original strip width would have had to be 300 m. Similarly, in the 'Executive Summary', EAPL stated that the reduction was from a 300 m strip width. However, another section referred to reducing the strip width from 180 m to 150 m.

On 31 January 2003, the Department provided EAPL with its initial assessment of the plan. The Department questioned the need to reduce the strip width and asked whether a safety case had been assessed by CASA. Following a meeting between the parties on 4 March 2003, EAPL wrote to the Department on 6 March to clarify their proposal to reduce the runway strip width, advising:

> Essendon Airport comprises two runways, a north-south (17/35) and east-west (08/26). Both runways have 45 metre bitumen surfaces, although the calculated width of runway 17/35 is 150 metres whilst 08/26 is 180 metres.
>
> Essendon's 08/26 is an Instrument Landings System (ILS) approach runway. The OLS calculation is taken from 150 metres from the runway's centreline.
>
> We understand these arrangements have been in place for decades, dating back to when Essendon was Melbourne's gateway domestic and international airport.
>
> *In essence, EAPL seeks to retain the runway's physical characteristics, but adopt a 150 metre runway width and calculate the OLS from the edge of this runway width.*
>
> This configuration would enable the development of an increased, commercially viable building envelope within the Bulla Precinct, whilst retaining the operational status quo of the runway for aircraft operators.

Earlier, on 17 January 2003, the Department wrote to CASA seeking their views on the plan. The Department noted CASA's previous comments to EAPL, dated 18 June 2002. CASA responded to the Department on 14 March 2003 stating:

> Provision of aviation facilities is a matter for the aerodrome operator. However, CASA would need to be satisfied that, for the type and level of aircraft operations at the aerodrome, the aviation facilities provided are appropriate and are in accordance with specified standards.
>
> CASA would expect to be consulted before any changes envisaged in the draft Master Plan are implemented by the airport operator.

Approval of the master plan

The ATSB's review of the CASA files for Essendon Fields Airport identified that there was likely further engagement with EAPL about CASA's views on the proposal to reduce the runway strip width. This occurred at the time the master plan was sent to the Minister for Transport and Regional Services (the Minister) for approval. On 26 March 2003, a senior CASA officer obtained a briefing from other CASA officers about the previous correspondence between CASA and EAPL. The officer was advised in the briefing:

> It is true that at a number of aerodromes equipped with ILS, due to terrain constraints, precision approach operations have been sanctioned where the runway strip widths are less than 300 m. This is allowed for in the standard and the reduced safety margin is recognised and sometimes compensated in the approach procedure. It should however be noted that this is a limitation imposed by site constraints. This is not the case for runway 08/26 therefore, it would be difficult to justify a reduction in the required standard especially for economic development reasons. This notwithstanding, the runway strip width may be reduced to 150 m if the ILS was decommissioned and replaced by a non-precision approach such as GPS.
>
> Accordingly, before any action is taken to actually reduce the runway strip width to 150 m, CASA needs to be assured that appliable standards will not be breached, or a proper safety assessment is made for any non-compliance situation.

There was no evidence on the available files to show if any further advice was provided by CASA to either the Minister's office or the Department. The Minister's office was working to approve the master plan on 27 March 2003. On that same day, EAPL wrote to the Minister advising:

> A provision of this draft Master Plan was a proposal to reduce the 08/26 runway strip width (for OLS calculation purposes) from 300 metres to 150 metres. This proposal's intent was to seek a more suitable land envelope for the development of the Bulla Road Precinct.
>
> …EAPL is now aware that this proposal has not yet attracted the support of the Civil Aviation Safety Authority.
>
> Accordingly, having reconsidered this matter and the process we undertook during the public consultation period to specifically address this issue, we have decided to withdraw the concept of reducing the runway strip width (for OLS calculation purposes) from 300 metres to 150 metres.

On 27 March 2003, the Minister approved the master plan with any references to reducing the runway strip width omitted. At the same time, EAPL published a 180 m runway strip width in the March 2003 version of the En Route Supplement Australia.

ATSB observation[41]

The applicable aerodrome standards at the time required a strip width of 300 m for runway 08/26. Although EAPL, CASA and the Department were discussing the reduction of the runway strip width from 300 m to 150 m, there was no available evidence, which showed that EAPL had published a 300 m strip width. Rather, the 2001 aerodrome manual and 2003 En Route Supplement Australia indicated the strip width was 180 m.

In correspondence about the draft master plan, EAPL referred to reducing the runway strip width from 300 m for 'OLS purposes'. Potentially, as set out in their 6 March 2003 letter to the Department, EAPL were seeking to differentiate the runway strip requirements from the OLS requirements. They published a 180 m runway strip width but believed they still had to locate the OLS transitional surface 150 m either side of the runway centreline.

Chapter 4 outlines ICAO's view on how the standard for the transitional surface was constructed. ICAO's view was that the location of the transitional surfaces was still determined by what the standard said the dimensions of runway strip width should be, which coincided with the width of the inner edge of the approach surface, and not what the published strip width was. This was consistent with EAPLs interpretation above that they would still require the 'support of CASA' to locate the transitional surface from a strip width less than 300 m despite the published runway strip already being less than that at 180 m. It was also consistent with CASA's 2002 advice that a 300 m strip width was the origin for the transitional surface.

2004 major development plan for the Bulla Road Precinct

Following the approval of the master plan, EAPL continued to progress arrangements for the development of the Bulla Road Precinct. In accordance with the Airports Act, they were required to submit a major development plan for the precinct to obtain approval from the Minister. The plan needed to include information about the location of the buildings relative to the runways and the OLS.

Continued discussions regarding the runway strip width and transitional surface

After the master plan was approved, incomplete records of exchanges (detailed below) between EAPL and CASA showed that the organisations were still seeking to resolve the dimensions required for the runway 08/26 strip width and the location of the associated OLS.

2003 aerodrome inspection

In 2013, EAPL submitted a safety case to CASA, which included information indicating that an aerodrome inspection had been conducted at Essendon in 2003. EAPL stated:

> During an aerodrome inspection in 2003, it was noted that certain structures associated with commercial development on the southern edge of Runway 26 penetrated the associated transitional surfaces of the OLS. As a result of this, the airport operator sought confirmation from CASA that the airport had correctly interpreted the regulatory standards, as detailed in the CASA Manual of Standards Part 139 (MOS 139).

There was no record on the CASA files of the aerodrome inspection report from 2003 that showed the penetration of the OLS. On 8 November 2022, in response to this draft report, CASA advised that it was unaware of any infringements of the OLS identified during an aerodrome inspection in 2003.

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[41] On 8 November 2022, in response to a draft of this report, EAPL submitted that the ATSB's observation was speculation and irrelevant as to what EAPL may or may not have believed about where the transitional surfaces were required to be located.

Essendon Airport Pty Ltd internal email

Records were obtained from EAPL and CASA covering the exchange on the applicability of MOS Part 139 and the required dimensions for the runway 08/26 strip width and associated OLS (below). The CASA files did not contain any further exchanges with EAPL on this matter. EAPL provided the following internal email dated 23 September 2003, where an EAPL office holder advised:

> I've had some further correspondence with CASA this afternoon…
>
> Following these discussions, CASA has agreed (verbally) to accept a 1-7 transitional surface from a 180 metre strip width, not the 300 metre Inner Edge [approach surface].
>
> This will give us an additional 60 metres of depth across the 600 metre (or so) frontage. Importantly, this will not require any changes to the Master Plan because our runway width is already 180 metres. It is simply changing the past technical argument. There has been varying views even within CASA on this so we have 100% secure reason not to put in a variation to the Master Plan.
>
> My view is that we can start development on 180 metres – without any approvals – as it is based off the existing specifications – but we have successfully argued a different interpretation…
>
> This should open up about 36,000 square metres of new land for development.

Essendon Airport Pty Ltd request for clarification of the aerodrome standards

It was evident that there were follow-up meetings between EAPL and CASA on the issue. Subsequently, on 1 October 2003, EAPL wrote to CASA seeking clarification on their interpretation of MOS Part 139. They noted that EAPL had previously applied to CASA and the Department to reduce the dimensions of both the runway 08/26 strip width and runway 26 approach surface inner edge. Referring to recent discussions with CASA, EAPL indicated that they now deemed 'these changes to be unnecessary'. Therefore, they intended to 'work within the airport's existing conditions'. EAPL sought confirmation from CASA that the following was the agreed understanding:

> 1) Essendon Airport's Runway 26 has an Approach Surface Inner Edge of 300 metres. This must be protected and maintained;
>
> 2) Essendon Airport's 08/26 Runway has a published Strip Width of 180 metres. The Transitional Surface of the OLS is measured from the edge of this Strip Width, being 90 metres from the centreline. From this point, the Transitional Surfaces slopes upwards and outwards at a rate of 1-7, to a height of 45 metres.
>
> We are confident that this interpretation is correct but would appreciate your confirmation of these details.

Civil Aviation Safety Authority advice to Essendon Airport Pty Ltd

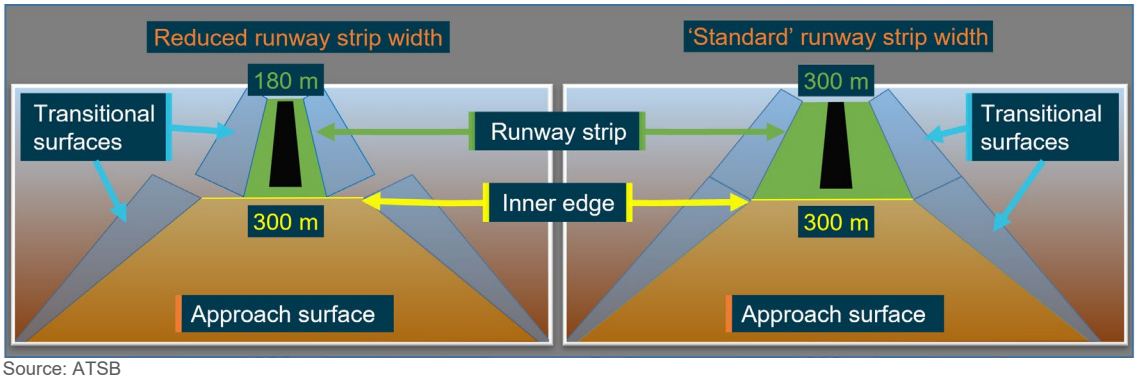
On 2 October 2003, CASA responded to EAPL's written request to confirm the applicability of the MOS Part 139 requirements for runway 08/26. The letter stated:

> Thank you for meeting with us on 30 September 2003 and your letter of 1 October 2003 in regard to confirmation of standards applicable to Essendon Airport.
>
> I can certainly confirm that your interpretations are correct, viz:
>
> 1) The approach [surface of the] OLS for Runway 26, a precision approach runway, must be based on an inner edge of 300m. Essendon Airport needs to have a monitoring program, which includes arrangements with relevant planning authorities, to ensure that any object that may infringe the OLS is brought to CASA's attention.
>
> 2) As stated in MOS section 7.3.2.6, the lower edge of the transitional surface originated from the side of the runway strip along the runway, and from the side of the approach surface for the portion of the approach that is below the inner horizontal surface [see Figure 3]. In the case of Runway 08/26, the portion of the transitional surface along the runway is based on the published runway strip width of 180m.

> As discussed in our meeting of 30 September 2003, you still need to monitor the airspace between the actual transitional surface and the transitional surface if the runway strip width is 300m. Information of any new obstacle in this area should be notified to Airservices Australia's Procedure Design Section to ensure that the published decision height of the ILS procedure is not compromised.

Figure 9 is a graphical representation of the dimensions and location of the runway 08/26 strip width and transitional surface as detailed in CASA's advice (left) and that normally required by the aerodrome standards (right). On the left, the transitional surface ran alongside the reduced runway strip width of 180 m and then 'stepped up' to accommodate an approach surface for runway 26 with a 300 m inner edge. On the right, the transitional surface was based on a 300 m inner edge and strip width, as per the standards.

Figure 9: Depiction of variation in the runway 08/26 strip width and transitional surface



Source: ATSB

On 8 November 2022, in response to this draft report, CASA stated that the advice provided by a CASA officer in the October 2003 letter regarding the 300 m dimension for the inner edge of the approach surface was incorrect.

ATSB observation[42]

After the master plan was approved, there were further discussions between EAPL and CASA regarding the location of the lower edge of the transitional surface, alongside the runway strip. That was, whether it was to be based on the dimensions of the approach surface inner edge (and the standard runway strip width) or the published runway strip width. In the October 2003 letter, CASA advised EAPL that the lower edge was based on the published strip width of 180 m, while the portion alongside the approach surface (for runway 26) was to be based on 300 m. This essentially separated the transitional surface into 2 portions, which were not aligned.

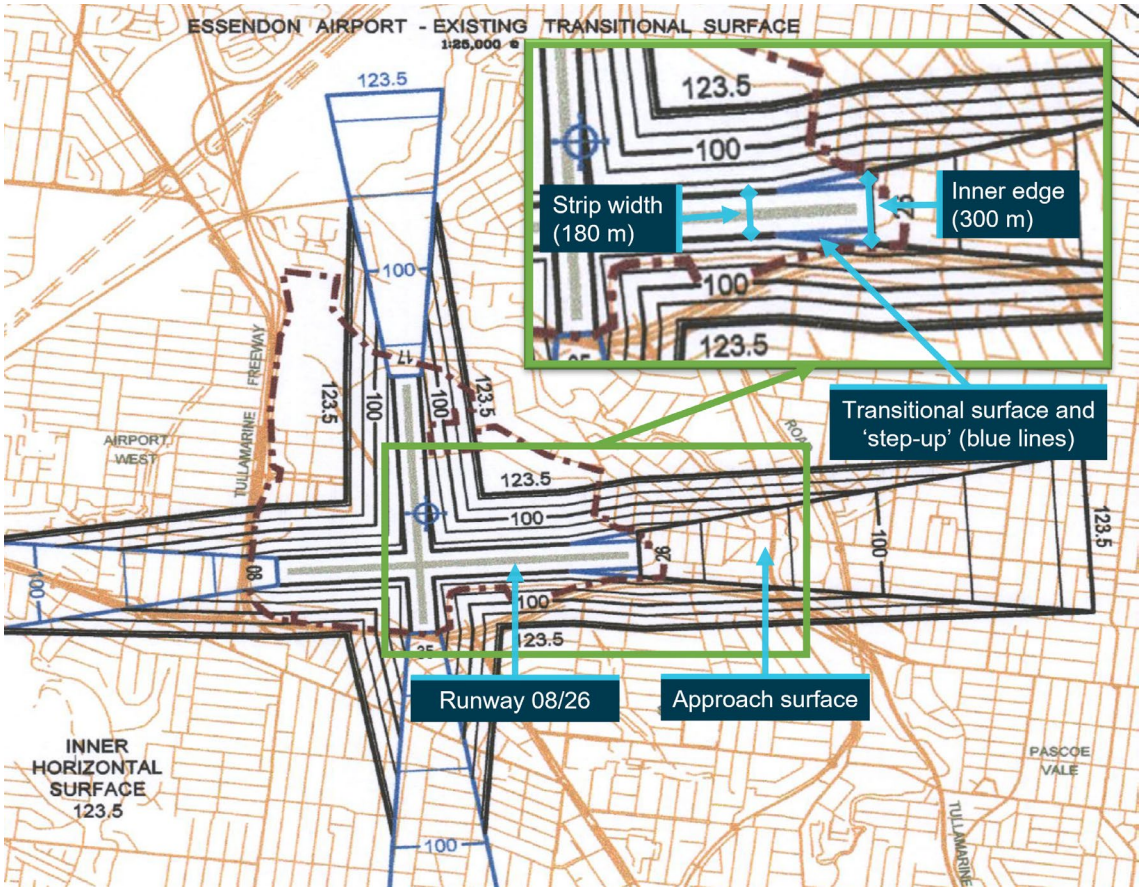
By advising EAPL to also continue to monitor a transitional surface based off a 300 m strip width, and report penetrations to Airservices Australia, the CASA officer appeared to have awareness the reduced strip width could affect obstacle monitoring with the basic ILS surfaces, which included the basic ILS transitional surface. As set out in Chapter 4, penetrations of the basic ILS surfaces were taken into account by the Airservices Australia instrument approach procedure designer in determining the landing minima. Chapter 9 discusses the risk with moving the OLS transitional surface and its effect on the obstacle monitoring requirements for the basic ILS transitional surface.

2003 obstacle limitation surfaces

On 16 October 2003, EAPL created an OLS diagram for Essendon Fields Airport depicted in Figure 10 below around a runway 08/26 strip width of 180 m and a 300 m inner edge for the runway 26 approach surface. The transitional surface was alongside the runway strip, stepping up (represented by the blue lines) to then run alongside the approach surface.

[42] On 8 November 2022, in response to a draft of this report, CASA submitted that the ATSB's observation was speculation based on incorrect advice given at the time by the CASA officer.

Figure 10: Essendon Fields Airport 2003 OLS diagram



Source: Essendon Airport Pty Ltd, annotated by the ATSB

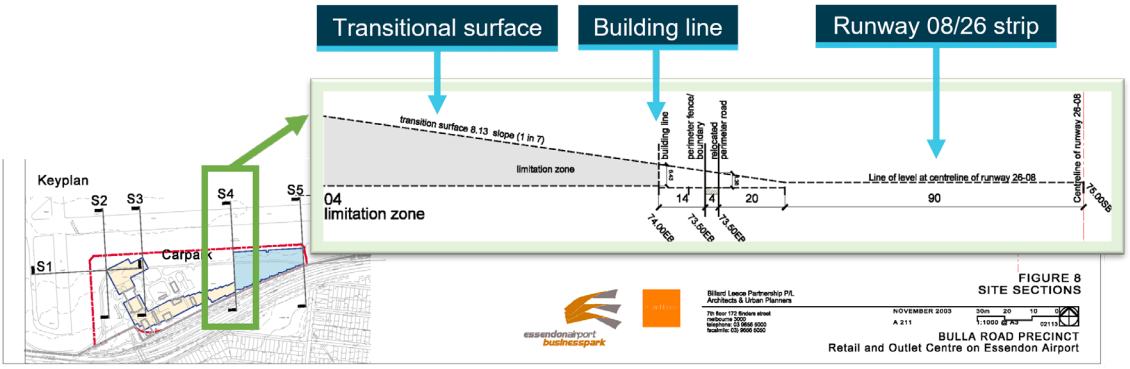
Submission and approval of the draft major development plan

On 12 December 2003, EAPL submitted the draft major development plan for the Bulla Road Precinct to the Department for comment and then to the Minister on 19 August 2004. The plan used the dimensions above consistent with the understanding EAPL presented to CASA on 1 October 2003. The Bulla Road Precinct development was placed proximate to the side of runway 08/26 without breaching the transitional surface.

Below (Figure 11) is an extract from the major development plan showing the runway centreline, the runway strip and location of the transitional surface. The section drawing ('S04') identified the height of the transitional surface at the building line,[43] which was 128 m from the runway centreline. EAPL provided a statement in the plan that, at this point, the buildings did not penetrate the transitional surface.

[43] Building line: The minimum distance a building or structure must be set back from a boundary.

Figure 11: Bulla Road Precinct section drawing in the major development plan



Source: Essendon Airport Pty Ltd, annotated by the ATSB

The major development plan was approved by the Minister on 16 December 2004. The relevant building permits were obtained under the Airports (Building Control) Regulations 1996 between January and May 2005. A significant part of the construction was completed and opened to the public in October 2005. Further development of the precinct continued after this time.

ATSB observation

With a runway 08/26 strip width of 180 m and approach inner edge of 300 m (for runway 26), as detailed in the OLS diagram and per the CASA 2 October 2003 advice, the buildings associated with the Bulla Road Precinct did not infringe the respective transitional surface. These dimensions were used for the basis of the major development plan.

Subsequent positions on compliance with the standards

Chapter 8 documents a period from 2012 when questions were raised through CASA audits about compliance with the aerodrome standards for the runway 08/26 strip width and OLS. Since that time, CASA and EAPL have expressed varying views on compliance with the aerodrome standards during the master plan and major development plan processes and the construction of the Bulla Road Precinct development. Evidence showing the progression of these views is set out below.

Civil Aviation Safety Authority's position on compliance

2015 recommendation form

Chapter 8 details CASA's implementation in 2015 of instrument 153/15, which approved obstacles within a 300 m wide runway strip and required EAPL to declare the strip width as 300 m. The CASA recommendation form that led to issuing the instrument, stated that:

> Runway 26 at Essendon Aerodrome is serviced by an Instrument Landing System and thus is a precision approach runway. Its status as a precision approach runway has hence remained unchanged since 1971. The ICAO Annex 14 standards require a 300 metre strip width to be provided for a Code 3 or Code 4 precision approach runway.
>
> In 2003, Essendon Aerodrome wrote to CASA requesting clarification of the runway strip width requirements for Runway 08/26. [A CASA officer] from Aerodrome Standards responded via letter and stated that a transitional surface based upon a published 180 wide strip was acceptable. No mention was made of the actual strip standard published under the 'Rules and Practices for Aerodromes' which was in place at the time and the Manual of Standards Part 139 – Aerodromes.
>
> The advice in CASA's letter of 2 October 2003 was not supported by an official legal instrument. As such, it was subsequently assessed by the Legal Services Division as having no legal validity.
>
> A separate assessment from the Aerodromes team has also concluded that the advice provided from [the officer] was incomplete and incorrect as it only referenced the Obstacle Limitation Surface based on published information and not the required standard for the actual strip.

> Upon the transition of Essendon Aerodrome to a Certified Aerodrome in 2005, the compliant strip width was not reinstated as part of this process. The Direct Factory Outlet (DFO) building [Bulla Road Precinct] was constructed at the aerodrome post Certification and was opened in October 2005.

Correspondence with professional associations

In response to correspondence from the Australian Federation of Airline Pilots and Civil Air[44] about the runway 08/26 strip width (in November 2017), CASA indicated that the width was compliant with the standards in 1970 and with MOS Part 139. CASA stated:

> The 180m strip width was consistent with the aerodrome standards that applied at the time Essendon became a domestic airport following the opening of Melbourne (Tullamarine) Airport (circa early 1970s). It was also consistent with the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998 (MOS Part 139) until November 2014, subject to landing minima adjustments. As you are aware, a landing minima penalty applies on the runway 26 instrument landing system procedure (Attachment E). Accordingly, based on the 180m wide runway strip and associated Obstacle Limitation Surface (OLS) in 2004, the DFO complex did not infringe the OLS.
>
> The November 2014 version of MOS Part 139 removed the provision for lesser strip widths to be provided subject to landing minima adjustments.[45] Subsequently, the strip width for runway 08/26 was published with a 300m strip width which resulted in established buildings infringing the OLS.

Response to ATSB questions

In August 2018, after the commencement of this investigation, CASA responded to several questions from the ATSB, which included advice about how to interpret the CASA letter from 2 October 2003 and EAPL's compliance at that time:

> The aerodrome was compliant with the RPA until they transitioned to become certified in 2007.[46] Under the RPA, and subject to grandfathering provisions in the MOS, the aerodrome operator appropriately published the 180m wide runway strip, which had been the case since the international aircraft operations ceased at Essendon Airport in the 1970s.
>
> …the ability of an operator to choose what was 'practical' changed with the introduction of the MOS. Unlike the RPA where Operators themselves could choose what they considered practical, under the current MOS Part 139, operators have to seek an exemption where they deemed compliance was not practical…

ATSB draft report consultation

In response to consultation on the first draft of this report, CASA advised in November 2018 that:

> The RPA permitted the runway strip to be reduced to not less than 150 m, subject to practicability and minima adjustment. Hence there was no need to grandfather the runway strip in the RPA.
>
> …the runway strip prior to the introduction of the MOS could be not less than 150 m. This situation remained until the aerodrome was certified under the CASR 1998.
>
> The only time the runway strip width should have been addressed was during the certification of the aerodrome.

In response to consultation on the second draft of this report, CASA stated in November 2019 that:

> On further review, CASA considers that the absence of grandfathering is an administrative issue which does not impact the safety of aviation at Essendon given that there has been no practical

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[44] The Australian Federation of Air Pilots was an industrial organisation and professional association for commercial pilots in Australia. Civil Air was the association advocating for the professional, technical and industrial needs of Australian air traffic controllers and air traffic control support.

[45] The reference to landing minima adjustments was removed from the standards at this time. However, removal of the reference did not prevent a procedure designer from raising the minima where the strip width was reduced.

[46] EAPL obtained certification in May 2005 and their certificate was reissued in 2007.

change to the nature or limitation on operations at Essendon using the published 180-metre runway strip (RWS).

Essendon Airport has had a published 180-metre RWS [runway strip] since 1972. This RWS was accepted by the relevant authority as consistent with the relevant standards that applied at that time. As a consequence of your review of the history of the approval process, it is CASA's view that the runway strip width of 180-metres should have been subject to administrative grandfathering in 1987 when the Rules and Practices for Aerodromes (RPA) were introduced.

Furthermore, it is CASA's view that the transitional surface is based on the actual RWS and the inner edge of the approach surface which must be consistent with the RWS width. Consequently, the retail outlet centre (ROC) did not require any approvals under the applicable legislation from either CASA or the Department of Infrastructure, Regional Development and Cities as the design did not infringe the runway strip or transitional surface. In the absence of any infringement, CASA was not required to conduct a safety assessment of the ROC proposal.

Essendon Airport Pty Ltd's position on compliance with the standards

2013 safety case

The EAPL 2013 safety case (refer to section titled *Essendon Airport Pty Ltd safety cases*) discussed the October 2003 CASA letter after mentioning that they had sought clarification on the application of the standards when a 2003 aerodrome inspection identified penetrations of the transitional surface. The letter responded to EAPL's request for confirmation that they could maintain a 180 m runway 08/26 strip width, associated transitional surface, and 300 m approach surface inner edge for runway 26 under MOS Part 139. In the safety case, EAPL stated:

> The response from CASA stated that Essendon Airport's interpretation of the standards was correct. However, it stopped short of providing a clear understanding as to whether CASA agreed that the current strip dimensions were acceptable, or whether an exemption was required to maintain precision approaches on Runway 26.

2019 ATSB draft report consultation

In response to consultation on the ATSB's second draft report in June 2019, EAPL provided its views on the requirements of the RPAs for determining the runway strip width. When discussing the strip width compliance at the time the major development plan was approved in 2004, EAPL stated that:

> On 16 December 2004 the 180m wide runway strip was compliant with the standards that applied to Essendon Airport at the time.
>
> The RPA [Rules and Practices for Aerodromes] applied to Essendon Airport until 2003.
>
> From May 2003 until May 2005 Essendon Airport was taken to comply with the MoS provided it complied with any requirements or standards for the physical characteristics of the movement area of an aerodrome that were set out in the RPA.
>
> The MOS applied to Essendon Airport in full from May 2005 when Essendon Airport became certified.

In follow-up correspondence to the ATSB in late 2019, for determining the runway strip width, EAPL's view was that RPAs standard 7.17.7 was an exception to the requirement in 7.17.6 to have a 300 m runway strip width for a code 3 or 4 precision approach runway. Specifically, EAPL stated:

> Nothing in 7.17.7 says that the aerodrome operator must have a concession granted in order to be compliant with the requirements of that clause. 7.17.7 says:
>
> > *"where it is not practicable to provide the full runway strip width, a lesser graded only strip width not less than… 150 m for code 3 and 4… may be provided subject to landing minima adjustments.*
>
> There is no qualification in the clause that requires the aerodrome operator to do anything else other than meet the minimum (150m) standard *where it was not practicable to do so*.

> A different way of saying this is that the aerodrome operator was able to comply with 7.17.7 by providing a runway strip of at least 150m *because* it was impracticable to meet the *standard* in 7.17.6, and therefore, *because it met the test within the clause*, no concession was required.

Meeting practicability considerations

EAPL advised the ATSB in December 2018, that the following was taken into account for meeting practicability considerations in the standards for having a runway strip width less than 300 m:

> Bearing in mind the cost and time required to upgrade a runway facility, the fact that the Runway was compliant with the prior APEIs would suggest that it was not practicable for the runway strip to be extended to 300 m, when its 180 m was in fact one fifth wider than the minimum requirement allowed under the RPA.

In June 2019 they further advised:

> The 08/26 runway strip width complied with RPA 7.17.7. It was not practical to provide the full runway strip width because part of the full runway strip width would have been outside the airport site boundary on land owned by third parties.

From the information available to the ATSB, there was no evidence provided about the cost and time to upgrade the runway strip width to determine whether it was impracticable. The ATSB noted that the land owned by third parties only encroached about 10-20 m into the north-east corner of a 300 m strip width. Figure 12 shows the land (blue) and approximate position of a 180 m (orange) and 300 m (yellow) runway strip width in 2003 (when the master plan was approved).

Figure 12: Approximate location of land owned by third parties

Source: Google Earth, annotated by the ATSB

2022 ATSB draft report consultation

In response to consultation on the third draft of this report, EAPL advised the ATSB on 8 November 2022 that the section in the report on the varying positions on compliance with the standards:

> …does not accurately record that EAPL sought confirmation from CASA on the compliance status [the 2003 letter from a CASA officer] and acted in accordance with CASA's guidance on the same.

With respect to the absence of any evidence of a concession being obtained under the RPAs, EAPL advised:

> It is important context that it appears no record that any concession was sought. There are two possible reasons for this:
>
> 1.Either a concession was sought, and granted, but the records were not duly transferred; or
>
> 2.A concession was not required as the aerodrome operator and CASA agreed that the standard of RPA 7.17.7 applied.

EAPL provided an alternative position to the need to have met practicability requirements:

> There was no requirement in the MOS Part 139 (2003) for the runway to meet the practicability requirements, as the runway was an existing facility. Under the quoted extracts from that version of the MOS Part 139, no modification was required unless specifically directed by CASA or upgrading the runway to a more demanding aircraft. Neither such trigger occurred. An existing facility was only required to continue to comply with the standard that was applicable to it. That standard was the standard when it was constructed, i.e., the APEIs, which it continued to comply with.
>
> A lack of clarity around whether, in the interim when the RPAs were the prevailing standards, a concession was required or the facility ought to have been grandfathered, does not change the requirement under the MOS Part 139.

EAPL further stated:

> By virtue of the issuance of an aerodrome certificate to EAPL by CASA [May 2005], based on the aerodrome manual contents and the facilities physical characteristics, including the condition and published information regarding the runway strip width, it was reasonable for EAPL to take confidence that they were indeed compliant at the time of issue and at the time of the construction of the Bulla Road Precinct.

Safety analysis and findings

Runway 08/26 strip width

Establishing the runway strip width and applicable standards

The Essendon Fields Airport master plan and major development plan for the Bulla Road Precinct were approved by the Minister in March 2003 and December 2004 respectively. While the master plan was unclear about the dimensions of the actual strip width for runway 08/26, EAPL had been in discussions with CASA and the Department about the possibility of reducing the strip width from 300 m to 150 m (possibly for the purpose of calculating the dimensions of the OLS only). The major development plan used a 180 m strip width and located the transitional surfaces alongside the strip. This was consistent with the dimensions in the aerodrome manual, OLS diagrams, and En Route Supplement Australia. Likewise, CASA had previously stated that the width had been 180 m since 1972.

At the time the major development plan was approved, EAPL had a transitional licence under MOS Part 139, which meant the requirements of the RPAs for determining the dimensions of runway strip width and the OLS (including the transitional surface) could continue to be applied. If the requirements of the RPAs were not met, the aerodrome operator had to meet the requirements of MOS Part 139.

Requirements for a runway strip width less than 300 m

From 2003, EAPL used the advice letter they received from a CASA officer in that year for determining the OLS around a 180 m published runway strip. However, the advice did not state the basis (aerodrome standard) on which the 180 m strip width was recognised, which was also acknowledged by EAPL in their 2013 safety case.

As runway 08/26 was a code 4 precision approach runway, to maintain a strip width less than 300 m under the RPAs and MOS Part 139 the runway strip facility needed to have done either one of the following:

- be grandfathered against an earlier standard permitting a lesser strip width
- meet the practicability requirements for a lesser strip width (which could include concession/exemption)
- otherwise comply with a concession/exemption granted by CASA.

Concession/exemption

There was no evidence that an aerodrome operator (whether EAPL or previous owners) had obtained a concession from CASA under the RPAs for maintaining a strip width less than 300 m or an exemption under the MOS Part 139. The possibility, as raised by EAPL, of a concession being granted under the RPAs in the past with records not being transferred is noted. However, in the absence of any record the parties needed to assure compliance against a standard.

Meeting practicability requirements

Prior to 2019, CASA advanced a position that under the RPAs the strip width could be reduced to 150 m subject to practicability and landing minima adjustments, and that there was no need to grandfather. To address the content of previous drafts of this report, EAPL has continued to make submissions about compliance with the provisions in the RPAs for reducing the strip width on practicability grounds. The ATSB has considered these positions as an alternative to grandfathering (addressed below) for maintaining compliance during the period 2002 to 2005.

Under the RPAs it was unclear to the ATSB whether an aerodrome operator needed to obtain a concession to apply the practicability provision and maintain a strip width less than the standard. It was EAPL's view that a concession was not required. This was also consistent with CASA's 2018 advice to the ATSB, which stated that operators themselves could choose what they considered practical.

As such, the ATSB considered whether the practicability grounds could have been relied upon to maintain a 180 m strip width. It was noted that there were no standards or guidance available defining the practicability criteria in the RPAs. Therefore, the ATSB took into account the views CASA officers offered at the time for interpreting the provision.

In 2002 correspondence between EAPL and CASA, it was apparent that CASA's then view was that practicability considerations were limited to physical and technical reasons for reducing the strip width. This was consistent with the position the ICAO Secretariat gave on the equivalent Annex 14 standard. In 2019 submissions to the ATSB, EAPL stated that it was not practicable to have maintained a 300 m runway strip width as the strip would have encroached onto privately owned land. However, this would have only been by 10–20 m. On the basis of EAPL's argument, it was likely that only a slight reduction in the strip width from 300 m would have been required to satisfy the practicability provision instead of a significant decrease to 180 m.

In addition to the above, EAPL had cited commercial reasons for having a reduced strip width, which the 2002 EAPL (Airbiz) and CASA correspondence indicated that CASA would not have accepted as a 'practicability' consideration. In 2018, EAPL advised the ATSB that it would not have been practicable to have had a 300 m strip width due to the cost and time required to update the facility. However, no evidence was provided to support the cost considerations. Further, rather than demonstrating cost was the concern, EAPL correspondence with the Department and Minister during the master plan approval process, and an internal EAPL email in September 2003, showed their concern was to increase the available land for development.

The CASA internal briefing at the time the Minister was asked to approve the master plan in March 2003 advised that it would be difficult to justify a reduction of the strip width for runway 08/26 'especially for economic development reasons'. There was no evidence to indicate that

EAPL had further advanced the economic development case with CASA and resolved its compliance with the RPAs on this basis.

The provisions under MOS Part 139 for maintaining a strip width less than the standard on practicability grounds were similar to those in RPAs. However, under MOS Part 139 it was clear that an exemption was required and the aerodrome operator had to submit a safety case. There was no evidence that an exemption was obtained or a safety case submitted, applying the practicability criteria under MOS Part 139.

Grandfathering

There was no evidence available to the ATSB that Essendon Airport Limited or EAPL had sought to rely on the provisions in either the RPAs or MOS Part 139 to grandfather the reduced runway 08/26 strip width against the APEIs. Further, there was no information recorded in the aerodrome manual that met the requirements with reference to standards in the APEIs. Instead, the 2001 aerodrome manual stated that the RPAs and ICAO Annex 14 were to be used to determine the movement area around the runway, which included the runway strip. In addition, correspondence between CASA, the Department, and EAPL during the period 2002 to 2005 did not mention the APEIs. Rather, these organisations discussed application of either the RPAs or MOS Part 139 to determine the dimensions of the strip width.

CASA's view in submissions to the ATSB from 2019 was that runway 08/26 should have been subject to administrative grandfathering when the RPAs came into existence in 1987. CASA's position was that it was an administrative matter to do with recording the grandfathering in the aerodrome manual and that compliance for a 180 m strip width had otherwise been maintained with the APEIs. The ATSB was uncertain that grandfathering under the RPAs was purely an administrative matter. The provisions also included references to obtaining concessions from CASA and giving consideration to the costs of complying with the RPAs.

In EAPL's 2022 submissions on the draft report, EAPL provided the view that a lack of clarity under the RPAs for grandfathering did not change their ability to apply the grandfathering provisions under MOS Part 139 from 2003. EAPL indicated that, under MOS Part 139, runway 08/26 was an 'existing facility' and that compliance could be maintained with the APEIs unless CASA directed a modification or there was an upgrade to allow for more demanding aircraft. There was no evidence of these occurring between 1972 and the development of the Bulla Road Precinct.

The ATSB noted that the application of the grandfathering provisions was subject to recording information in the aerodrome manual about the non-compliance with MOS Part 139 and plans to bring the facility into compliance. There was no evidence available to the investigation that this was recorded in the aerodrome manual. As CASA and EAPL were discussing compliance with MOS Part 139 in 2003, it was very unlikely the APEIs had been identified at the time as the applicable standards. Identification of the standards was significant, as it was necessary to demonstrate ongoing compliance with those provisions for the purpose of grandfathering under MOS Part 139.

Summary

The wording of the aerodrome standards for grandfathering or otherwise maintaining a strip width less than 300 m for a code 4 precision approach runway was open to different interpretations. While acknowledging the positions of CASA and EAPL, the ATSB was unable to determine with certainty that the basis for establishing a 180 m strip width for runway 08/26 during the planning processes or construction of the Bulla Road Precinct development had been resolved.

The standards on which the 180 m runway strip was based when the Bulla Road Precinct was developed in 2005 were not clearly determined. Neither EAPL or CASA had identified the APEIs in correspondence prior to this time. Further, there was insufficient evidence to show the

application of the practicability criteria had been resolved with CASA for a 180 m runway strip under the RPAs or MOS Part 139. There was also no evidence of a concession granted by CASA under the RPAs or an exemption issued under MOS Part 139.

EAPL reportedly relied on the advice provided in the October 2003 letter from CASA for determining the approach and transitional surfaces around the strip width. However, while this advice acknowledged the 180 m published strip width, it did not advise which standards were the basis for maintaining this dimension.

ATSB finding

Since 1972, successive aerodrome operators had published a 180 m strip width for runway 08/26. However, in 2005, when the Bulla Road Precinct was developed, it was unlikely that the aerodrome standards against which the strip width was based had been adequately determined to assure compliance against those standards.

Variation in transitional surface design

Under the RPAs and MOS Part 139, the aerodrome reference code design principles (as discussed in Chapter 4) were used to determine the dimensions of the runway strip width and the OLS. These principles worked with the intention that parts of the OLS, being the inner edge of the approach surface, and the lower edge of the transitional surface alongside the runway strip, would be aligned. This alignment ensured obstacle protection to aircraft in the final stages of the approach to land and during the missed approach. ICAO, and more recently CASA in 2019, indicated the expectation was these surfaces should be aligned.

At the time the draft master plan was submitted for approval in late 2002, there was no survey information available showing the location of the transitional surface for runway 26. Subsequent correspondence from EAPL to the Minister indicated an understanding that the transitional surface was to be located 150 m either side of the runway centreline, as if based on a standard 300 m runway strip width (or/and the 300 m approach surface inner edge). However, following the CASA October 2003 letter, the 2003 OLS diagram (Figure 10) and major development plan located the lower edge of part of the transitional surface alongside the published 180 m runway strip width. The other part of the transitional surface was located alongside the approach surface with a 300 m inner edge, which had been established in 2001. This resulted in the misalignment as shown in Figure 10.

However, this misalignment was consistent with the interpretation presented in the CASA 2003 letter where the definition in the Australian aerodrome standards allowed the lower edge of part of the transitional surface to be based off the published 180 m runway strip width. As noted above, this letter did not establish the basis for the 180 m strip width.

ATSB finding

In 2005, the transitional surfaces were likely being maintained in accordance with the standards applicable at the time, which were interpreted to allow part of the transitional surface to be located alongside the approach surface and the other part alongside the published runway strip. With the different dimensions of the inner edge of the approach surface and runway strip, the transitional surfaces were misaligned.

7. Assurance framework for airport planning

Introduction

Chapter 6 detailed the correspondence between Essendon Airport Pty Ltd (EAPL), the Department of Transport and Regional Services (the Department) and the Civil Aviation Safety Authority (CASA) on the 2003 draft master plan for Essendon Fields Airport and the 2004 draft major development plan for the Bulla Road Precinct. It was established that the aerodrome standards against which the dimensions of the runway 08/26 strip width were based had not been adequately determined to assure compliance with the standard. The transitional surfaces for runway 26 were established in accordance with advice provided in the CASA 2003 letter to EAPL interpreting the definition in the Manual of Standards Part 139 – Aerodromes (MOS Part 139).

This chapter examines the effectiveness of the assurance processes and framework for checking the safety content of airport planning documentation created for the purposes of the *Airports Act 1996*. It also addresses the uncertainty in the Airports (Protection of Airspace) Regulations for determining 'prescribed airspace'. This uncertainty arises as prescribed airspace under the regulations was to be determined using the International Civil Aviation Organization's (ICAO) standards in Annex 14 (Aerodromes) to the Convention on International Civil Aviation (ICAO Annex 14) rather than MOS Part 139.

Determining prescribed airspace

Airports (Protection of Airspace) Regulations 1996

Chapter 4 discussed the requirements under Part 12 of the Airports Act and the Airports (Protection of Airspace) Regulations 1996 for the protection of prescribed airspace at federally leased airports. Prescribed airspace was established around an airport in the interests of the safety, efficiency or regularity of existing or future air transport operations. Controlled activities, such as the construction of buildings that would intrude into prescribed airspace, required approval of the Secretary of the Department. This approval was required separately from the Minister's approval for draft master plans and major development plans that may reference the construction of those buildings.

The Secretary's approval was dependent on advice required to be provided from CASA. If CASA had advised that the controlled activity would have an unacceptable effect on the safety of existing or future air transport into or out of the aerodrome concerned, the Secretary could not approve that activity.[47]

Prescribed airspace included airspace above the OLS that was to be protected and determined in accordance with ICAO Annex 14. The regulations did not define the OLS by reference to the requirements set out in the standards administered by CASA, such as MOS Part 139 or the earlier Rules and Practices for Aerodromes. Guidance continued to be provided by the Department of Infrastructure, Transport, Regional Development and Cities on its website (at the time of publication of this report) that airport operators were to provide a signed statement that the OLS had been prepared in accordance with Annex 14.

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[47] See also ATSB report AI-2013-102 *Building approval process for structures in the vicinity of Australian airports*. That investigation found that the approval process under the Regulations used a prescriptive approach to safety by requiring CASA to make an 'acceptable' or 'unacceptable' declaration and that this was contrary to a safety management risk-based approach.

Prescribed airspace also included Procedures for Air Navigation – Aircraft Operations (PANS-OPS) surfaces. These were established in accordance with ICAO Doc 8168 OPS – 611, *Procedures for Air Navigation Services - Aircraft Operations*. The standards administered by CASA referenced the same ICAO document for establishing the PANS-OPS surfaces. It was noted that under the Airport (Protection of Airspace) Regulations, long term penetrations of a PANS-OPS surface could not be approved.

ATSB observation

The ATSB noted that PANS-OPS surfaces could include surfaces like the basic ILS transitional surface discussed in Chapter 4. Under ICAO Doc 8168, intrusions into these surfaces were not prohibited but they could result in the obstacle clearance altitude/height (OCA/H) being raised.

As discussed in Chapter 4, a gap could be created between the OLS and the basic ILS transitional surfaces when the OLS transitional surface was moved in towards the runway with a reduced strip width. This meant that, while an obstacle might not penetrate the OLS transitional surface it could still penetrate the basic ILS transitional surface. Noting that under ICAO Doc 9168 any intrusions of the basic ILS surfaces would be used in assessing the OCA/H to provide obstacle clearance, the investigation did not pursue this anomaly further in relation to approvals under the Airports Act. Further, procedure designers would likely use more sophisticated methods to determine the OCA/H and instrument procedures.

No approval sought under Part 12 of the Airports Act

On the basis of the OLS information put forward in the approved major development plan for the Bulla Road Precinct, EAPL did not seek further approval under Part 12 of the Act. As shown in Figure 11 (from the major development plan), the height of the buildings did not penetrate through the transitional surfaces (established in accordance with the CASA 2003 letter interpreting MOS Part 139). In the plan, EAPL stated that an application for approval of the building under Part 12 was not applicable, advising ‘no changes to airspace protection’.

Difference in transitional surface definitions

As discussed in Chapter 44, the definition in MOS Part 139 for the transitional surface connected to the side of the runway strip and the side of the approach surface. The definition did not reference the inner edge of the approach surface. These standards were interpreted by CASA to allow the part of the transitional surface alongside the runway strip to move in towards the runway centreline with a reduced strip width.

In contrast, ICAO Annex 14 connected the transitional surface with the inner edge of the approach surface as well as the side of the approach surface and the side of the runway strip. The ICAO Secretariat emphasised the connection with the inner edge of the approach surface when they provided an interpretation of the ICAO Annex 14 standards that kept the location of the transitional surface fixed with that connection. On that basis, the transitional surface did not move when the published runway strip width was less than the standard.[48]

2007 prescribed airspace review of Essendon Fields Airport

In January 2007, EAPL engaged a consultant to review the prescribed airspace for Essendon Fields Airport. The consultant’s final report recognised that ICAO Annex 14 and MOS Part 139

[48] When the 2003 master plan for Essendon Fields Airport and the 2004 major development plan for the Bulla Road Precinct were approved, Australia had not lodged a difference with ICAO for a variation to the ICAO Annex 14 definition for the transitional surface. At the time of publishing this report, Australia had still not lodged a difference. Rather, Australia had advised ICAO that the ICAO Annex 14 standard had been adopted through the Part 139 MOS 2019 (current at the time of the report’s publication).

could result in different constructions of the OLS. Specifically, the consultant stated that, they had used MOS Part 139 rather than ICAO Annex 14:

> In this instance the Australian OLS standard specified in the CASA Manual of Standards, Section 139 has been adopted in preference to ICAO Annex 14 since these are considered a more realistic and appropriate definition of airspace requirements in the Australian context. CASA advised a number of key differences between ICAO and Australian standards as recently as June 1998. DOTARS [the Department of Transports and Regional Services] should be requested to formally endorse the use of the revised Australian standard for the purposes of regulation 4 of the *Airports (Airspace Protection) Regulations*. This has been formally agreed by CASA.

Of note, the report indicated that the use of MOS Part 139 was agreed with CASA and recommended approval be sought from the Department of Transport and Regional Services (which was responsible for administering the Airports Act and regulations). There was no evidence available to the ATSB showing whether the Department was consulted at that time.

Views on the application of standards under the Airports (Protection of Airspace) Regulations

CASA has provided varying views on the effective difference between the Australian standards and ICAO Annex 14 for locating the transitional surface. In 2019, CASA advised the ATSB:

> Essendon Airport is a Leased Federal Aerodrome and is subject to legislation other than the CASR [Civil Aviation Safety Regulations] 1998. The assessment of the buildings including a review of the requirements of the Airports (Protection of Airspace) Regulations 1996. Regulation 4 (Ascertainment of OLS and PANS-OPS surfaces) in clause (1) required that 'an OLS for an airport is a surface ascertained in accordance with the procedures in Annex 14 to the Chicago Convention'.
>
> Informal advice from Department of Infrastructure, Regional Development and Cities was CASA only needed to consider the standards relevant in the CASR [Civil Aviation Safety Regulations] 1998 and the MOS [Manual of Standards Part 139 - Aerodromes]. It was noted nothing in the Airports (Protection of Airspace) Regulations 1996 permits a variation to the standards applicable in Annex 14 to the Chicago Convention.

In later correspondence in 2019, CASA provided advice to the ATSB that:

> There is no substantial difference in the development or construct of the transitional surface as described in the Annex [Annex 14] and the MOS.
>
> In the case of Essendon Airport, the legitimate width of the runway strip as published is 180 m in width. The width of the inner edge of the approach surface for runway 26 was 300 m in width. From an Annex 14 perspective it could be argued it was not possible for the inconsistency between the inner edge of the approach surface and the runway strip.

In 2020, when responding to follow-up questions from the ATSB, CASA again advised that there was no difference between ICAO Annex 14 and MOS Part 139 definitions for the transitional surface. CASA indicated that the runway strip width standard was 300 m, if practicable, and the transitional surface commenced from the end of the strip.

In 2022 submissions on a draft of this report, CASA took the view that the ICAO Secretariat's interpretation of the Annex 14 standard was incorrect and that under Annex 14 the transitional surface would move inward with the published strip width. These comments have been addressed in Chapter 4.

The Department of Infrastructure, Regional Development and Cities (the Department), advised the ATSB in 2018 that:

> Our practice is that the Department administers the APAR [Airports (Protection of Airspace) Regulations] on the basis that the OLS should be ascertained in accordance with Annex 14 as it applies in Australia (i.e. incorporating any notified differences that are formalised in MOS Part 139).

In 2020, the Department provided comments to the ATSB on an earlier draft of this report. With respect to the discussion on whether there was a difference between the Australian standards

and ICAO Annex 14 for defining the transitional surface, the Department referenced the view provided by CASA that there was no substantial difference between the standards.

On 8 November 2022, in response to this draft report, the Department advised that:

> The requirements for an obstacle limitation surfaces (OLS) are established through the Civil Aviation Safety Regulations 1998 – Part 139 (Aerodromes) Manual of Standards (MOS), not the Airports (Protection of Airspace) Regulations 1996 (APARs).
>
> The first MOS was published in September 2004. Regarding differences between ICAO Standards prescribed in the APARs and the Australian standards prescribed in the MOS, the 2004 version advised: Notwithstanding the above, where there is a difference between a standard prescribed in the ICAO standards and one in the MOS, the MOS standard shall prevail.
>
> Part 12, section 190 of the Airports Act also specifies: This Part [in relation to Protection of Airspace around airports] has effect in addition to, and not instead of, regulations under the Civil Aviation Act 1988.
>
> This means requirements in Part 12 of the Airports Act and in the APARs do not replace the relevant requirements in the Civil Aviation Act and the associated Civil Aviation Safety Regulations 1998 through which the MOS is established. In referring to the procedures in Annex 14 to the Chicago Convention for ascertaining an OLS, the APARs are complementing, not replacing the requirements in Part 139 of the CASRs and the associated MOS. Regardless, the MOS standards would prevail if there was a difference to the ICAO standards. Therefore, the assertion that there is uncertainty or ambiguity of which standard should apply when establishing an OLS is incorrect.

In 2022, in response to a draft of this report, EAPL advised that, although they considered ambiguity in the regulatory environment to be a matter for the Department and CASA:

> Ambiguity between the airport planning and development approval regulations and the Civil Aviation Safety Regulations (CASRs) is not relevant to safety. Safety will always be governed by the CASRs and any deficiencies in protection which may result from the prescribing of airspace in accordance with the Australian standards rather than the ICAO ones will ultimately manifest in operational (efficiency, regularity) restrictions rather than a reduction in safety.

Assurance requirements for draft master plan and major development plan safety information

As detailed in Chapter 4, federally leased airports were required to have master plans and major development plans. There was no requirement in the legislation for the Minister of the Department administering the legislation to enquire into the information included in a draft master plan or major development plan. However, in approving or rejecting a plan, the Minister was required to consider the needs of civil aviation users and 'the views of the Civil Aviation Safety Authority and Airservices Australia, in so far as they relate to safety aspects and operational aspects of the plan'.

This was further emphasised by the Department during consultation on an earlier draft of this report. Specifically, they stated that, 'As the safety regulator, CASA is able to independently verify aerodrome information and provide advice it considers relevant to the Minister's consideration of draft MDPs [Major Development Plans]'. Aside from asking for their advice, there was no obligation for CASA and Airservices Australia to provide any feedback on the draft plans under the Airports Act.

The Department had established practices to review and assess the information in order to recommend to the Minister whether a plan should be approved. This included the Department writing to government agencies with regulatory responsibilities in relation to the proposals in the plans. Further, the Department had developed assessment tools for addressing the content of plans in accordance with the requirements set out in section 71 and section 91 of the *Airports Act 1996* (the Airports Act). For a draft major development plan, this included the aerodrome operator advising whether approvals were needed from the Secretary of the Department under Part 12 of the Airports Act.

Application of assurance processes to the 2003 and 2004 plans

2003 master plan

In the draft master plan, EAPL had originally proposed to reduce the runway 08/26 strip width from 300 m to 150 m 'for OLS [obstacle limitation surfaces] calculation purposes'. The Department completed an assessment of the plan using the assessment tools mentioned above. With respect to changes to the OLS (including the transitional surface), the Department noted the reduced OLS was subject to EAPL receiving 'favourable consideration from CASA and Airservices Australia'.

Following exchanges between the Department and CASA on the plan, EAPL withdrew the proposal to reduce the runway strip width for OLS calculation purposes. The exchanges included references to the requirements of both MOS Part 139 and ICAO Annex 14. The Department had followed their processes, seeking responses from CASA to clarify whether EAPL had included the correct information in the plan for determining the runway strip width and OLS.

2004 major development plan

In the draft major development plan, EAPL stated that they had consulted CASA on the location of the runway 08/26 transitional surface. They further indicated that aviation safety standards required the buildings to be below the transitional surface and confirmed that this was the case with the Bulla Road Precinct (as shown in Figure 11). As previously discussed, EAPL located the runway 08/26 transitional surface based on a 180 m strip width (rather than the 300 m strip width required by the aerodrome standards).

On 27 August 2004, the Department wrote to CASA providing them the 'opportunity to comment' on the safety and operational aspects of the draft major development plan in accordance with the requirements of the Airports Act. The Department sent a follow-up letter to CASA on 29 October 2004, again seeking their advice on the safety and operational aspects of the draft plan. That letter also stated that, if 'CASA does not wish to provide a comment, advice of this would also be appreciated'. Neither of the letters sent to CASA referenced the issues with defining the OLS for runway 08/26, which had arisen during the approval process for the master plan. A similar letter was also sent to Airservices Australia, who subsequently provided a response on 24 September 2004.

On 16 December 2004, CASA sent a letter to the Department in response to their requests seeking comments on the draft major development plan for the Bulla Road Precinct. The letter stated that:

> As there are numerous civil aviation safety requirements imposed upon airport operations, many of which are technical in nature or which are dependent upon numerous factors, CASA has determined that the Authority can no longer provide substantive comment on draft Master or master plans. Invariably, draft master plans do not contain sufficient detail to determine compliance with civil aviation safety requirements.
>
> …gathering the information required for the Authority's assessment of whether every item in a draft master plan will be compliant with civil aviation safety requirements would be time-consuming and expensive, and inconsistent with the purpose of the Master Plan in any case.
>
> …CASA does not provide 'no objection' responses to draft airport master plans, as such a response is apt to be construed by the airport operator as an approval by CASA of the plan. Based on the position outlined above, CASA is not able to provide substantial comments on the Essendon Airport major development plan. CASA notes however that the airport is obliged to comply with the relevant Civil Aviation Regulations.

The Department had completed an assessment of the draft major development plan using their assessment tools. The Department concluded that the plan was consistent with the 2003 master plan. They had also noted that EAPL had included information stating that approval under Part 12 of the Airports Act was not required.

Consequently, the Department recommended that the Minister approve the draft major development plan, which was given on 16 December 2004 (the same day CASA had provided the Department with its letter above). However, noting the absence of comment from CASA, a condition included in the Minister's approval was that:

> Essendon Airport Pty Ltd (EAPL) must consult the Civil Aviation Safety Authority (CASA) during the construction of the proposed development, and comply with any safety requirements specified by the agency. Additionally, EAPL must advise my department of any changes to the approved major development plan arising from the need to comply with CASA standards.

The records available to the ATSB showed that, after partial construction of the Bulla Road Precinct development in October 2005, the Department followed up with EAPL on 9 November 2005 on their compliance with the condition. On 10 November 2005, EAPL responded to say the condition was 'completed and adhered to'. This advice did not contain any further detail or evidence of compliance. Despite this, there were no records available to indicate that consultation between EAPL and CASA had occurred.[49]

The Department and Civil Aviation Safety Authority views

The Department provided its views to the ATSB on the matters outlined above during discussions on earlier drafts of this report. They advised that expertise for providing safety advice on draft master plans and major development plans was not within the Department's remit. Rather, this advice came from CASA and Airservices Australia as the safety specialists. Specifically, in February 2020, the Department noted that:

> …the Act specifies the Minister must make a decision to approve an MDP [Major Development Plan] with regard to the views of the Civil Aviation Safety Authority (CASA) and Airservices Australia (Airservices) in so far as they relate to safety aspects and operational aspects of the MDP. CASA's and Airservices' views are sought on all MDPs. This input is provided to the Minister to support his decision and conditions can also be included in the decision to ensure CASA and Airservices have an ongoing role in the MDP where needed.
>
> If follows that CASA, as the aviation safety regulator, is best placed to determine the appropriate level and form of safety assessment to undertake so the appropriate safety advice can be provided to the Minister to inform their decision.
>
> The Department acknowledges the views of CASA were not included in the Bulla Road Precinct MDP submitted to the Minister for consideration in 2004.

With respect to the absence of advice from CASA on the 2004 draft major development plan, the Department advised that they had mitigated this by imposing the condition for EAPL to consult CASA during the construction of the Bulla Road Precinct.

In 2014, a CASA officer reviewed the history of the Bulla Road Precinct development. In that review, the officer noted the absence of comment by CASA on the 2004 draft major development plan. However, the officer stated that, if CASA had reviewed the plan, they may have considered the information regarding the OLS to have been correct based on the CASA 2 October 2003 letter to EAPL. The content of that letter, detailed in Chapter 6, indicated that the portion of the transitional surface alongside the runway 08/26 strip at Essendon Fields Airport could be based off a 180 m strip width under MOS Part 139.

On 8 November 2022, in response to this draft report, CASA advised that:

> Section 94 of the Airports Act 1996 states that the Minister must have regard to the views of CASA in considering whether to approve a major development plan (MDP). It is correct CASA is not required to comment, and does not always need to.

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[49] There were no records made available to the investigation that demonstrated that this occurred. There were no records on the CASA files, but it should be noted that these files did not document all interactions with the aerodrome operator at that time.

> CASA is provided exposure drafts of MDPs to provide comment and following the preliminary draft MDP process, the Department formally seeks comment from CASA to fulfil the requirements of s.94 of the Airports Act 1996.
>
> CASA routinely provides robust comment to the Department under the Airports Act 1996.

Confirmation of assurance framework

Following receipt of previous drafts of this report, the then Department of Infrastructure, Transport, Cities and Regional Development wrote to CASA in 2019 to seek:

> …written confirmation of CASA's ongoing commitment to provide authoritative and timely safety and operational advice to the Department on all federal Airport draft Mast [Master] Plans and MDPs [Major Development Plans].

In response, CASA advised that they had a dedicated airspace development team that was responsible for managing all requests related to draft master plans and major development plans. They advised that:

> The team has established processes to ensure each request from the Department of Infrastructure, Transport, Cities and Regional Development (the Department) is processed with the expected timeframe to avoid delays…

On 8 November 2022, in response to this draft report, the Department advised:

> …the seeking and receiving of this advice is a well-established process the department and CASA (and Airservices Australia) have been following for many years. The exchange of letters in 2019 between the department and CASA simply confirmed this process.

The Minister for Infrastructure, Transport and Regional Development also included in his Statement of Expectations for CASA from 15 July 2019 to 30 June 2021, an expectation that CASA:

> Provide authoritative and timely advice to me and my Department on other airport developments, to assist me in complying with the statutory requirements of the *Airports Act 1996*, and regulations made under it.

The Minister's Statement of Expectations for 31 January 2022 to June 2023 included a similar expectation for CASA relevant to the matters raised in this chapter:

> Provide regulatory oversight for major aerodrome infrastructure projects, including significant new runway projects, as well as providing authoritative and timely advice to me and the Department on matters related to leased federal airport developments.

Safety analysis and finding

Establishing protective surfaces for prescribed airspace

The Airports (Protection of Airspace) Regulations referred to ICAO Annex 14 rather than MOS Part 139 for establishing the OLS and PANS-OPS surfaces for 'prescribed airspace' at federally leased airports. Although CASA indicated that the Department had informally advised that MOS Part 139 could be used to determine the OLS, the Department reaffirmed in public guidance issued to aerodrome operators that Annex 14 was to be used.

As previously established, the transitional surface was defined somewhat differently in ICAO Annex 14 and MOS Part 139. It was open to interpretation that the location of the transitional surface moved inwards with a reduced runway strip width under MOS Part 139, while not moving under ICAO Annex 14 (as per the interpretation provided by the ICAO Secretariat in 2020).

If the ICAO Annex 14 definition of the transitional surfaced had been used for runway 26, the transitional surface would have remained connected to the 300 m inner edge of the approach surface and 300 m strip width specified in the standard. In which case, the buildings would have intruded through the OLS. This would have resulted in the need to seek approval for the

buildings under Part 12 of the Airports Act and the Airports (Protection of Airspace) Regulations. However, as the major development plan for the Bulla Road Precinct had the transitional surfaces for runway 26 based off the published runway strip width of 180 m, an approval was not sought.

EAPL stated that safety with respect to determining the OLS would be governed by the Civil Aviation Safety Regulations (and the aerodrome standards under those regulations). The Department considered the Airports Act and Airports (Protection of Airspace) Regulations and MOS Part 139 as being complimentary. However, if there was a difference between these, the Department stated MOS Part 139 would prevail over the ICAO standards.

The Airports Act and regulations were used for building control around federally leased airports and were expressed to have a safety objective. The Department may consider MOS Part 139 standards for the OLS to be acceptable for the purposes of the Airports Act and regulations with respect to building control. However, it was ICAO Annex 14 that was referenced in the regulations and public guidance issued by the Department for the purpose of determining the OLS to protect airspace around federally leased airports. Consequently, the use of different standards under the Airports regulations made it uncertain whether federally leased airports relying on an application of the standards in MOS Part 139 (or historical standards) were correctly determining prescribed airspace for the purpose of building control under the Airports Act.

ATSB finding

Aerodrome operators used the Australian aerodrome standards to establish the obstacle limitation surfaces. For the purpose of building control around federally leased aerodromes, the Australian Airports (Protection of Airspace) Regulations referenced the international aerodrome standards. These standards may be applied differently with respect to the structure of the transitional surface.

No agreed assurance framework

There was a requirement under the Airports Act for the approving Minister (and Department administering the Act) to seek advice from CASA and Airservices Australia about the safety and operational aspects of the plans, although they were not obliged to provide this advice. The Department sought CASA and Airservices Australia advice on both the 2003 draft master plan for Essendon Fields Airport and the 2004 draft major development plan for the Bulla Road Precinct development. Consistent with the Act, the correspondence from the Department to CASA on the planning documentation did not require CASA and Airservices Australia to provide advice. Although it was noted that Airservices Australia had provided responses to both requests.

When CASA did not respond to the first letter sent by the Department on the major development plan, the second letter only expressed concern that CASA at least advise if they did not wish to provide comment. CASA replied on the same day the Minister approved the plan, indicating they would not be providing comments on this, and future plans. This response demonstrated that the Department did not have an agreed assurance framework with CASA to ensure they would provide advice on the safety content of the plans in the absence of a legislative requirement.

Importance of assuring information in the plans

The lack of an agreed assurance framework was despite the Department's reliance on advice from CASA from a safety perspective. In this case, the need for advice on the draft major development plan was likely elevated given the Department had previously questioned if the dimensions of the runway 08/26 strip width and location of the OLS were correct during the draft master plan process. The Department did not appear to have raised the historical context when asking CASA for advice on the draft major development plan.

As previously established in Chapter 6, at the time the master development plan was approved, it was unlikely that the aerodrome standards against which the runway 08/26 strip width were based had been adequately determined to assure compliance. Further, there was no evidence that a view from CASA had been expressed on the location of the transitional surfaces for runway 26 under Annex 14. Information about the location of the OLS transitional surface was important for determining whether any part of the Bulla Road Precinct development would breach the aerodrome's prescribed airspace. A proposed development that breached prescribed airspace required a separate approval by the Secretary of the Department under Part 12 of the Airports Act and regulations.

Effect of condition for Essendon Airport Pty Ltd to consult with the Civil Aviation Safety Authority

While the major development plan was approved by the Minister without CASA's advice, a condition was imposed on EAPL to consult with CASA during the construction of the Bulla Road Precinct development. However, this was unlikely to have been an effective mitigator in the absence of CASA's advice. The Department followed up with EAPL on compliance with the condition after part of the development had been completed. Despite EAPL indicating that this condition had been completed, there were no records to show that any consultation with CASA had taken place. Therefore, having regard to the timing, if there was incorrect information in the major development plan, it was too late to question EAPL about the need to obtain an approval for the building under Part 12 of the Airports Act.

Influence of the Civil Aviation Safety Authority October 2003 letter

As noted by the CASA review in 2014, if CASA had reviewed the draft major development plan, they may have considered the information correct based on their October 2003 letter to EAPL. Further, although CASA officers had previously discussed the need to comply with ICAO Annex 14, there was no evidence as to how they would have interpreted the transitional surface provisions in the Annex in parallel to the advice provided in MOS Part 139. Therefore, the absence of a CASA review in this case may not have made a difference to EAPL's advice in the major development plan that there were 'no changes to airspace protection'.

Increased risk of no agreed assurance framework

The lack of advice from CASA on the 2004 major development plan may not have affected the prescribed airspace for Essendon Fields Airport. However, the fact that CASA could decline to provide advice to the Department on airport plans demonstrated the lack of an agreed assurance framework. This increased the risk of draft major development plans being approved with incorrect safety information about the OLS. In turn, in around 2004, this increased the risk of objects or structures not being assessed under Part 12 of the Airports Act on an incorrect declaration that the proposed object or structure did not intrude through prescribed airspace. However, this did not reflect assurance processes that the Department and CASA state have been in place since and that were confirmed in correspondence in 2019.

ATSB finding

In 2004, the Department of Transport and Regional Services did not have an agreed assurance framework with the Civil Aviation Safety Authority for assessing the safety information in draft major development plans. This increased the risk of plans being approved with incorrect dimensions for runway facilities and obstacle limitation surfaces.

8. 2015 – 2019: runway strip width and obstacle limitation surfaces

Introduction

The Civil Aviation Safety Authority (CASA), through audits in 2012 and 2014, raised compliance issues with the runway 08/26 strip width and transitional surfaces. Subsequently, in 2015, CASA issued an instrument approving obstacles on a 300 m strip width and requiring Essendon Airport Pty Ltd (EAPL) to publish the strip width as 300 m. Then in 2019, EAPL relied on grandfathering provisions in the Manual of Standards Part 139 (MOS Part 139) to reduce the published strip width to 180 m. CASA revoked the instrument referencing the 300 m strip width. This chapter reviews compliance with the standards with the decisions taken during that period.

Regulatory means for addressing non-compliance

Runway strip width and obstacle limitation surfaces

As previously shown in Table 5, the means through which a non-compliance with MOS Part 139 for facilities (such as the runway strip) or the obstacle limitation surfaces (OLS) could be addressed was by either:

- grandfathering to an older standard with which the facility/OLS was compliant (see below *Grandfathering requirements under Manual of Standards Part 139*)
- obtaining a 3-year exemption from CASA after demonstrating how an acceptable level of safety (presenting a safety case) could be achieved with the exemption.[50]

During the period under consideration in this chapter, under MOS Part 139, if grandfathering was not available an exemption was required to maintain a strip width less than the standard current at the time. The MOS Part 139 further emphasised that 'if an aerodrome operator wishes to provide a lesser runway strip width to that specified in the standards, the aerodrome operator must provide CASA with a safety case justifying why it is impracticable to meet the standard. The safety case must include documentary evidence that all relevant stakeholders have been consulted'.

There was no provision in MOS Part 139 for issuing an enduring approval for a non-compliant runway strip or OLS. The capacity for CASA to provide approvals for non-compliant facilities without a time limitation was only made possible later under Part 139 (Aerodromes) Manual of Standards 2019 (Part 139 MOS 2019 - in effect in 2020).

Objects on a runway strip

Runway strips had to be free of fixed objects, other than visual aids on the graded portion of the runway strip. Any fixed objects elsewhere on the runway strip had to be of a low mass and frangibly mounted.[51] Further, no part of the fly-over area (area of strip outside the graded portion), or any object on it, must project through a plane:

(a) that starts along each outer side of the graded area; and

(b) has an upward slope of away from the graded area of more than 5%.[52]

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[50] MOS Part 139 during the period under consideration was clear that an exemption was required if a provision mentioned practicability considerations for complying with a standard.

[51] MOS Part 139, s.6.2.24.

[52] MOS Part 139, s.6.2.22.3.

Section 7.1.2.1 of the MOS Part 139 stated:

> Objects, except for approved visual and navigational aids, must not be located with the obstacle restriction area without the specific approval of CASA.

The obstacle restriction area was defined to include the runway strips, runway end safety areas, clearways and taxiway strips. Although obstacles on the runway strip were generally prohibited, specific approval could be obtained from CASA under section 7.1.2.1.

Safety cases

Where a safety case was required, such as for seeking an exemption, the aerodrome operator was to provide CASA with an understanding of the current situation, what areas would be affected by the deviation from the standard, the relevant stakeholders involved or affected, when the applicant could comply with the regulations, and how the proposed deviation was likely to impact aircraft operations. In addition, the applicant was to provide a copy of their safety assessment, including the detailed risk assessment. Ultimately, the purpose of the safety case was to demonstrate to CASA that the proposed deviation would provide an acceptable level of safety (Civil Aviation Safety Authority, 2020a).

Safety assessment

In order to understand the expectations for assessing risks for maintaining aerodrome facilities less than the standard, the ATSB had regard to CASA advisory circular AC 139.A-04 v1.0 (Civil Aviation Safety Authority, 2020a), *Applying for aerodrome authorisations, exemptions and approvals*.[53] The advisory circular provided guidance to aerodrome operators on applying for an authorisation, exemption, or an approval under Part 139 MOS 2019. The guidance extended to the considerations for a safety assessment as part of a safety case.

When detailing the safety assessment process, the circular stated that:

> Understanding the risks to the safe operation of aircraft at, to and from the aerodrome, is the basis for the development of appropriate and effective risk mitigation measures that might be needed to ensure safe aerodrome operations.

A safety assessment must demonstrate how a safe environment is provided for the intended operation of aircraft in-flight, manoeuvring on the aerodrome and when parked on the apron. The CASA advisory circular noted items that could be considered for the assessment depending on the reason for seeking the authorisation, exemption or approval including, but not limited to (Civil Aviation Safety Authority, 2020a):

- aerodrome layout
- the types of aircraft intended to operate at the aerodrome, including their dimensions relevant to the assessment, such as the aerodrome reference code, and their performance characteristics
- instrument flight procedures

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[53] Although AC 139.A-04 v1.0 accompanied Part 139 MOS 2019, the expectations for a safety assessment summarised from the circular were congruous with generally understood expectations for safety assessments articulated before the advisory circular's publication. Versions of International Civil Aviation Organization Doc 9981, *Procedures for Air Navigation Services – Aerodromes* (International Civil Aviation Organization, 2020), stated similar expectations. Earlier guidance around safety cases for aerodrome operators in AC 139-16(1) *Safety management systems for aerodromes* (Civil Aviation Safety Authority, 2013) referred to AC 172-02(0) *Guidelines for preparing safety cases covering CASR Part 172 Services* (Air Traffic Service Providers) (Civil Aviation Safety Authority, 2005). This guidance was general in nature. Chapter 6 set out correspondence between CASA, EAPL and the Department of Transport and Regional Services when it was proposed in 2002 that EAPL would need to seek an exemption for a reduced runway strip width. The correspondence indicated similar factors to be considered for a safety assessment to those contained in the 2020 AC 139.A-04. As the AC came into effect in 2020 just after the changes to the published strip width and OLS dimensions at Essendon Fields Airport, it was considered the advisory circular provided an appropriate summary of the expectations for a safety assessment.

- obstacles and hazardous activities at, or in the vicinity of the aerodrome
- planned construction or maintenance works at, or in the vicinity of the aerodrome
- any local or regional hazardous meteorological conditions such as windshear.

Safety management system

There were broader expectations for an aerodrome operator to undertake risk assessments in accordance with their safety management system (refer to advisory circular AC 139-16(1) *Safety management systems for aerodromes* (Civil Aviation Safety Authority, 2013). This was consistent with ICAO's guidance in ICAO Doc 9981 – *Aerodromes*, which stated that (International Civil Aviation Organization, 2020):

> A safety assessment is an element of the risk management process of an SMS [safety management system] that is used to assess safety concerns arising from, inter alia, deviations from standards and applicable regulations, identified changes at an aerodrome…, or when any other safety concerns arise.
>
> *Note. – Changes on an aerodrome could include changes to procedures, equipment, infrastructures, safety works, special operations, regulations, organization, etc.*

EAPL had established a safety management system for Essendon Fields Airport.

Civil Aviation Safety Authority surveillance

Surveillance 2005 to 2012

In February 2005, when EAPL was seeking certification for Essendon Fields Airport, CASA conducted an audit of the airport. At the time, the aerodrome manual was found to require substantial revision for it to be in compliance with that required of a certified aerodrome. EAPL subsequently submitted a revised aerodrome manual to CASA for approval. This was assessed as being compliant with the regulations and standards, and accepted by CASA.

Part of CASA's process included the completion of a checklist. Included within that checklist was a requirement to check that the physical characteristics of the aerodrome (including the runway strip) were compliant with MOS Part 139. These were marked as acceptable.

A 2007 CASA audit also included a checklist for verifying aerodrome data against MOS Part 139. This aerodrome data covered both the physical characteristics of the aerodrome and the OLS. Both items were marked as acceptable.

CASA completed 2 further audits prior to 2012. There were no compliance issues noted with the runway strip or the OLS.

ATSB observation

Following the letter provided by CASA in 2003 that was used by EAPL to form the view that they could retain a 180 m runway strip for runway 08/26, there were further opportunities for the regulator to address the standards against which the strip width was based to assure compliance.

2012 audit

On 21-22 November 2012, CASA conducted an on-site surveillance audit of EAPL to assess aspects relating to aerodrome management, the aerodrome environment, inspection and reporting, and airside control. The audit concluded that, overall, EAPL had operated in

accordance with the regulations and standards, however, several observations[54] were made. In particular, observation '720 147' concerned the lack of identification of the standards against which the runway 08/26 strip width was compliant with. Specifically, the audit report noted that:

> Notwithstanding previous CASA advice [the 2 October 2003 letter], MOS Part 139 paragraph 2.1.2.2 requires (that) an aerodrome facility must comply with the standard applicable to it. Audit Observation 720 147 advises that unless the historic standard that preceded MOS Part 139 can be identified ['grandfathering'], MOS Part 139 is deemed to apply. In the latter case, a request can be made to CASA to draft a legislative instrument of exemption. Any such request will need to be supported by a suitable safety case...

In March 2019, CASA advised the ATSB that the 2012 audit observation was raised as a result of a 'mismatch' between the information contained in the EAPL aerodrome manual and the existing aerodrome infrastructure. The purpose of the observation was to provide EAPL with the 'opportunity to analyse the identified deficiency through their Safety Management System (SMS) and update their manual accordingly'. However, EAPL chose not to 'grandfather' the runway and runway strip at that time.

2014 audit

On 19-20 February 2014, CASA conducted another on-site surveillance audit and issued EAPL with non-compliance notices. Those most relevant were:

- Runway 26, which was a code 4 precision approach runway, did not have a 300 m wide strip as required by the standards (notice '708937').
- Runway 17/35, which was a code 3 non-precision approach runway, did not have a 300 m wide strip as required (although beyond the scope of this investigation).
- The OLS dimensions in the EAPL aerodrome manual were not consistent with the standards.

In follow up correspondence to the ATSB in March 2019, CASA reiterated that notice 708937 was issued as runway 08/26 did not have a strip width of 300 m and continued to be published as 180 m. They emphasised that 'the Aerodrome Manual did not include necessary information to 'grandfather' the runway strip, notwithstanding safety observation 720 147 raised the previous year'.

On 8 November 2022, in response to a draft of this report, CASA emphasised they now consider that the non-compliance notice was incorrectly issued in 2014. CASA said it should have been issued as an administrative non-compliance to EAPL for not having documented information in the aerodrome manual about the standards the runway strip and OLS complied with.

Essendon Airport Pty Ltd safety cases

2013 safety case

In response to the CASA 2012 audit observation about the lack of identification of the standard with which the runway strip width complied, EAPL provided a safety case in late 2013 to support a request for an exemption from MOS Part 139. In the safety case, EAPL indicated that the exemption would continue to permit runway 08/26 to operate as a code 4 precision approach runway. The safety case addressed the history of the strip width dimensions and stated that:

- the airport provided facilities and services for international and domestic corporate aircraft, aircraft maintenance, air freight, charter and emergency air service providers
- runway 26 had been operating with a strip width of 180 m since 2003 (it was earlier than 2003, see Chapter 5)

[54] Audit observation draws attention to latent conditions or minor deficiencies in a system that could not be attributed to a current legislative requirement. The intention was to raise awareness with a view to avoiding problems in the future.

- while the strip width did not provide the full width of the flyover area, the strip met the physical requirements stipulated by the regulations
- it would be impractical to provide a 300 m runway strip width
- both the Australian and international aerodrome standards allowed for a reduced runway strip width subject to adjustments to the landing minima (note: ICAO Annex 14 did not have a reference to landing minima adjustments)
- the landing minima for runway 26 had been previously adjusted to take into account obstacles (see Chapter 5)
- an obstacle monitoring program was already in place to determine and report on any changes to the obstacle environment that may reduce the effectiveness of any risk mitigators.

When describing their position at the time, EAPL stated that they had continued to operate with a reduced runway strip width safely. However, referencing the 2 October 2003 CASA letter (see Chapter 6), which acknowledged the 180 m strip width, they noted that:

> …this arrangement is supported by CASA correspondence rather than an official exemption to the applicable regulations. The current operating 'arrangement' is not supported by any regulatory head of power and provides little surety to the airport operator to develop its business model into the future. As such the situation requires addressing.
>
> The 'arrangement' between CASA and Essendon Airport has been in place and working successfully since 2003.

After submitting the safety case, EAPL instructed CASA to cease processing the application for the exemption.

2014 safety case

In July 2014, EAPL submitted a second safety case to CASA in response to the non-compliance notice (708937) issued regarding the dimensions of the runway 26 strip width. The objective again was to obtain an exemption to the standard requiring a 300 m width. EAPL sought to demonstrate that a 300 m runway strip width was not practicable, nor necessary, based on risk principles; and that the existing 180 m width should have been maintained.

Obstacles and structures

When discussing the obstacles and structures adjacent to runway 26, the safety case stated that the direct factory outlet (DFO) buildings within the Bulla Road Precinct was the only relevant structure. Specifically, EAPL noted that:

> The DFO building has been constructed specifically to comply with transitional OLS [transitional surface] from a 180 metre wide runway strip for runway 26.
>
> For the current 180 metre wide runway strip, the entire DFO building is below the transitional OLS but would be within the lateral dimensions of any 300 metre wide runway strip.

Reducing the runway width

The safety case discussed the option of reducing the existing runway 08/26 width of 45 m to 30 m. This would have downgraded the runway classification to a code 3 precision approach runway. When taking into consideration the weight restrictions at Essendon (under the Air Navigation Essendon Air Navigation (Essendon Fields Airport) Regulations 2001) EAPL said:

> The practical effect of aircraft curfew and maximum take-off weight restrictions is that the largest aircraft that have, and are likely to operate from Essendon Airport are those with a combined reference code of 3C.

Irrespective, MOS Part 139 also required a code 3 precision approach runway to have a strip width of 300 m. Therefore, EAPL did not consider this to be a viable option.

Consequence of increasing the runway strip width to 300 m

The DFO building, which was considered a 'significant structure', was located about 128 m south of the runway 08/26 centreline and was built based on a runway strip width of 180 m. The northern edge of the building was about 22 m within a 300 m runway strip. EAPL indicated that, if a 300 m strip width was mandated, this building had to be demolished.

Conclusions

In summarising their analysis, EAPL concluded the following:

- A reduction in the strip width had been previously approved when Melbourne Airport was commissioned in 1971. This was formally accepted by CASA in 2003.
- There was a considerable margin between the surveyed obstacles and the decision height (landing minima) for the runway 26 instrument landing system approach.
- Multiple types of failures that could affect directional control of an aircraft and result in a lateral deviation from the runway centreline were assessed against the purpose of the runway strip as defined in the MOS, using ICAO risk assessment processes. These included the probability of:
  - an accident
  - the failure of a critical engine during take-off
  - landing gear failures
  - and descending to the height of obstacles during a missed approach.

  EAPL concluded that, in all these scenarios, maintaining a strip width of 180 m provided an 'acceptable' risk rating that was considered 'tolerable'.[55] The largest aircraft that were currently using the airport (the Bombardier Global Express, Fokker F100, Gulfstream G IV) were used for this assessment.
- The range of aircraft types that required a runway strip width of 300 m ranged from the Jetstream 41 (code 3C) to the extreme of an Airbus A380 (code 4F), with maximum take-off weights of 10,433 kg and 560,000 kg respectively. However, the code 3C aircraft types that used Essendon with the restriction of 45,000 kg were 8% of the weight of an Airbus A380. Therefore:

  > Based on risk principles, if an A380 requires a runway strip width of 300 metres to operate safely, logic dictates that an aircraft with only 8% of that mass could operate just as safely with significantly less runway strip width.
- There were no documented lateral runway excursion accidents at Essendon in the past 44 years (1970 to 2014). However, over the same period, there were 3 major accidents involving small twin piston-engine aircraft (code 1A) that had departed Essendon, but collided with terrain outside the airport's boundaries. These aircraft required a runway strip width of 90 m for a non-precision approach runway.
- The total number of fixed-wing aircraft movements was forecast to decrease by 10% in the period to 2033. However, fixed-wing movements above 20,000 kg were expected to increase from 1,791 movements in 2014 to 3,391 in 2033.
- The 3 types of larger code C aircraft using Essendon (Bombardier Global Express, Fokker F100 and Gulfstream IV) would account for the greatest proportion of fixed-wing movements by 2033.

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[55] Safety risks are conceptually assessed as 'acceptable', 'tolerable' or 'intolerable'. A safety risk can be tolerable based on the safety risk mitigation, but may require management decision to accept the risk. A safety risk classified as 'acceptable' is considered 'acceptable as is' and no further safety risk mitigation is required (International Civil Aviation Organization, 2018c).

- An analysis of records for these aircraft identified that the likelihood of any type of accident occurring was 'one possible accident for in excess of 400,000 flight hours'.[56]
- Reducing the runway 26 width (paved portion) to 30 m to be a code 3 was impractical, costly and provided no safety benefit.
- Increasing the runway strip width to 300 m was impractical based on the existence of the DFO buildings, which would have required major changes to infrastructure, would have negatively impacted aviation activity at the airport, and provided no safety benefit.

Civil Aviation Safety Authority assessment of the safety cases

Preliminary review

In September 2014, a CASA aerodrome inspector conducted a review of the 2013 and 2014 runway 08/26 safety cases provided by EAPL and concluded the following:

- **Current and projected aircraft movements:** More movements of code 3 aircraft involving a maximum take-off weight above 22,000 kg (EAPL said 20,000 kg) equated to a higher likelihood of an incident involving these aircraft occurring.
- **Runway centreline deviation analysis:** The centreline deviation information was incomplete as it only considered take-off and not landing. The safety case did not also consider the absence of a flyover [as part of the runway strip] and how this would have affected aircraft with compromised performance or in high crosswind conditions. The runway centreline deviation for take-off did not provide 'complete evidence that a reduced runway strip is safe'.

  Further, the inspector was also of the view that the risk of a runway excursion involving code 3 or 4 aircraft was 'foreseeable'. The officer's own analysis identified several examples of runway excursion events worldwide involving the type of aircraft that operated regularly at Essendon Fields Airport identified by EAPL in their assessment. The inspector considered the Airbus A380 comparison was 'superfluous' as these aircraft did not operate at Essendon and had different approach/take-off speeds to those aircraft using the airport.
- **Risk assessments:** There were deficiencies in the application of the risk management methodology, where a higher consequence level should have been used in some cases, escalating the risk rating from 'acceptable' to 'review'. The inspector recommended that EAPL reconsider their risk assessment to ensure that it accurately reflected potential consequences.
- **Accident history:** EAPL's justification for reducing the runway strip width was largely based on having 'no accidents to date' involving the narrow strip width. However, international risk management practices recommended that safety could not be 'justified' on the basis that an event had yet to occur. Therefore, the inspector indicated that this did not justify a reduction from the standard and that EAPL could not ignore that such an accident was possible in the future.

The inspector recommended to a CASA manager that EAPL should reconsider the assessment of risk to ensure it was an accurate reflection of the potential consequence. However, notwithstanding what the aerodrome inspector considered 'flaws' in the EAPL safety case, the inspector believed CASA had sufficient evidence to accept the risk of a 180 m non-compliant strip width. This was subject to the review for an exemption being completed and appropriate conditions being met by EAPL.

[56] The ATSB noted that flight hours were not the appropriate measure for risk in this context. The aerodrome operator should have used the number of landings.

Recommendation for approving the buildings on a 300 m wide runway strip

In August 2015, a CASA aerodrome inspector submitted a recommendation to senior management to address the matter of what had been identified at the time as the non-compliant runway 08/26 strip width. The recommendation was to issue an instrument to require EAPL to reinstate a compliant 300 m strip width while approving the existing obstacles (buildings) that infringed the transitional surface and runway strip, subject to conditions. The submission provided the following information in support:

- The DFO building infringed both the 300 m runway strip width and the OLS (transitional surface) required by MOS Part 139 and ICAO Annex 14. Based on a non-compliant strip width of 180 m, the buildings remained 'just clear' of the transitional surface.
- EAPL had provided evidence that it was not possible to have a compliant runway strip width due to the existing development, which infringed the 300 m.
- Grandfathering was not a desired outcome as EAPL were unwilling to document a date to become compliant with the current standards [required under MOS Part 139 – see Table 5 and below].
- Airservices Australia had reviewed the proposal for the reduced 180 m runway strip width and had no objections as the landing minima had been adjusted [the minima was still 590 ft above mean sea level or 351 ft above the landing threshold height – see Chapter 5].
- The CASA Airways and Aerodrome Branch had reviewed the EAPL proposal and believed that safe operations could be conducted subject to reinstating a compliant 300 m runway strip width with an approval of the obstacles. The recommendation further stated that this:

  > …will result in Essendon Airport meeting the requirements of Annex 14 and the MOS. Furthermore, the compliance with Annex 14 will assist in the aerodrome operator's compliance with the Airports Protection of Airspace Regulations.

When discussing the impact of the current state at Essendon Fields Airport, the inspector noted that the aerodrome operator had been non-compliant since certification. The inspector further considered the 2 October 2003 CASA advice provided to EAPL was not consistent with ICAO Annex 14 and the MOS, and:

> [With the 180 m strip width] The aerodrome operator is currently free to further infringe upon the compliant strip area [300 m]. This could further increase their safety risk in the event of an incident, accident or other adverse aircraft operation occurring at the aerodrome.

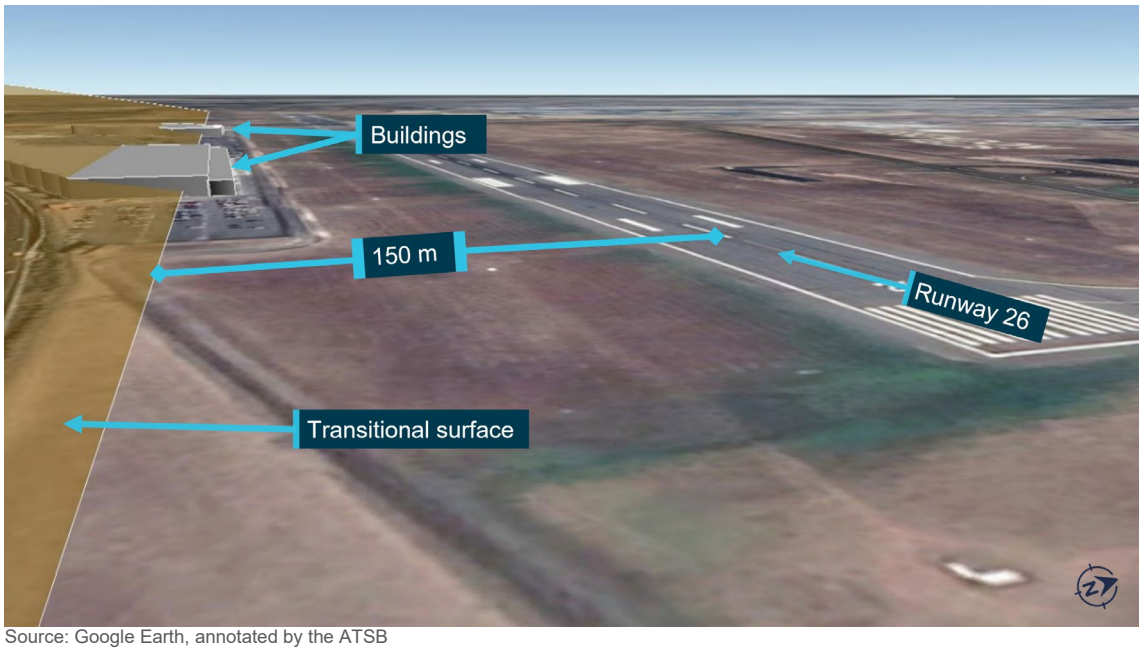
Therefore, a recommendation was made to issue an instrument as an approval for the buildings on a 300 m runway strip width.

CASA instrument 153/15

Enactment of the instrument

On 17 November 2015, in accordance with 7.1.2.1 of MOS Part 139, CASA issued instrument 153/15, *Approval – obstacles at Essendon Aerodrome*, to EAPL, based on the information provided in the safety cases. This instrument recognised a 300 m strip width for runway 08/26. The northern portions of the DFO buildings (5 buildings) within the Bulla Road Precinct became obstacles that infringed the runway strip and intruded the OLS, specifically, the transitional surface (Figure 13).

Figure 13: Representation of the buildings infringing the runway strip and transitional surface with a 300 m width (150 m from the runway centreline)



Source: Google Earth, annotated by the ATSB

The instrument contained an approval for these obstacles under the following conditions, requiring EAPL to:

- publish the overall runway 08/26 strip width as 300 m
- ensure that information relating to the approved obstacles was published in the En Route Supplement Australia
- ensure the obstacles were illuminated with a low intensity steady red light at night
- apart from the obstacles identified in the instrument, no further developments or obstacles could infringe the obstacle restriction area (that is, the runway strip) or transitional surfaces based on the 300 m strip width.

In compliance with the instrument, EAPL published the runway 08/26 strip width as 300 m in December 2015 and the obstacles were listed in the May 2016 edition of the En Route Supplement Australia. The buildings were also lit in accordance with the requirement.

ATSB observation

In 2015, EAPL published a 300 m strip width for runway 08/26 in response to a direction from CASA that approved obstacles on a runway strip with the width dimensions required by the standards at that time. The transitional surface was aligned with the published 300 m strip width and the 300 m inner edge for the approach surface.

Civil Aviation Safety Authority advice on the instrument

With the issue of instrument 153/15, CASA had elected not to provide an exemption for a 180 m runway 08/26 strip width. In response to questions from the ATSB in 2019 regarding the approach taken, CASA advised:

> At the time CASA chose not to provide an instrument of exemption as it was considered the aerodrome operator had the ability to 'grandfather' the runway strip width…
>
> At the time it was determined that as the runway strip width had not been appropriately 'grandfathered' in the manual, the aerodrome operator needed to therefore comply with the current standard, to which the then existing obstacles were located within the obstacle restriction area of Runway 08/26.

On 8 November 2022, in response to a draft of this report, CASA advised:

> Had the non-compliance been identified appropriately as a failure to document the status of the runway strip width in the aerodrome manual, the more appropriate remedial action of amending the aerodrome manual would likely have been identified.
>
> …
>
> At the outset, seeking an exemption was both unnecessary and not the preferred option of EAPL. Exemptions were only valid for three years and EAP wanted an enduring approval.
>
> …
>
> Instead of seeking an exemption or grandfathering, EAPL wanted the NCN [non-compliance notice] for RWY 08/26 to be acquitted on the basis of its safety case.
>
> However, CASA did not consider this possible but was conscious of the need for a way forward.
>
> Under the circumstances, CASA issued an instrument imposing a 300m RWS width and obstacle lighting.

CASA also noted that, at the time, EAPL had not been able to identify the standard applicable to the 180 m runway strip width. EAPL did not identify this until after reviewing an earlier draft of this investigation report.

Notification of intent to grandfather

On 15 March 2019, EAPL notified all operators and tenants at the airport of an intention to publish the runway 08/26 strip width as 180 m. The notice stated that this would return the runway strip width to what it had been previously from 1972 to 2015, and that this would not reduce safety at the airport. Further, the 5 buildings that were classified as obstacles under the previously published 300 m strip width, as required by instrument 153/15, would no longer be obstacles. These changes were to occur prior to 2 April 2019.

EAPL proposed to publish a 180 m runway strip width and relocate the part of the transitional surfaces alongside the runway strip by ‘grandfathering’ to the Airport Engineering Instructions (APEIs) (in place until 1987). EAPL did not seek to grandfather the runway 26 approach surface inner edge, which remained at 300 m. On 2 April 2019, EAPL officially advised CASA that they intended to grandfather the runway 08/26 strip width (and transitional surface), effective immediately, and requested revocation of instrument 153/15. EAPL provided CASA with evidence in their aerodrome manual, which they believed demonstrated they had met the grandfathering requirements in MOS Part 139, applicable in 2019.

Grandfathering requirements under Manual of Standards Part 139

Grandfathering against historical standards was permitted under section 2.1.2.3 of MOS Part 139 (applicable in 2019), which stated:

> The operator of a certified aerodrome is not required to modify an existing aerodrome facility (a non-compliant facility) so that it complies with this MOS until the facility is replaced or upgraded. However, until it is replaced or upgraded, details of the non-compliant facility must be recorded in the Aerodrome Manual, including:
>
> (a) identification of the facility; and
>
> (b) the date or period when the facility was first introduced or last upgraded (as the case may be); and
>
> (c) a description of, or documented evidence of, the standard with which the facility complies, including a supporting reference to the version and date of the MOS, RPA [Rules and Practices for Aerodromes], AEI [Airways Engineering Instructions], APEI [Airport Engineering Instructions], API [Airport Instructions] or other aerodrome facility standard embodying the standard with which the facility complies; and

(d) details of the plans and timescale for replacing or upgrading the facility so that it complies with this MOS.

An aerodrome facility was defined as:

> Any of the following at an aerodrome, or in or on something at an aerodrome, for which standards are provided by the MOS: surfaces; infrastructure; structures; buildings; installations; stations; systems; equipment; earthing points; cables; lighting; signage; markings.

The term 'surfaces' was not defined further in MOS Part 139, but it was understood by the ATSB by reference to the grandfathering actions taken by EAPL to include the runway strip as well as the OLS. The Part 139 MOS 2019, which came into effect in 2020 (after EAPL 'grandfathered'), defined an aerodrome facility differently. It did not use the term surfaces. A facility was limited to something physical like a runway. However, the grandfathering provisions also said that the associated OLS could be grandfathered with the facility.

An upgrade for an aerodrome facility was defined as:

1. Any change to, or improvement of, the facility that allows it to do 1 or more of the following:
   (a) accommodate the parking, holding, movement or operation of larger or heavier aircraft, or aircraft modified to carry more passengers or freight;
   (b) accommodate the parking, holding, movement or operation of more aircraft;
   (c) be used by aircraft flying under changed approach conditions, for example, a change:
      (i) from non-instrument to non-precision instrument; or
      (ii) from non-precision instrument to precision instrument; or
      (iii) from precision category I to category II or III;
   (d) accommodate aircraft take-offs and aerodrome surface movements in RVR conditions of less than 550 m.
2. The replacement of any aerodrome facility that does not comply with the standards for the facility in this MOS.

Note: The upgrade of a particular non-compliant aerodrome facility is the trigger for that particular non-compliant facility to be brought into compliance with the relevant MOS standards. Since the timing and budgeting of an upgrade is usually under the aerodrome operator's control, so too is the timing of works necessary to bring the non-compliant facility into compliance with the MOS.

The terms 'replaced' and 'replacement' were not defined in relation to a facility with respect to a change that would limit the use of grandfathering provisions.

Guidance on grandfathering

The ATSB did not identify any additional guidance in support of the grandfathering provisions in MOS Part 139 applicable at the time. The latter Part 139 MOS 2019 that came into effect in 2020 was accompanied by advisory circular AC 139.A-03 v1.0, *Application of aerodrome standards* (Civil Aviation Safety Authority, 2019b), which provided advice on the use of the grandfathering provisions under those standards.

No requirement for a safety case

There was no requirement in either MOS Part 139 or Part 139 MOS 2019 for the aerodrome operator to provide a safety case with a safety assessment to grandfather an aerodrome facility against the requirements of a historical standard.

Essendon Fields Airport aerodrome manual

In their 2 April 2019 correspondence, EAPL provided the CASA officer with an extract of their aerodrome manual that sought to provide the information for the purpose of grandfathering in accordance with the requirements of MOS Part 139.

Identification of the facility

EAPL continued to declare runway 08/26 as a code 4 runway with runway 26 being served by a precision approach. The strip width was identified as the facility being grandfathered along with the lower edge of the transitional surface. EAPL did not seek to grandfather the inner edge of the approach surface for runway 26.

History of the facility

EAPL set out a history for the runway 08/26 strip width consistent with the known information included in Table 6 of this report. EAPL acknowledged that the published width had been changed from 180 m to 300 m in 2015 (when CASA issued instrument 153/15 and the runway strip facility became compliant with MOS Part 139). They stated that the inner edge of the approach surface for runway 26 had been changed from 180 m to 300 m in 2003 (rather than 2001 as documented in Table 6).

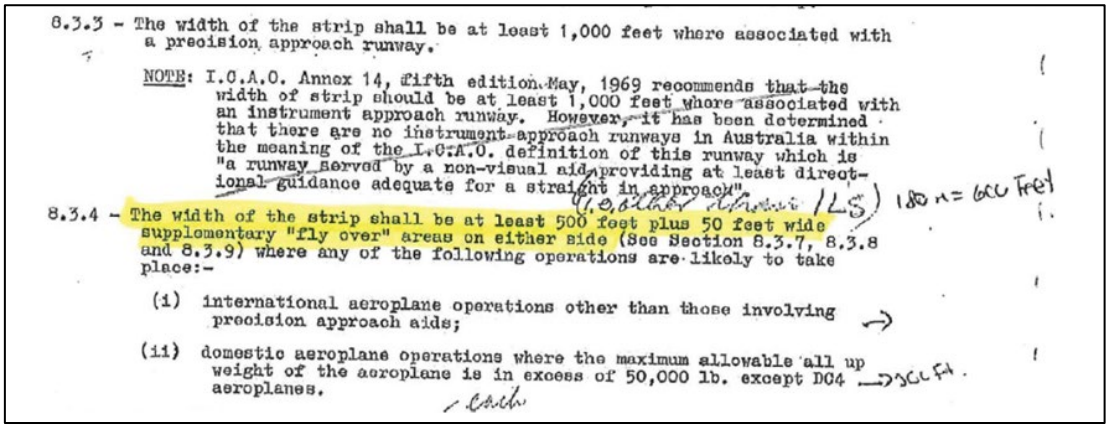
The standard with which the facility complied

EAPL referenced the APEIs dated April 1970 as the standard to which the runway strip width and transitional surface complied. Table 2 in this report includes the requirements for the dimensions of the runway strip width under the APEIs. Table 4 defines the requirements for locating the transitional surface under the APEIs.

The extracts from the APEIs for the runway strip width and transitional surface included in the Essendon Fields Airport aerodrome manual are provided below (Figure 14 and Figure 15). They contained text that was 'struck out' as well as hand annotations, which was how smaller amendments were made at the time.

EAPL indicated the runway 08/26 strip width met the requirements of section 8.3.4 in Figure 14, which was 500 ft with an additional 50 ft either side for a total of 600 ft or about 180 m. EAPL further indicated the transitional surfaces met the requirements of section 13.5.1(ii) in Figure 15, which relied on an approach surface inner edge of 600 ft or about 180 m.

Figure 14: Runway strip width requirements in the APEIs Volume II, Part 4



8.3.3 - The width of the strip shall be at least 1,000 feet where associated with a precision approach runway.

NOTE: I.C.A.O. Annex 14, fifth edition May, 1969 recommends that the width of strip should be at least 1,000 feet where associated with an instrument approach runway. However, it has been determined that there are no instrument approach runways in Australia within the meaning of the I.C.A.O. definition of this runway which is "a runway served by a non-visual aid providing at least directional guidance adequate for a straight in approach".

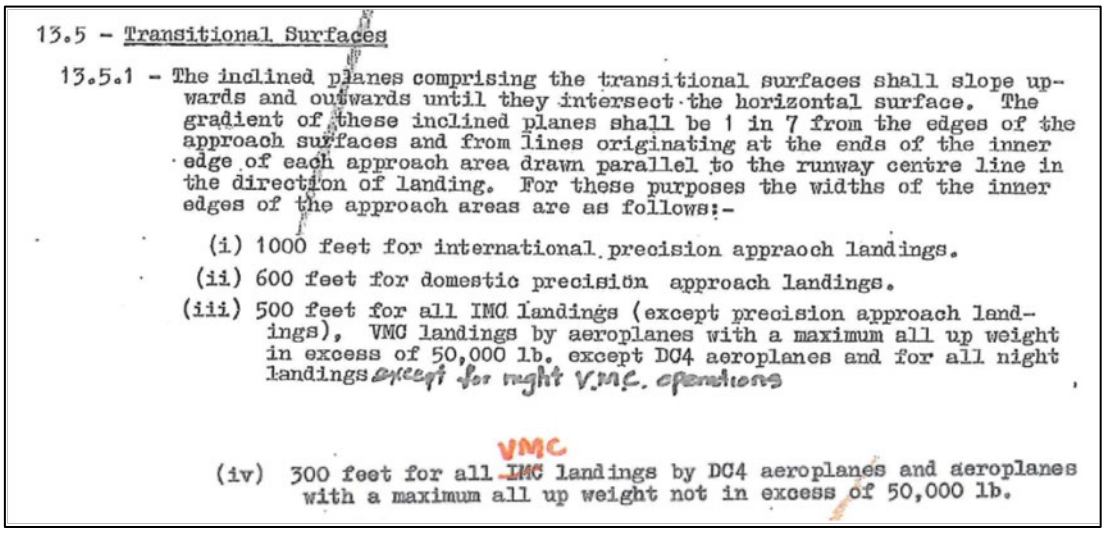
8.3.4 - The width of the strip shall be at least 500 feet plus 50 feet wide supplementary "fly over" areas on either side (See Section 8.3.7, 8.3.8 and 8.3.9) where any of the following operations are likely to take place:-

(i) international aeroplane operations other than those involving precision approach aids;

(ii) domestic aeroplane operations where the maximum allowable all up weight of the aeroplane is in excess of 50,000 lb. except DC4 aeroplanes.

Source: Essendon Airport Pty Ltd

Figure 15: Transitional surface requirements in the APEIs Volume II, Part 4



13.5 – Transitional Surfaces

13.5.1 – The inclined planes comprising the transitional surfaces shall slope upwards and outwards until they intersect the horizontal surface. The gradient of these inclined planes shall be 1 in 7 from the edges of the approach surfaces and from lines originating at the ends of the inner edge of each approach area drawn parallel to the runway centre line in the direction of landing. For these purposes the widths of the inner edges of the approach areas are as follows:-

(i) 1000 feet for international precision appraoch landings.

(ii) 600 feet for domestic precision approach landings.

(iii) 500 feet for all IMC landings (except precision approach landings), VMC landings by aeroplanes with a maximum all up weight in excess of 50,000 lb. except DC4 aeroplanes and for all night landings except for night V.M.C. operations

(iv) 300 feet for all VMC landings by DC4 aeroplanes and aeroplanes with a maximum all up weight not in excess of 50,000 lb.

Source: Essendon Airport Pty Ltd

Interpretation and application of standards to runway 26

The aerodrome manual did not include additional parts of the standards that may have been required to understand the application of, and interpret the sections extracted, such as a definitions section. Similarly, the aerodrome manual did not include extracts of any orders or regulations that provided for the promulgation of the instructions, which may have aided in their interpretation to determine compliance.

Precision approach

An incomplete copy of the APEIs that the ATSB obtained contained a definition for precision approach runway, which was ‘a runway served by I.L.S. or G.C.A approach aids and intended for use in conditions of poor visibility or low cloud base’. Runway 26 was served by an instrument landing system approach aid prior to the 1970s and one was in use when EAPL sought to grandfather in 2019.

International operations

As noted in Chapter 4 the presence of international operations was a consideration for compliance with the aerodrome design requirements set out in the ICAO Annex 14. The terms ‘international aeroplane operations’ and ‘international precision approach’ used in the standards for the runway strip width and transitional surface extracted above were not defined in the version of the APEIs available to the ATSB. One section of the standards provided for the functional classification of aerodrome (that is, international airport, customs airport, domestic airport, training airport). However, none of these were referenced for defining the runway strip physical characteristics or the OLS in the APEIs.

The ATSB did not have copies of the regulations or orders in effect at the time that may have provided clarification. However, the ATSB noted that, the term ‘international operations’ generally referred to ‘an operation that involves departure from a point outside Australia, or arrival at a point outside Australia’.

At the time of publication of this report, Essendon Fields Airport was not listed as a designated international airport on the Department of Infrastructure, Transport, Regional Development, Communications and the Arts website. However, while not listed, aircraft operators could conduct non-scheduled international flights to the airport subject to meeting exemption criteria and/or seeking prior approvals in accordance with the *Air Navigation Act 1920*.

In 2021, Airservices Australia provided the ATSB with data dating back to 2013, which showed that aircraft engaged in international operations had been using Essendon Fields Airport with

some regularity.[57] However, there was no evidence available to suggest that there were scheduled international operations after 1971-72. Therefore, the international flights were most likely private/business and charter operations.

On 28 November 2022, in response to a draft of this report, EAPL stated that varying definitions of 'international' have been included in standards subsequent to the APEIs. For the purpose of the Part 139 MOS 2019 (in effect 2020) they stated the relevant definition for 'international' in relation to the application of grandfathering with respect to an 'upgrade' was a change 'which enables the aerodrome to accommodate aircraft on scheduled international operations'.

Timeframe to replace or upgrade the facility

EAPL stated that the proposed timescale for compliance with the current standards was 1 July 2097, and that there was no intention to upgrade the runway strip width until that time.

Revocation of CASA instrument 153/15

In response to EAPL's request to have instrument 153/15 revoked, CASA internal email correspondence (dated 2 April 2019) indicated that this could be done by the appropriate delegate subject to receiving the required background information. A senior CASA officer involved in the decision initially advised they did not have sufficient information to understand the reasoning for the revocation. They also indicated that a 'standard form recommendation' (a formal CASA internal process for documenting evidence and considering options for decisions) was not required. In response, a CASA aerodrome officer provided a 1-page email explaining:

> In 2005, buildings were constructed relative to the then existing published runway strip width of 180 m for runway 08/26, and relative to the transitional surface based on an approach surface inner edge of 180 m (i.e. 90 m either side of the runway centreline).

The CASA officer then briefly detailed the history of the non-compliance notices (refer to section titled *Civil Aviation Safety Authority surveillance*) and the issue of instrument 153/15 before stating:

> Essendon Fields Airport Pty Ltd (EAPL) has satisfactorily demonstrated that they have now appropriately grandfathered the overall runway strip of Runway 08/26 in their manual, and the information has been appropriately submitted to the Aeronautical Information Publication for entry into the next version of the En Route Supplement Australia.

There was no information provided in the correspondence explaining how they thought EAPL had appropriately grandfathered against the aerodrome standards. The requirements of the APEIs for the runway strip width and the transitional surface were not addressed. Further, the limited brief did not detail the earlier CASA analysis of the EAPL safety cases or the full reasons in the recommendation for implementing instrument 153/15.

In the correspondence, the CASA officer had further stated:

> …the need for the CASA instrument [153/15] is no longer necessary as the obstacles cited in the instrument are outside of the 180m overall runway strip and associated obstacle limitation surfaces.

Subsequently, on 7 May 2019, CASA revoked instrument 153/15. This included removal of the conditions put in place by CASA, such as lighting of obstacles, the declaration of obstacles in the En Route Supplement Australia, and preventing future obstacles that infringed a 300 m runway strip width and associated transitional surface.

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[57] There was further evidence to indicate that international operations were occurring before this time. The CASA files available to the investigation showed a letter from the Department of Transport and Regional Development (the Department) in 2001, which stated that Essendon Airport 'is currently regularly used by small aircraft as the origin or destination of flights between Australia and points overseas'. The files also showed that, in 2005, the Department and CASA were discussing EAPL's safety management system requirements to have a temporary designation for an international operation.

ATSB observation

In contrast to what was stated in the CASA internal correspondence, the inner edge of the runway 26 approach surface was not 180 m in 2005. It was 300 m and was unchanged by EAPL when they grandfathered the runway 08/26 strip width and transitional surface.

2019 safety case

Prior to EAPL publishing a 180 m strip width for runway 08/26, EAPL developed a safety case in February 2019 for the purpose of their safety management system. On 8 November 2022, in response to a draft of this report, EAPL stated:

> EAPL was not at the time of the grandfathering required to undertake an assessment of risk as part of the grandfathering process.
>
> Despite this fact, EAPL did undertake an assessment of risk on its own initiative and in accordance with its risk management processes set out in EAPL's Safety Management System (SMS) (as approved by CASA and published by EAPL) in advance of the application of the grandfathered standards in 2019.[58]

In the safety case EAPL stated:

> The safety concern that required production of this safety case is that changes to aerodrome standards over time now require a 300 m wide runway strip for a runway with a classification of runway 08/26 (Code 4 precision approach runway). As detailed above, runway 08/26 has operated for decades with a 180 m wide runway strip.
>
> Thus the safety concern is not related to a specific identified hazard, but rather a non-compliance with a changed regulatory standard.

In the conclusion, EAPL stated that the safety case will be available for scrutiny by CASA if required. Noting that there was no requirement for an aerodrome operator to submit a safety case to apply the grandfathering provisions in MOS Part 139, the safety case was not submitted to CASA with the documentation supplied on 2 April 2019. Therefore, it was not considered as part of CASA's acceptance of EAPL's use of the grandfathering provisions and the revocation of instrument 153/15.

In May 2023, the ATSB sought confirmation as to whether CASA had been made aware of the existence of the safety case. CASA advised that they did not have a copy. EAPL also advised that its records showed that CASA was not made aware of the safety case. EAPL stated:

> The safety consequences of the decision to grandfather were and are EAPL's responsibility. The safety case is part of the process by which EAPL ensured that the safety consequences of its decision to grandfather were appropriately assessed and considered. EAPL had already notified CASA of the decision to grandfather and consulted with CASA about that decision.

EAPL reiterated the statement in the safety case that a copy would be provided to CASA if requested.

On 8 November 2022, in response to a draft of this report, CASA maintained that:

> By definition, since the standard of the day was identified and grandfathered, risk assessment was not necessary. The risk associated with aerodrome facilities has been considered as part of the continued policy of permitting previously compliant facilities to apply the standards that existed at the time they were constructed/last upgraded.

The EAPL 2019 safety case and assessment of risk is discussed in Chapter 9.

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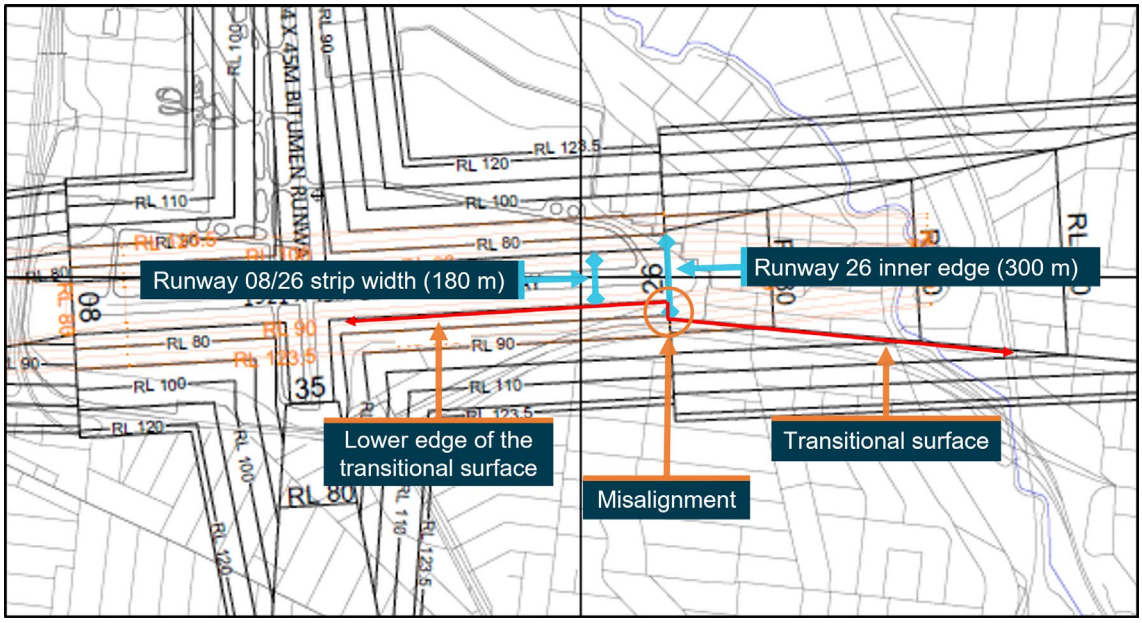
[58] EAPL did seek to provide the ATSB with a copy of the 2019 safety case prior to the ATSB issuing a draft of this report in 2022 to directly involved parties for comment. The ATSB omitted to realise that it had not been received in correspondence. The 2019 safety case was subsequently taken into account in the final report.

Publication of changes

On 1 April 2019, EAPL issued a Notice to Airmen[59] (published by Airservices Australia) with advice that the runway 08/26 strip width was 180 m and that the En Route Supplement Australia was to be amended to reflect this. It was noted by the ATSB that the notice was issued before instrument 153/15 had been revoked by CASA.

In February 2019, EAPL had also conducted a survey of the OLS adjacent to a 180 m runway strip, producing a new diagram for the OLS (Figure 16). The survey identified that the strip width was narrower than the inner edge of the runway 26 approach surface. This resulted in the transitional surface becoming misaligned, with part of the surface based off a 180 m runway strip width and the other part based off the side of the approach surface with a 300 m inner edge. Both the OLS and PANS-OPS survey diagrams were published on EAPL's website for the purpose of identifying the airport's prescribed airspace under Part 12 of the *Airports Act 1996* and Airports (Protection of Airspace) Regulations 1996.

Figure 16: Essendon Fields Airport 2019 OLS diagram



Source: Essendon Airport Pty Ltd

In the June 2022 version of the En Route Supplement Australia, EAPL advised pilots and aircraft operators that runway 08/26 was a code 4 runway with a strip width of 180 m. There was no information about the grandfathering or the design of the approach and transitional surfaces for runway 26, nor were these details required to be published. As the Bulla Road Precinct buildings did not intrude through the transitional surface with the reduced strip width, the information designating the buildings as obstacles was removed.

Civil Aviation Safety Authority's comments

Grandfathering

In November 2019, CASA provided comments in response to a previous version of the ATSB's draft report. In this, they indicated that the absence of grandfathering was an administrative issue, which did not impact safety at the airport as there had been no 'practical change to the

[59] Notice to Airmen: A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations https://www.organisationalresilience.gov.au/.

nature or limitation on operations at Essendon' with the 180 m runway strip width. CASA's view was that this had been the published dimensions of the runway strip width since 1972, which was accepted by the relevant authority as complying with the applicable aerodrome standards at that time.

Further, CASA reported that the 180 m runway strip width should have been subject to grandfathering when the Rules and Practices for Aerodromes were introduced in 1987 (replacing the APEIs). However, they considered the appropriate grandfathering arrangements had been implemented by Essendon to retain the 180 m strip width. CASA also stated that the transitional surface was based on the actual runway strip width and inner edge of the approach surface, which must be consistent.

CASA was also provided with information from the ATSB in 2020 that questioned whether EAPL had correctly used the grandfathering provisions in MOS Part 139 after the published runway strip width was reduced to 180 m in stated compliance with requirements of the APEIs. CASA responded indicating that they had conducted a comprehensive review of the available information and relevant regulations from 1971. From this, they established that Essendon had complied with the APEIs when the instrument landing system was commissioned in 1968 (EAPL stated it was commissioned in 1953) and applied a 300 m runway strip width. However, the width appeared to have been reduced to 180 m in 1971, when Essendon ceased international operations. CASA again stated that the runway strip width and inner edge of the approach surface had to be identical to establish the transitional surface.

Overall, CASA concluded that there did not appear to be any evidence of compliance issues with the runway strip width. However, they indicated that, when they submitted the comments that they were continuing to review this aspect.

In 2022, the International Federation of Airline Pilots' Associations (IFALPA) corresponded with CASA on the runway 08/26 compliance issues. CASA advised IFALPA that, while they would consider new and different information, CASA considered that runway 08/26 was compliant with the Australian standards.

On 8 November 2022, in response to a draft of this report, CASA advised the ATSB that:

> On review, CASA assesses that Essendon Airport was in compliance with the contemporary legislation when it became a domestic airport over 50 years ago, it was in compliance prior to the accident precipitating this investigation [2017] and it has been in compliance since the time of the accident.
>
> …
>
> …on the evidence available, CASA maintains that the facility was appropriately "grandfathered" when the former MOS was made [2003].
>
> On this basis, an assessment of risk was not required.
>
> The minimum RWS width requirement is 150m and this is exceeded on RWY 08/26 with its RWS of 180m.
>
> …
>
> CASA's position is that the administrative grandfathering relating to the Runway Strip by EAPL's January 2019 amendment of the Aerodrome Manual was correct and entirely consistent with the applicable standards.
>
> …
>
> CASA's position is that grandfathering was permitted once the standard to which the 180 m runway strip width was identified.
>
> …
>
> The ATSB's draft report notes that in 2015, EAPL published a 300 m strip width in response to CASA instrument 153/15. It does not follow that grandfathering ceases if temporal compliance is achieved.

CASA did not explain further how grandfathering was still available after a 'temporal compliance'.

Airports Act and regulations

With respect to the effect of the changes on compliance with the Airport (Protection of Airspace) Regulations 1996 for defining prescribed airspace, CASA stated in the 8 November 2022 submission that:

> There was no infringement of prescribed airspace under the Airports (Protection of Airspace) Regulations 1996 at Essendon.

ATSB observation

When CASA directed EAPL to publish a 300 m strip width for runway 08/26 and base the transitional surfaces on that 300 m strip width, a CASA officer considered that this would result in compliance with the MOS Part 139 and ICAO Annex 14. They said further that it would assist with compliance with the Airports (Protection of Airspace) Regulations. The CASA officers considering the grandfathering material provided by EAPL in 2019 did not comment on compliance with ICAO Annex 14 and the Airports (Protection of Airspace) Regulations.

Chapter 7 provided the following finding with respect to the identification of prescribed airspace:

> Aerodrome operators used the Australian aerodrome standards to establish the obstacle limitation surfaces. For the purpose of building control around federally leased aerodromes, the Australian Airports (Protection of Airspace) Regulations referenced the international aerodrome standards. These standards may be applied differently with respect to the structure of the transitional surface.

Essendon Airport Pty Ltd's comments on grandfathering

On 28 November, in response to a draft of this report, EAPL advised:

> …
>
> The MOS provided that an operator of a certified aerodrome (such as the Airport) "is not required to modify an existing aerodrome facility (a non-compliant facility) so that it complies with this MOS until the facility is replaced or upgraded".
>
> This means that EAPL did not have to upgrade the aerodrome facility (including the relevant runway strip width and associated surfaces), or undertake any further action, in line with the MOS (i.e EAPL could maintain the infrastructure to the same standard it was in the 1970s) until the aerodrome facility was replaced or upgraded.
>
> The relevant airstrip had never been changed since the 1970s (during Government ownership and since privatisation in 2001) and was still 180m, and the original standards applied.
>
> The published information regarding the aerodrome facility changed for a period from 2015, pursuant to Instrument 153/15. However, this did not make the airport compliant with current standards - it was simply a (revocable) permission by CASA (pursuant to MOS section 7.1.2.1) to operate with some obstacles on certain conditions.
>
> The applicable standards (the APEIS) were published by the airport to the satisfaction of CASA and included in Amendment No: 25.2 to the Aerodrome Manual.
>
> As stated above, the Instrument did not make the airport compliant with MOS standards, It simply allowed the airport to operate while certain obstacles existed provided it complied with certain conditions.
>
> …
>
> The step taken in April 2019 (under the prior MOS), amending the aerodrome manual and seeking revocation of the Instrument, was only done with the approval of CASA. Importantly, this was all again formally approved and ratified by CASA in the subsequent airport certification (aerodrome manual) process under the new MOS [MOS Part 139 2019]. EAPL further asserts that this

> amendment to the aerodrome manual also resulted in enhanced safety to airport users as the manual then reflected the actual strip width.
>
> …
>
> CASA not only accepted the "grandfathering" in 2019 but has continued to approve the grandfathering in subsequent airport approval and audit processes.

EAPL further advised:

> Runway 26 had not become compliant as a result of the Instrument itself, as there were obstacles in the obstacle restriction area, which necessitated the CASA instrument 153/15. The issuing of the Instrument does not affect the compliance of the Runway, rather it required the publication of prescribed information.

Safety analysis and findings

Grandfathering in 2019

The 2012 and 2014 CASA audits identified that the published dimension of 180 m for the runway 08/26 strip width and associated transitional surface were not compliant with the current aerodrome standard, MOS Part 139, which required 300 m for a code 4 precision approach runway. EAPL had not applied grandfathering provisions or obtained an exemption. As such, CASA issued instrument 153/15, which approved certain objects (buildings) as part of the Bulla Road Precinct development as obstacles in the obstacle restriction area for a 300 m runway strip width.

However, since 2019, CASA has maintained that what had occurred was an administrative matter and that the instrument had not been necessary as the strip width had previously been grandfathered to the APEIs (1970) but not appropriately documented in the aerodrome manual. Although, the ATSB noted that, when the audits occurred and the instrument was issued, there was no information provided to indicate that the APEIs had been identified as the standard the 180 m strip width complied with. Further, CASA advised that, at the time, EAPL did not want to grandfather as they did not want to identify a time for compliance with MOS Part 139 and did not want to proceed with an exemption due to the 3-year limit. This was more than an administrative matter. Without reference to the applicable standard, it was uncertain how CASA could assure compliance, including any operational limitations that might be specified for the 180 m strip width in those standards.

Subsequent to the above, in early 2019, EAPL advised CASA that they had grandfathered the runway strip width and transitional surfaces to the APEIs. EAPL changed the published strip width back to 180 m and moved the parts of the transitional surface alongside the runway strip with this change. The part of the transitional surface that remained alongside the runway 26 approach surface was based on the 300 m inner edge.

Application of the MOS Part 139 grandfathering provisions

The grandfathering provisions under MOS Part 139 were for an existing ‘non-compliant’ facility. In reference to EAPL’s publication of a 300 m strip width in 2015, CASA advised that it did not follow that grandfathering ceased if ‘temporal compliance’ was achieved. CASA did not explain further how the standards could allow an aerodrome operator to become compliant and then subsequently rely on grandfathering.

EAPL advised that the runway strip had not become compliant with MOS Part 139 as the physical characteristics of the strip had not changed with the presence of obstacles. While the obstacles themselves may have been non-compliant on a 300 m strip width (that is, the buildings were not of low mass and frangibly mounted and projected through the gradient limitation for the flyover area), CASA, through instrument 153/15, had issued approvals for the obstacles in the obstacle restriction area. This indicated that CASA proceeded on the basis the obstacle

restriction area was comprised of a runway strip with a 300 m width as required by MOS Part 139.

EAPL further stated that the runway strip had not been 'replaced' or 'upgraded'. These terms were used in the grandfathering provisions to indicate when a facility had to become compliant with the current standards and could no longer be grandfathered. The ATSB had nil evidence to show there was an upgrade as specified in paragraph 1 of the MOS Part 139 definition. With respect to the term 'replaced', there was no definition to assist with interpreting this term to understand when a facility was considered 'replaced'. The ATSB noted that there was no requirement for markers to identify the boundaries of the full strip width (only the graded portion), which might have shown a physical replacement. However, in response to instrument 153/15, EAPL published information referring to a 300 m strip width instead of a 180 m strip width.

Compliance with APEIs

In the copy of the APEIs supplied for the purpose of grandfathering, a 180 m strip width could be interpreted to be applied where there were international aeroplane operations, other than those using the precision approach aids. The Airservices Australia data showed that international flights had been using Essendon Fields Airport in 2019. As the airport had not been listed as a designated international airport, they would not have been scheduled international flights. Further, the regulated weight limitation had been increased in 2018 to allow larger high-performance business jets to use the airport. Therefore, it was not unreasonable to consider that some non-scheduled international flights, particularly those involving more sophisticated aircraft, would have utilised the runway 26 instrument landing system.

The APEI's required a strip width of about 300 m for 'international aeroplane operations' conducting precision approaches. The term 'international aeroplane operations' was not defined in the version of the APEIs available to the ATSB. EAPL noted that varying definitions of the term 'international' had been included in aerodrome standards subsequent to the APEIs and that an 'upgrade' for the purpose of considering the grandfathering provisions in the newer Part 139 MOS 2019 referred to scheduled international operations. There was no evidence that scheduled international operations had occurred at any time since the runway 08/26 strip width was reduced from 300 m to 180 m in the early 1970s. However, the wording in the APEIs was still unclear for the purpose of assuring compliance with the standard with the non-scheduled international flights conducting precision approaches in 2019.

Summary

The ATSB review raised matters which required further clarification on how to interpret and apply the MOS Part 139 grandfathering provisions after a 300 m runway strip width had been published for runway 08/26. The matters raised above were not clearly addressed on the available evidence when CASA accepted EAPL's use of the grandfathering provisions in 2019. Any uncertainty with compliance with the APEIs with the presence of international operations was also not discussed.

ATSB finding

In 2019, the grandfathering provisions of the Manual of Standards Part 139 made it uncertain how the provisions could be applied to a runway strip width that had been published as compliant with those standards. Further, there was ambiguity in the older standards being applied with respect to non-scheduled international operations. It was unclear how the regulator had addressed these matters when they accepted grandfathering and the publication of the 180 m strip width.

Safety cases not required for grandfathering

Previously, EAPL had prepared 2 safety cases to address the 2012 and 2014 CASA audit findings regarding compliance of the runway 08/26 strip width with MOS Part 139. CASA had reviewed these safety cases and made comments concerning their adequacy. These safety cases were used by CASA in its review of risk prior to issuing instrument 153/15.

In early 2019, prior to applying the grandfathering provisions, EAPL had completed another safety case acknowledging changes to the aerodrome standards, requiring a 300 m strip width, which was different to the standards they were relying on for a 180 m runway 08/26 strip width. When advising CASA of the intent to grandfather in April 2019, EAPL provided an extract of the amended aerodrome manual, but did not submit the safety case as supporting documentation. However, they were not required to under MOS Part 139, nor did CASA have an expectation that EAPL would submit a safety case. EAPL undertook their assessment in accordance with their own safety management system.

CASA later advised the ATSB that 'administrative grandfathering' was 'correct and entirely consistent with the applicable standards'. While CASA may have accepted EAPL's use of the grandfathering provisions as an administrative matter, the circumstances were different to the expected application of the provisions where information relating to the compliance of the facilities had not changed.

Normally, grandfathering did not involve a previous history of safety cases being presented to, and assessed by the regulator with respect to the risks of a runway strip and the OLS not complying with the current standard. Further, grandfathering did not normally involve the regulator having previously mandated the publication of information consistent with compliance with the current standard and requiring the implementation of risk mitigators such as the lighting and notification of buildings as obstacles.

Further, the published information for the runway 08/26 strip width was reduced from 300 m to 180 m and part of the transitional surface was relocated alongside the reduced strip width. The approach surface inner edge did not change (the CASA officer accepting the grandfathering incorrectly referenced an approach surface inner edge of 180 m). CASA characterised this as the operator choosing to apply a more conservative standard than the 180 m inner approach surface edge in the APEIs (see Chapter 4). However, in the case of runway 26, the approach surface inner edge had been 300 m in compliance with the requirements for a code 4 precision/non-precision approach runway since 2001. The effect of the reduced published runway strip width was to relocate the part of the transitional surface running alongside the strip, resulting in a misalignment with the part running along the side of the approach surface.

The transitional surfaces were being applied as they were since 2003 in accordance with the definition in MOS Part 139. The application of an older standard to the strip width changed the structure of the OLS, which was being defined in accordance with the current standards applicable to the runway's code 4 designation.

Where grandfathering was not available, a safety case was required to be considered by CASA for an aerodrome operator to provide a lesser strip width than the current standard, which should have assessed any risks associated with the runway strip as well as the associated OLS. While grandfathering was accepted in 2019 and a safety case was not required, the circumstances were not a normal application of the provisions as they affected changes related to the strip width and OLS.

In 2019, EAPL did produce a safety case. In this circumstance, an assurance of safety could have been enhanced by CASA having access to, and considering, the safety case in the context of previous risk assessments that CASA had assessed when implementing instrument 153/15.

ATSB finding

The Manual of Standards Part 139 did not require submission of a safety case to the Civil Aviation Safety Authority to consider for acceptance of grandfathering. However, a safety case was prepared by Essendon Airport Pty Ltd, completed in accordance with its safety management system. As this was not a standard application of the grandfathering provisions, greater safety assurance could have been provided for the changes in 2019 for runway 08/26 by the regulator's consideration of that safety case.

9. Assessment of risk

Introduction

This chapter reviews the risks associated with the protections provided by the runway strip and transitional surfaces. The focus of the review is the extent to which relevant information was considered in the risk assessments in the Essendon Airport Pty Ltd (EAPL) 2019 safety case and statements about risk made by EAPL and CASA for the 180 m runway 08/26 strip width. The chapter also examines the factors that contextualise the risks being assessed. This includes the operational limitations at Essendon Fields Airport and ongoing work at an international level to revise the standards for the obstacle limitation surfaces (OLS).

The ATSB has not conducted a risk assessment for operations at Essendon Fields Airport. This was not the responsibility of the ATSB and outside the scope of this investigation.

Background considerations to assessment of risk

Chapter 8 covered the application of grandfathering provisions in 2019 to the runway strip width for runway 08/26 at Essendon Fields Airport. The published strip width was reduced from 300 m to 180 m, applying the Aerodrome Engineering Instructions (APEIs) from the early 1970s. Consistent with the definition for the transitional surface in the Manual of Standards Part 139 – Aerodromes (MOS Part 139) the part of the transitional surface running alongside the strip was relocated. The other part of the transitional surface alongside the approach surface was based on a 300 m inner edge.

The MOS Part 139 did not require an aerodrome operator to produce a safety case to be reviewed by CASA for accepting the application of grandfathering provisions. Nonetheless, a safety case was produced by Essendon Airport Pty Ltd (EAPL) in 2019 for its own assessment of having a strip width less than the 300 m standard in MOS Part 139 under its safety management system. Further, statements were made by CASA about the safety of the runway with the changes in the published dimensions.

Civil Aviation Safety Authority comments

As discussed in Chapter 8, CASA advised the ATSB that since runway 08/26 was grandfathered, a risk assessment was not necessary. Risk associated with the facilities had been considered as part of the continued policy of permitting previously compliant facilities to apply the standards that existed at the time they were last constructed/upgraded.

In 2022, CASA advised the International Federation of Airline Pilots that there were ‘no safety or compliance issues that would render Essendon Airport as critically deficient’. In addition, CASA stated their expectation that pilots will make their own decision on whether to use the runway as configured based on all the available information.

Essendon Airport Pty Ltd comments

Chapter 8 addressed the production of the safety case by EAPL in 2019. EAPL had advised the ATSB that the safety case was produced on its own initiative and in accordance with its safety management system. In the safety case, it was stated that the concern that required its production was that the standards had changed to require a 300 m strip width for a code 4 precision approach runway. Runway 08/26 had operated for decades with a 180 m strip width.

The safety case further stated:

> The purpose of the safety case is to demonstrate that a 180 metre wide runway strip provides an operational environment that manages risks for all fixed wing aircraft permitted to operate at YMEN [Essendon Fields Airport] to a level that is as low as reasonably practicable.

The safety case considered stakeholder feedback on the proposal to revert to the published 180 m strip width. It considered risks associated with the runway strip width dimensions and location of the transitional surface in the context of its safety management system, and risk appetite and tolerance.[60] EAPL concluded that:

> …reverting to a 180 m wide runway strip for runway 08/26 provides an Acceptable risk rating that is Tolerable in accordance with EAPL SMS risk management procedures that have been accepted by CASA.
>
> Additionally, EAPL believes that a reasonable person would conclude that over 40 years of safe operations with a 180 m wide runway strip supports this conclusion.

Overview of risks to be assessed

The general expectations for a safety assessment as part of a safety case are documented and have been previously discussed in Chapter 8. Guidance was provided by the International Civil Aviation Organization (ICAO) in ICAO Doc 9981, *Procedures for Air Navigation Services - Aerodromes* (International Civil Aviation Organization, 2020d) for safety assessments and advice was provided for the objectives of the physical characteristics of the aerodrome, including the runway strip. Guidance was given for the consideration of hazards and objects on the runway strip. ICAO Doc 9137 – *Airport Services Manual, Part 6 Control of Obstacles* (International Civil Aviation Organization, 1983), provided guidance for managing obstacles and background to the OLS. However, specific guidance was not provided for all the individual surfaces and the hazards with an explanation for their dimensions (see Chapter 4, noting the historical review undertaken by the ICAO Obstacle Limitation Surface Taskforce to clarify the safety objectives of the transitional surface).

On 8 November 2022, in response to a draft of this report, CASA stated that 'the aviation industry and aerodrome operators in particular have a demonstrated understanding of the function of the OLS'. On 12 October 2022, the ICAO Secretariat advised:

> The report, in a few places, seeks guidance to assist States in deviating from Standards. It is not practicable to provide guidance on how to apply deviations to a published Standard. In the case of transitional surface and runway strip width, they are Standards in Annex 14, Vol I. It is expected that States comply with these Standards.

Despite the above comments, it is reasonable to expect that, if there are going to be variations from the standards, that the risks the surfaces managed are considered as part of any assessment. For the runway strip width and transitional surface, these risks, particularly with respect to protection from obstacles, included the below (as discussed in Chapter 4):

- The runway strip, as part of the obstacle restriction area, provided protection:
  - to reduce the risk of damage to aircraft running off a runway (veer-off); and
  - protecting aircraft flying over it during take-off or landing.
- The transitional surfaces (with the approach surface) provided protection from obstacles to aircraft during the final phase of the approach-to-land manoeuvre experiencing a lateral deviation during a visual approach or the visual segment of an instrument approach. This included protection during a missed approach.

The importance of these surfaces as risk mitigators protecting aircraft operations around the approach to land, landing, and take-off phase of flight is exemplified by the prevalence of accidents around the runway. In its 2022 Annual Safety Report, the International Air Transport Association examined accident data for commercial aircraft[61] with a maximum take-off weight above 5,700 kg, between 2005-2022. Of the 1,365 accidents identified, about half (53%)

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[60] The ATSB has not sought to determine the adequacy of the consultation or the criteria for assigning values for determining risk tolerance and acceptability.

[61] Executive jet operations, training, and maintenance/test flights were excluded.

occurred during the landing phase.[62] A much smaller proportion occurred while on approach,[63] during a go-around,[64] and take-off/rejected take-off,[65,66] accounting for 8%, 2% and 10% respectively (International Air Transport Association, 2022).

Further context for the risks associated with aircraft operations protected by the runway strip width and transitional surface (in connection with the approach surface) are explained under the relevant headings below. Consideration is given to objects being placed higher and closer to the runway with the strip width for runway 26 being less than the standard for a code 4 precision/non-precision approach runway.

Critical aircraft type

As discussed in Chapter 8, a key factor in any risk assessment will be the critical aircraft types that use the runway. These aircraft are the most demanding for the relevant elements of the physical infrastructure and the facilities for which the aerodrome is intended.

Although runway 08/26 was a code 4 runway, the Air Navigation (Essendon Fields Airport) Regulations 2018 placed a 50,000 kg maximum take-off weight (MTOW) limit to regulate noise at the airport. The weight limitation meant that it was unavailable for larger code 4 aircraft. In their 2019 safety case, EAPL stated that the largest aircraft that have, and are likely to operate from the airport, are those with a combined reference code (number and letter) of 4C such as the Global Express (note in the table below the Global Express were referenced as 3C but some had a field length requirement that could classify them as a 4C aircraft).

As previously stated in Chapter 4, the code number applied to the field length required for take-off at the aircraft's MTOW. The letter referenced the wingspan and the outer main gear wheel span. The latter Part 139 MOS 2019 separated the outer main gear wheel span element from the code letter.

Table 8 below is extracted information from a table produced in the 2019 safety case of code C aircraft that EAPL said currently used Essendon Fields Airport as well as CASA's advice on the critical aircraft for the aerodrome.

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62 IATA: the landing phase begins when the aircraft is in the landing configuration and the crew is dedicated to touch down on a specific runway; it ends when the speed permits the aircraft to be manoeuvred by means of taxi for arrival at a parking area. It may also end by the crew initiating a go-around phase.

63 IATA: the approach phase begins when the crew initiates changes in aircraft configuration and/or speeds enabling aircraft to manoeuvre to land on a specific runway; it ends when the aircraft is in the landing configuration and the crew is dedicated to land on a specific runway. It may also end by the crew initiating a 'go-around' phase.

64 IATA: the go-around phase begins when the crew aborts the descent to the planned landing runway during the approach phase; it ends after the speed and configuration are established at a defined manoeuvring altitude or to continue the climb for the purpose of cruise.

65 IATA: the take-off phase begins when the crew increases the engine thrust for take-off; it ends when an initial climb is established or the crew initiates a rejected take-off phase.

66 IATA: the rejected take-off phase begins when the crew reduces engine thrust to stop the aircraft before the end of the take-off phase; it ends when the aircraft is taxied off the runway for a taxi-in phase or when the aircraft is stopped and engines shutdown.

Table 8: Details of typical critical aircraft for Essendon Fields Airport

Aircraft	MTOW	Aerodrome reference code	Wingspan
Bombardier Global Express	Up to 47,536 kg	3C	28.7 m
British Aerospace 146-300	43, 091 kg	3C	26.34 m
Gulfstream G IV	43, 000 kg	3C	23.7 m
On 8 November 2022, in response to a draft of this report, CASA stated the Fokker F100 was the critical aircraft type for aircraft operating at Essendon Fields Airport.			
Fokker F100[67]	44, 450 kg	3C[68]	28.1 m

In their November 2019 submissions to the ATSB, CASA stated that:

> Regulatory limitations to the size of aircraft permitted to use the aerodrome ensures the ROC [retail outlet centre – Bulla Road Precinct development] does not generate a risk to aviation safety now or in the future.

Runway veer-offs

Overview of risk

According to ICAO, runway excursions continue to be a high priority due to the frequency of these types of events. While most of these events are survivable, the fatality risk remains significant (Future Airport, 2018). Recent research also reviewed worldwide events from 1996 to 2019, and found that about 52% of accidents occurred near the runway. Of this, about 41% were runway excursions, which were evenly distributed between veer-offs and overruns. Most of these occurred during the landing phase of flight (Di Mascio, Cosciotti, Fusco, & Moretti, 2020).

ICAO Doc 9981 (International Civil Aviation Organization, 2020d) stated:

> Particularly, the graded portion of the runway strip is provided to minimize the damage to an aeroplane in the event of a veer-off during a landing or take-off operation. It is for this reason that objects should be located away from this portion of the runway strip unless they are needed for air navigation purposes and are frangibly mounted.

The mandated graded portion for a code 3 or 4 precision/non-precision approach runway was 75 m from the runway centreline (150 m) to provide protection for a veer-off event with the wheels coming to the edge of this portion. The wing extending beyond the graded portion was an additional factor that needed to be considered for veer-off protection provided by the overall strip width (International Civil Aviation Organization, 2017).

ICAO Annex 14 also provided guidance for consideration of an extended graded portion for a code 3 or 4 precision approach runway. The guidance stated that it may be desirable to have a graded portion extending 105 m out from the centreline, except that the distance is gradually reduced to 75 m from the centreline at both ends of the strip, for a length of 150 m from the runway end. The guidance was given using information on aircraft running off runways (International Civil Aviation Organization, 2018a).

With reference to the guidance, it was noted that runway 26 was classified as a precision approach runway in 2019. However, changes to the standards meant that runway 26 was

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[67] The Fokker F100 may not have regularly used Essendon Fields Airport. However, it has done so and would not be restricted from landing on runway 08/26.

[68] A search for this aircraft type indicated that there were a number of references to it being a code 3C. However, ICAO Doc 9157, *Aerodrome Design Manual* (International Civil Aviation Organization, 2020) listed the Fokker F100 in a table as a code 4C aircraft. An aerodrome safeguarding consultant engaged by the ATSB advised the reference code tables need to be updated.

classified as a non-precision approach runway at the time of publication of this report (see Chapters 3 and 4).

The risk of veer-off was highlighted in the ATSB's research report into runway excursions (AR-2008-018 Part 2):

> Runway strips are a key recovery risk control when runway excursions do occur, especially for veer-offs. They consist of a fully graded area surrounding the runway at both ends and beyond the side of the runway. The aim of this area is to reduce the risk of damage to aircraft running off the ends or sides of the runway.
>
> Fortunately, Australia has not experienced a runway excursion accident of the severity of those seen overseas. However, given the proximity of Australia's major airports to urban residential and industrial areas, Australia is not immune.

In ICAO Doc 9981, ICAO further stated that:

> The lateral runway excursion hazard is clearly linked to specific aeroplane characteristics, performance/handling qualities and controllability in response to such events as aeroplane mechanical failures, pavement contamination and crosswind conditions. This type of hazard comes under the category for which risk assessment is mainly based on the flight crew/aeroplane performance and handling qualities. Certified limitations for the specific aeroplane is one of the key factors to be considered in order to ensure that this hazard is under control.

Essendon Airport Pty Ltd safety case and comments

The 2019 EAPL safety case referenced the airworthiness standards for the aircraft they considered to be the critical aircraft types operating at the airport (see Table 8). EAPL noted:

> The take-off scenario is considered the most critical by certification authorities because the potential for lateral deviation and control problems is greatest with an operating engine set to take-off power on one side and a failed engine with low or zero power on the other side of the aircraft. Such a scenario is not present during landing operations since the power on an operating engine(s) is close to that of a failed engine.

EAPL considered the minimum control speeds for an aircraft and noted that the most critical situation involving lateral deviation was a take-off emergency (for example, the failure of an engine at low speed) and that it 'must not result in the aircraft moving laterally more than 9.1 m'. EAPL stated that this applied for lateral deviations on the ground and in the air while the aircraft was over the runway and the associated strip.

In addition to considering the airworthiness standards, EAPL considered risks with respect to:

- failure of a single tyre
- failure of both tyres and landing gear leg
- failures of both tyres on main landing gear leg
- structural failure of the main landing gear leg
- structural failure of nose gear leg
- failure of nose wheel steering system
- pilot incapacitation.

Further, EAPL analysed accident records for the airport and more broadly for the 3 aircraft listed in their critical aircraft type (see Table 8) as well as for the smaller Saab 340. EAPL concluded that 'these records show that lateral excursions are not common over time for the aircraft types above but when they have occurred, the excursion has been contained well within the limits of a 180 m runway strip'. The safety case concluded that analysis of all the possible types of failure that could affect directional control of an aircraft resulting in a lateral excursion gave an acceptable risk rating that was tolerable.

In CASA's review of a safety case EAPL submitted in 2014 (see Chapter 8), a CASA officer detailed 2 occurrences at airports in other countries considered relevant for a risk assessment of veer-off events on runway 26 at Essendon Fields Airport:

- A Bombardier BD-700-1A11 (Global Express) aircraft that sheered its landing gear during landing and veered-off the runway before coming to rest outside the graded portion of the runway strip, about 65 m from the centreline. A swale drain[69] and earth berms appeared to have arrested much of the aircraft's energy, otherwise it may have travelled into houses.
- A Fokker 100 aircraft that was landing when the right main landing gear failed. The aircraft veered-off the right side of the runway, coming to rest at least 90 m from the centreline.

Comparing these accidents to the conditions at Essendon Fields Airport, the officer assessed that:

> …The grade between Runway 26 and the DFO building consists of a constant down slope. Whilst meeting the standards, this grade does not provide any upslope to arrest the energy of an aircraft departing the runway. The distance the aircraft travelled in the Iran [Fokker 100] accident would have exceeded the strip environs.

The ATSB notes that the Global Express accident was referenced in the 2019 EAPL safety case. However, factors such as the swale drain and earth berms preventing it travelling further than 65 m from the runway centreline were not discussed. The Fokker 100 incident was not referenced.

On 28 November 2022, in response to a draft of this report, EAPL referenced their 2019 safety case and further stated:

> The width of the graded portion of the runway strip provided the protection for runway excursions (veer-offs). The width of the graded portion of the runway strip met the requirements for the minimum graded runway strip width of 150 m for a Code 4 instrument runway.

Civil Aviation Safety Authority comments

On 8 November 2022, in response to a draft of this report, CASA stated that the minimum requirement for the graded portion of the runway strip was 150 m. CASA further noted that there have been veer-offs up to 500 m, but this did not show the need for larger strip widths. CASA advised that they considered the evidence showed an acceptable level of risk for the type of aircraft operating at Essendon Fields Airport.

Changes to the strip width standards

In a 2017 State letter proposing changes to the standards in ICAO Annex 14, ICAO explained to contracting States that the existing aerodrome design specifications based on the aerodrome reference code were overly conservative (International Civil Aviation Organization, 2017). With respect to the runway strip width, the letter stated the:

> Current strip width is not designed based on modern aeroplane performance or safety objectives according to historical evidence [such as the extent of runway veer off events].

For code 3 and 4 precision/non-precision approach runways, ICAO proposed reducing the strip width from 300 m to 280 m. ICAO considered a series of runway veer-off studies stating there was:

> … a sharp reduction in veer-off events within a distance of 100 m from the runway centreline, and a much smaller decrease between 100 m and 150 m from the centreline. Only a few extreme cases can be found exceeding 150 m from the runway centreline.

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[69] A swale drain is a broad, shallow ditch that can be lined with grass, vegetation, or rocks.

For code 3 and 4 precision/non-precision approach runways, ICAO used the guidance for the graded portion of the strip width for a precision approach runway extending 105 m from the runway centreline. ICAO accounted for the wing of larger code 4F aircraft extending beyond the graded portion. The 280 m strip width was derived from these considerations.

The changes for the overall strip width dimensions were adopted in subsequent editions of ICAO Annex 14 and in Part 139 MOS 2019 (see Table 2 in Chapter 4). The standards for the graded portion (75 m from the runway centreline) did not change. ICAO also continued to provide guidance for consideration of an extended graded portion out to 105 m from the centreline for code 3 or 4 precision approach runway.

Deviations on approach to land

With respect to the risks to aircraft airborne in proximity to the runway, the investigation focussed on the approach to land rather than take-off. This was due to the dimensions of the runway strip width under consideration being determined by the status of runway 26 as a precision/non-precision approach runway rather than as a take-off runway. Further, the transitional surface is associated with the OLS approach surface, not the take-off surface.

As explained in Chapter 44, the landing minima was the lowest height at which a pilot in instrument flight conditions could be assured of obstacle clearance without having sighted and aligned with the runway. This provided pilots operating under instrument flight rules with assurance that obstacle free airspace will be provided by PANS-OPS if they needed to conduct a missed approach at or above the landing minima (that is, the decision height). The OLS and related notification, marking and lighting requirements for objects penetrating the OLS provided protection below the minima when pilots had visual confirmation they were correctly aligned with the runway and protected from obstacles.

Lateral deviations below the landing minima

As discussed in Chapter 4, along with the runway strip (flyover area), the approach and transitional surfaces provided aircraft with protection from obstacles in the event of a lateral deviation from the runway centreline during a visual approach or the visual segment of an instrument approach below the landing minima. Protection provided by the full width of the surfaces likely included an aircraft with compromised performance, such as with an engine inoperative, high crosswind, pilot handling error, or during a rejected landing (missed approach, go-around, or balked landing).

The findings and conclusions of the 2013 international Go-around Safety Forum (Skybrary, 2013) recognised that a go-around (an occurrence in which the aircraft discontinues the approach to land such as a missed approach) is a normal phase of flight and pilots should be encouraged to conduct this manoeuvre when the conditions necessitate such. However, this ‘does not mean that there are no safety issues associated with it’. From the research quoted by the forum, the majority of the accidents (over the last 10 years) occurred during the approach, landing and go-around flight phases, with 1 in 10 go-around reports resulting in a ‘potentially hazardous go-around outcome’. Notably, it was also emphasised that the height at which a go-around was initiated presented different challenges and risks.

The Flight Safety Foundation completed a study (Go-Around and Decision-Making and Execution Project) in 2017, which examined more than 1,500 go-around events involving jet aircraft worldwide. The study found that a go-around was conducted once every 340 approaches. Of these, about 40% were initiated below 500 ft, 15% below 200 ft, and 7% below 50 ft (Flight Safety Foundation, 2017). The ATSB noted that a go-around at 200 ft would be below the landing minima at its lowest for a category I precision approach runway (as defined in 2019).

The United States Federal Aviation Administration (United States Federal Aviation Administration, 2017) also noted that:

> It is imperative to recognize that any delay in making a decision to execute the Missed Approach Procedure at the DA/DH or MDA [minimum descent altitude]/Missed Approach Point will put the aircrew at risk of impacting any obstructions that may be penetrating the visual obstacle clearance.[70]

International Civil Aviation Organization review of obstacle limitation surfaces

ICAO hosted an 'OLS symposium' at the end of 2021 to discuss the work of the Obstacle Limitation Surface Taskforce (OLSTF), which had been reviewing the OLS. Changes were proposed on the basis that the OLS had origins in the 1950s and 'no longer reflect the performance characteristics of modern aircraft and air navigation systems whose evolution has enabled a significant decrease of aircraft deviation' from the intended flight path. The OLSTF was concerned that using the aerodrome reference code meant the OLS dimensions were established independently of the operational use of the runway (International Civil Aviation Organization, 2020a). At the OLS symposium in 2021, the OLSTF noted that they had been reviewing the OLS dimensions and advised 'the taskforce sees the need to provide clarity on the application of these surfaces'.

Consistent with the discussion at the symposium, ICAO issued a letter to contracting States in May 2023 (International Civil Aviation Organization, 2023) proposing 2 new sets of surfaces to replace the OLS:

- The obstacle free surfaces (OFS) would provide a volume of airspace necessary for safe and accessible operations near the runway and in the vicinity of the aerodrome. As such, the volume of airspace would be kept free from obstacles, except for existing obstacles and terrain that would have been assessed earlier.
- The obstacle evaluation surfaces (OES) would provide the volume of airspace where obstacles could impact the operations intended for the aerodrome. States would then evaluate their impact and decide whether obstacles were acceptable, after adequate mitigation measures. They would act as triggering surfaces used when determining whether obstacles are acceptable for safe and regular operations. Surfaces were proposed to protect instrument approach procedures.

The OLSTF also proposed to disconnect the OLS from the runway strip. Further, for the purposes of defining the parameters of these surfaces related to the approach runway, it was proposed to categorise aircraft based on the indicated airspeed when over the runway threshold and wingspan rather than the aerodrome reference code number. As noted above, the aerodrome reference code number was based on the field length for aircraft taking-off. However, the indicated airspeed was used by the PANS-OPS approach procedure designer when calculating airspace and obstacle clearance requirements for the aircraft approach (Skybrary, 2023). The aircraft wingspan was relevant to considering how wide an aircraft extended when deviating laterally from the runway centreline.

Part of the work of the OLSTF included a review of the approach trajectory data below 500 ft on instrument runways in the United States. The taskforce stated that the data encompassing lateral deviations at the threshold, and during a missed approach forward of the threshold, suggested that the dimensions of the inner edge of the approach surface could be reduced and the transitional surfaces brought in closer to the runway. A member of the OLSTF advised the ATSB that the data set covered approximately 135, 000 trajectories and likely included go-arounds and balked landings. It could have also included cases of engine failure based on the amount of data reviewed.

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[70] This term in the United States refers to the equivalent of the obstacle limitation surfaces.

In their 28 November 2022 submissions on a draft of this report, CASA advised that using the Fokker F100 aircraft as the critical aircraft type for runway 26 at Essendon Fields Airport (considering airspeed and wingspan), the OFS approach surface inner edge would be 155 m. A member of the OLSTF and an aerodrome safeguarding consultant confirmed that the Fokker F100 would fit within the categorisation for aircraft requiring the OFS with these dimensions.

The ATSB noted that the OES surface for a precision approach using an instrument landing system (ILS) would be consistent with the basic ILS surfaces. While an ICAO contracting State could vary the dimensions of the OES based on the operations at a particular aerodrome, it was proposed that there would be an OES approach surface with a 300 m inner edge and the lower edges of the transitional surface would be determined by this dimension.

At the time of publication of this report the ICAO proposals were under consideration by contracting States. Any proposals adopted would not be applicable until 2028.

Essendon Airport Pty Ltd safety case and comments

EAPL's 2019 safety case considered the risk of a collision in an instrument missed approach on runway 26. The safety case stated:

> The runway 26 ILS approach has a Decision Height (DH) of 251 feet above the runway 26 threshold. Pilots must make a decision to land or conduct a missed approach by the DH. In the event of a decision to conduct a missed approach at the DH, an aircraft may descend by up to 50 feet below the DH, although most pilot training and testing require the pilot to initiate a missed approach by the DH with the aircraft not descending below that height. Instrument rating testing of pilots and the inherent accuracy of air data computers that provide altitude information to the pilot mean that any breach of this requirement is assessed as extremely improbable.

EAPL also reviewed surveyed obstacles and the distance between them and the decision height concluding 'there is clearly considerable margin'. Consequently, EAPL rated the risk as acceptable. However, EAPL also considered it appropriate to monitor aircraft incident reports provided by Airservices Australia and aircraft operators for missed approach altitude breaches. The ATSB engaged an aerodrome safeguarding consultant who advised that:

> To evaluate risks in the visual phase of an approach-to-land manoeuvre, ideally trajectories are considered to enable statistical analysis of aircraft behaviour and lateral deviation. Adequate data for such analysis, however, is often not available. Although other assessment methods and criteria exist for the assessment of obstacles, especially in the pre-threshold environment (area related to the approach surface), statistical analysis of trajectories is considered preferable to justify a reduction of OLS dimensions in the near runway environment.

On 28 November 2022, in response to a draft of this report outlining risk considerations for changes after 2019, EAPL stated it was not clear why crosswind would be a specific issue [for a lateral deviation] when the Airservices Australia runway nomination criteria required runway 17/35 to be nominated as the runway for use if the crosswind on runway 08/26 exceeded 20 kt.

Civil Aviation Safety Authority comments

On 8 November 2022, in response to a draft of this report, CASA stated that it was unaware of a single instance where a transitional surface protected an aircraft with compromised performance to the extent that it was flying over a transitional surface. As noted above, CASA also referenced the work of the OLSTF stating that 'it proposes a reduction of the inner edge of the approach surface to 155 m at airports catering to Essendon RWY 08/26 type operations'.

Landing minima as a risk mitigator

As discussed in Chapter 6, both the Rules and Practices for Aerodromes and MOS Part 139 standards included a provision for adjusting (raising) the landing minima (decision altitude/height) of a code 4 precision approach runway such as runway 08/26 when it was not practicable to provide the full runway strip width. In their 2013 safety case to CASA, EAPL discussed having raised the runway 26 landing minima (decision height) in 2003:

> As a result of the penetrations of the southern [OLS] transitional surfaces of Runway 26 noted in 2003,[71] and in accordance with CASA's direction to monitor and report obstacles accordingly, the Essendon Airport Runway 26 ILS [instrument landing system] approach decision height (DH) was raised by the magnitude of the penetration. This resulted in an amendment to the RWY 26 ILS procedure's DH to 590 feet AMSL [above mean sea level], positioning the approaching aircraft at 351 feet above the Runway 26 landing threshold.[72]
>
> The raising of the RWY 26 ILS approach decision height ensures that aircraft utilizing the instrument approach procedure are adequately protected from collision with an obstacle and satisfied compliance to the Procedures for Air Navigation Services – Aircraft Operations (PANSOPS) criteria. Furthermore, the identification, reporting and subsequent amending of approach procedures illustrated the airport operator's robust system and overall desire for maintaining continued regulatory compliance with regard to the reduced runway strip dimensions.
>
> Landing minima adjustments have been implemented for Runway 26 approaches to take account of the obstacle environment, thus completely mitigating the requirement for a full 300m wide runway strip…

The above comments were also mentioned by CASA in 2019, where they stated to the ATSB that the 'approach minima had not changed since 2003'. The aerodrome approach charts that the ATSB obtained showed that this was the case from at least 2005 (see Chapter 5).

The ATSB noted the decision height of 351 ft (251 ft with the QNH applied) was higher than the 200 ft minimum required for a precision approach category I runway as stated in MOS Part 139 (definition for an instrument approach runway in MOS Part 139 in 2019 prior to changes in runway classification: see Chapter 4). In 2018, Airservices Australia confirmed to the ATSB that the Bulla Road Precinct development had no impact on the landing minima for runway 08/26 (as it had already been raised). They also advised that, from the most recent obstacle surveys available, no further changes to the minima were required.

In October 2020 correspondence with the ATSB, CASA referenced the raised decision height for a missed approach as a risk mitigator for the strip width less than the standard, noting that increasing the minima ensured aircraft were above any obstacle while operating in instrument meteorological conditions. This was further reiterated in CASA's 8 November 2022 submission to the ATSB (see Chapter 5 for references to the decision height). Likewise, EAPL considered the raised decision height to be one of the risk mitigators and that sufficient obstacle clearance was provided by the existing minima.

Obligation to assess risks associated with obstacles

Assessment of obstacles

Chapter 4 discussed the restrictions on obstacles around aerodromes with reference to the runway strip, OLS and PANS-OPS surfaces. Intrusions on the runway strip were generally

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[71] As noted in Chapter 6 the ATSB did not have evidence of the penetrations of the transitional surface in 2003. However, in 2005 the Bulla Road Precinct development would have infringed a transitional surface based off a 300 m strip width. Despite acknowledging the 180 m strip width for runway 08/26, CASA in 2003 had told EAPL to still monitor a transitional surface based off a 300 m strip width and report obstacles to Airservices Australia.

[72] The ATSB noted that the correspondence appeared to incorrectly use the term 'decision height'. In the context to which EAPL were referencing the minima at AMSL, they were likely to have meant 'decision altitude'.

prohibited although CASA could issue an approval as they did with instrument 153/15. As discussed in Chapters 4 and 7, Part 12 of the *Airports Act 1996* and the Airports (Protection of Airspace) Regulations 1996 were used to facilitate the assessment of intrusions into the OLS and PANS-OPS airspace at federally leased airports. The requirements applied in addition to the regulations and standards administered by CASA.

Monitoring and assessment requirements existed under the Civil Aviation Safety Regulations and MOS Part 139 (and Part 139 MOS 2019) for the OLS. Obstacles penetrating through the OLS were to be referred to CASA to determine if they would be a hazard to aircraft operations. CASA could direct that the obstacles be marked and/or illuminated. For PANS-OPS, the flight procedure designer was to be advised of an actual or proposed intrusion into this airspace.

The Civil Aviation Safety Regulations provided CASA with the power to issue a direction about a matter affecting the safe navigation and operation of aircraft. CASA could use this power to limit operations at an aerodrome to manage any identified hazard.[73] The regulations also provided for an identified hazard to be published in the Aeronautical Information Package [En Route Supplement Australia] or notice to airmen.[74]

Runway 26 published runway strip width and obstacle limitation surfaces

Chapter 8 explained the changes to the published runway strip width and the transitional surfaces for runway 26 when the grandfathering provisions of MOS Part 139 were applied and accepted. This resulted in buildings in the Bulla Road Precinct no longer being notified as obstacles and requirements for marking and lighting being removed. Further, additional objects could be placed higher and closer to the runway with a 180 m strip width rather than a 300 m strip width.

Essendon Airport Pty Ltd safety case and comments

The EAPL 2019 safety case acknowledged ‘amendment of the runway strip width to 180 m defines the datum for the OLS Transitional Surface as at any other certified aerodrome’. EAPL considered that the control of potential future obstacles was a matter for future planning controls including the airport master planning process under the Airports Act. EAPL further stated that monitoring and reporting of obstacles was a business as usual issue in accordance with any requirements stipulated by CASA.

Civil Aviation Safety Authority comments

On 8 November 2022, in response to a draft of this report, CASA stated that they agreed with the position that buildings could be placed higher and closer to the runway without the need for an assessment. Based on this, CASA indicated that this should have led the ATSB to the conclusion that the Bulla Road Precinct had no transport safety impact on aviation operations at the airport.

Building-induced windshear and turbulence

Background

Historical ICAO documents indicated that one purpose of the transitional surface was to protect aircraft during crosswind operations (International Civil Aviation Organization, 2020a) when a lateral deviation from the runway centreline may occur. Building-induced windshear and turbulence (BIWT) was not identified as one of the original protections provided by the

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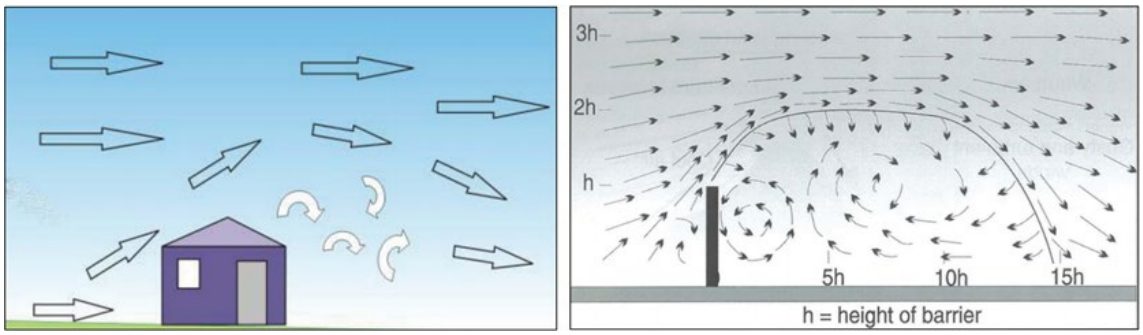
[73] CASA has limited power under the Civil Aviation Regulations 1988 to require removal of an object or part of an object that infringes surfaces, defined by that regulation, at an aerodrome open to public use by aircraft engaged in international air navigation or air navigation within a Territory.

[74] A notice to airmen: A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

transitional surface, but its occurrence can be associated with a crosswind.[75] Building generated windshear is changes in wind speed and/or direction between 2 points, while building generated turbulence is rapid irregular changes in wind speed and/or direction at fixed points (National Airport Safeguarding Advisory Group, 2018a). According to research conducted by the Netherlands National Aerospace Laboratory, aircraft were most vulnerable to the effects of disturbed wind velocity profiles during the final stages of an approach to land, especially below 200 ft (Nieuwpoort, Gooden & de Prins, 2010).

Figure 17 is a representation of how a building can affect the localised wind downwind of that structure. The diagram on the left shows the wind being diverted around and over a building causing the localised wind to vary. The diagram on the right shows the turbulence created by a barrier an equivalent distance of up to 15 times the height of the object that created the disturbance (ATSB investigation AO-2010-008).

Figure 17: Graphic representation of building-induced windshear and turbulence



Source: ATSB (investigation AO-2010-008)

ATSB investigation (AO-2010-008)

The risk presented to aircraft operations around the runway environment by BIWT was examined by the ATSB in investigation AO-2010-008. This investigation looked at the brief loss of control experienced by the pilot of a Grumman Traveller AA-5 aircraft during late final approach to runway 12 at Canberra Airport, Australian Capital Territory, in 2010. The combination of wind direction and speed, and the location of buildings within the vicinity of the runway resulted in the aircraft experiencing severe turbulence when at about 150 ft above ground level. This resulted in the aircraft banking sharply, but the pilot regained control and landed safety.

The investigation determined that 2 buildings[76] were constructed north of the runway 12 threshold at a height and position that could generate turbulence affecting the approach, threshold and touchdown areas of the runway under some wind conditions. It was also noted that the En Route Supplement Australia alerted pilots to the possibility of severe turbulence during touchdown on runway 25 in strong westerly winds. However, there was no such alert to affected pilots about the possible risk on runway 12.

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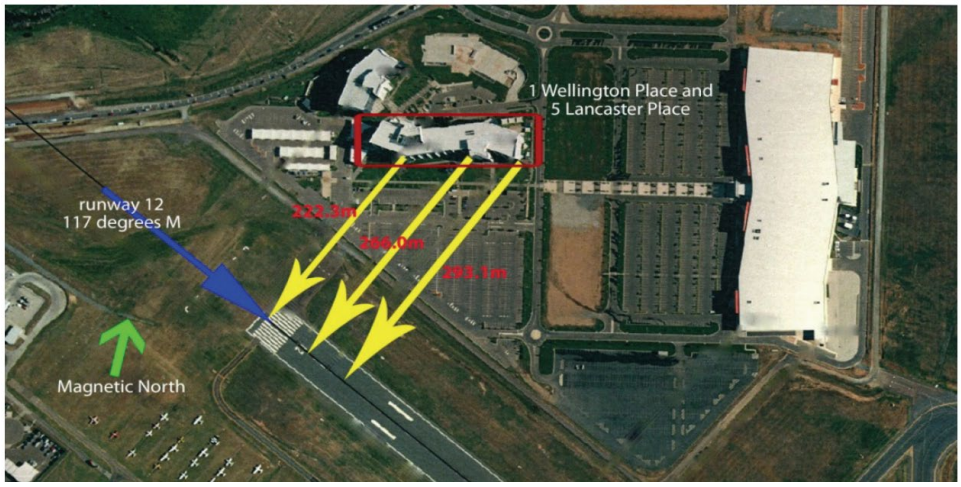
[75] Low level windshear associated with buildings around the runway was a known concern. ICAO published Circular 186-AN/122 in 1987 addressing the known risks (International Civil Aviation Organization, 1987).

[76] On 8 November 2022, in response to this draft report, CASA noted that the buildings at Canberra Airport were 'significantly taller' than those for the Bulla Road Precinct.

Figure 18: Aerial view of runway 12 and the adjacent buildings



Source: ATSB (investigation AO-2010-008)

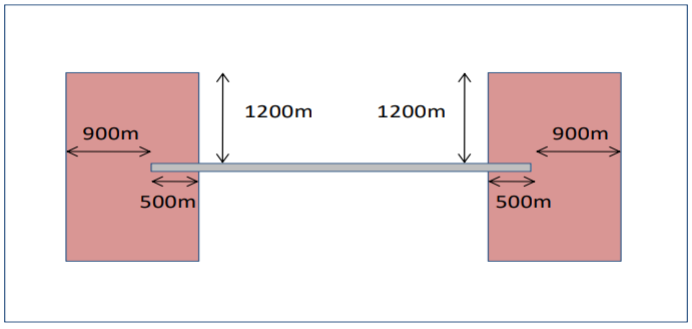
The reference to ATSB investigation AO-2010-008 is provided as an example of the need to be aware of the risks of BIWT. It is not indicative of any BIWT risk at Essendon Fields Airport.

National Airports Safeguarding Framework

In the 2008 National Aviation Policy Green Paper, the formation of a National Airports Safeguarding Advisory Group[77] was initially proposed and subsequently included in the 2009 White Paper. Around 2012, the advisory group developed the National Airports Safeguarding Framework (NASF), which provided guidance on the planning requirements for developments that affect aircraft operations. The framework applied to all Australian airports and included building activity around airports that may penetrate operational airspace and/or affect navigational procedures for aircraft. However, they were not mandatory and did not have any retrospective application to buildings constructed before they were introduced.

The guidelines stated that any proposed structure, which penetrated a specified 'trigger area' located around the runway ends should be assessed for its potential to create BIWT (National Airport Safeguarding Advisory Group, 2018a). The trigger area was located by reference to the runway threshold and centreline (Figure 19).

Figure 19: Building induced windshear turbulence runway trigger area



Source: National Aerodrome Safeguarding Framework – Guideline B

Risk was mitigated within the trigger area by reference to a height limitation. This limitation was defined by a 1:35 surface extending perpendicular from the runway centreline. In other words,

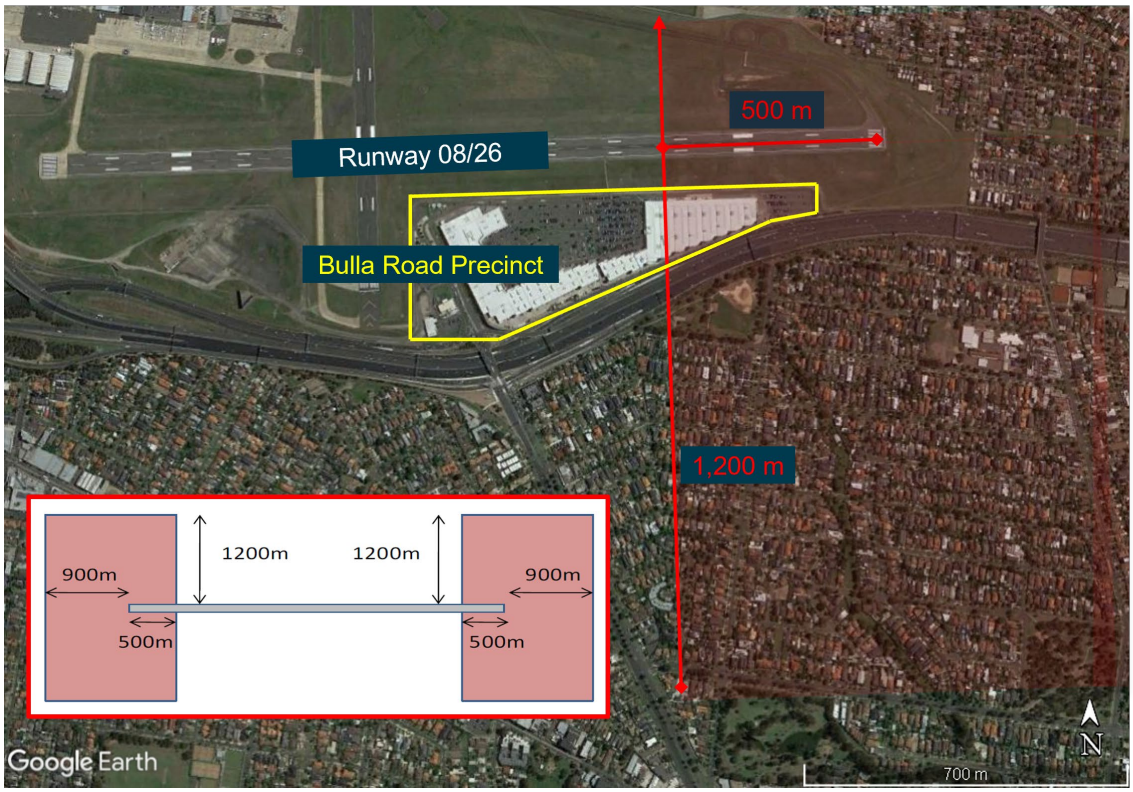
[77] The group comprised of Commonwealth, State and Territory Government planning and transport officials, the Australian Government Department of Defence, CASA, Airservices Australia and the Australian Local Government Association.

the distance from the runway centreline to the closest point of the building should be more than 35 times the height (above runway level) of the building. The guidelines advised that the 1:35 surface was used to rule out buildings that 'clearly do not propose a risk'. They further stated, 'the 1:35 surface is very conservative and any building that does not penetrate the surface is not expected to create unsafe wind effects'.

Bulla Road Precinct development location within the trigger area

Figure 20 below shows the dimensions of the trigger area (inset) compared with runway 08/26 at Essendon Fields Airport (main). This shows that part of the Bulla Road Precinct development was within the trigger area.[78]

Figure 20: Assessment trigger area (red shading) around runways (inset) and partially around runway 08/26 (main) for comparison



Source: Department of Infrastructure, Transport, Regional Development and Communications, annotated by the ATSB

In correspondence with the ATSB in 2020, EAPL acknowledged that some parts of the buildings penetrated the 1:35 surface with reference to the height of the buildings and distance from the runway. EAPL stated that the buildings had not been subject to a BIWT assessment, noting that the guidelines were introduced in 2012 and not intended to be applied retrospectively.

2003 Airservices Australia's comments

During the public exhibition of the 2003 Essendon Fields Airport draft master plan, which included the proposal for the development of the Bulla Road Precinct, Airservices Australia submitted the following to the then Department of Transport and Regional Services:

> With regards to building infrastructure adjacent to the runways, we suggest they be assessed for potential turbulence generated by the structures in strong winds. The Draft Master Plan limits the infrastructure assessment to obstacle impediment of the Obstacle Limitation Surface (OLS).

[78] The ATSB was of the understanding that changes to the runway strip width or movement of the transitional surface would not affect the application of these guidelines.

This suggestion was not restated by Airservices Australia in their submission on the 2004 draft major development plan for the Bulla Road Precinct.

Essendon Airports Pty Ltd safety case and comments

EAPL's 2019 safety case considered wind turbulence, stating:

> CASR 139.350 and provisions in Part 139 MOS requires the operator of a certified aerodrome to monitor the airspace around the aerodrome for obstacles and their effect on aircraft operations. Consequently, the potential for new obstacles to present a wind turbulence problem is a BAU [business as usual] issue for the aerodrome operator.
>
> EAPL has assessed there are no hazards associated with wind turbulence from potential future obstacles that require a risk assessment specifically as a result of a reduced runway strip width.

Civil Aviation Safety Authority comments

On 8 November 2022, in response to a draft of this report, CASA stated:

> CASA notes that during wind conditions that would generate BIWT issues of concern, the preferred runway will be RWY 17. CASA also notes that the prevailing wind climate at Essendon generally favours operations on RWY 17/35 and not RWY 08/26.

CASA also noted the NASF guidelines came into effect 10 years after the major development plan process for the Bulla Road Precinct. They stated that:

> There was no requirement from the department as the regulator for retroactive BIWT assessment of buildings.

Obstacle monitoring for PANS-OPS

Chapter 4 set out the requirements for aerodrome operators to monitor obstacles under the Australian aerodrome standards for the purpose of assessing them as hazards to aircraft operations. The presence of obstacles may be considered when determining the landing minima and establishing instrument approach procedures. As noted in Chapter 4, the requirements for obstacle monitoring in MOS Part 139 centred around the OLS. The latter regulations and Part 139 MOS 2019 were specific with respect to the obligations of the aerodrome operator to monitor both the OLS and PANS-OPS surfaces regardless of whether a runway was a precision or non-precision approach runway.

In their 2013 safety case to CASA (refer to Chapter 8), EAPL acknowledged the October 2003 letter from CASA and stated:

> It should be noted that the current arrangement in place at Essendon Airport to monitor and report obstacles within a 180 m strip width and a 300 m approach inner edge is not supported by the guidance material contained in the MOS.

Noting that it had been unclear in the past what the obstacle monitoring requirements were when there was a gap between the OLS transitional surface and the corresponding PANS-OPS basic ILS transitional surface, the ATSB asked Airservices Australia in 2021 how the monitoring requirements should be addressed. Airservices Australia advised:

> The proper solution is in having a clear obstacle surveying and reporting specification for aerodromes with precision runways, which will be linked to PANS-OPS protection areas and not to the OLS only.

CASA did not consider that there was an issue that required addressing. On 8 November 2022, in response to a draft of this report, CASA stated:

> Under the aerodrome manual requirements, in previous and current legislation, the aerodrome operator is/was required to establish procedures to monitor obstacles for infringements of PANS-OPS and to report them to the procedure designer. The procedure designer is responsible for ensuring the MOC [Minimum Obstacle Clearance] criteria are met when designing and maintaining TIFPs [Terminal Instrument Flight Procedure]. The procedure designer cannot rely on the aerodrome operator to ensure the absence of infringements.

The ATSB addressed CASA's position with Airservices Australia in further correspondence in 2023. Airservices Australia supplied the ATSB with diagrams that it provided to the aerodrome operator for the purpose of the aerodrome operator fulfilling its obligations with respect to protecting instrument flight procedure areas. Airservices Australia noted that the diagrams did not provide detail in close proximity to the aerodrome that are protected by the OLS.

PANS-OPS obstacle monitoring for runway 08/26 at Essendon Fields Airport

On 28 November 2022, in response to a draft of this report, EAPL stated the following with respect to the ATSB observation that 'there was the potential for penetrations of the PANS-OPS basic ILS surfaces not be identified with the gap between the OLS transitional surface and the basic ILS transitional surface' (see Chapter 4):

> As the surfaces in question are entirely over airport property, this potential is considered highly limited in case of EAPL due to the processes of due diligence and planning associated with on-airport development.

In comments provided to the ATSB by Airservices Australia on 18 May 2023, Airservices Australia confirmed:

> In relation to DFO [within the Bulla Road Precinct] and CRM [collision risk model], the highest points related to the DFO building are already included in the obstacle list used in CRM for ILS RWY 26.

As discussed in Chapter 4, the collision risk model was a computer program that established the numerical risk, which could be compared to the target level of safety for aircraft operating to a specified OCA/H height.

Pilots to determine suitability of aerodromes

In response to a previous draft version of this investigation report, CASA indicated that 'Aircraft operators and pilots need to assess the suitability of the aerodrome for their intended operations based on published information'. This was consistent with former regulation 92 of the Civil Aviation Regulations 1988 and currently in section 91.410 of the Civil Aviation Safety Regulations 1998, which placed the onus on pilots and aircraft operators to determine the suitability of an aerodrome or other place for take-off or landing.

Advisory circular 139.A-03 v 1.0 (2020), *Application of aerodrome standards* (Civil Aviation Safety Authority, 2019b) noted the responsibility of the aerodrome operator to nominate the design criteria for each facility so that aircraft operators could make informed decisions about the use of the facility. Among other sources, pilots and aircraft operators relied on information published by aerodrome operators in the En Route Supplement Australia about the runway and obstacles in the vicinity. Relevant information included the aerodrome reference code for the runway, the strip width, and obstacles penetrating the OLS.

Chapter 8 noted that, when the grandfathering provisions were applied to runway 08/26 in 2019 the published information still designated the runway as a code 4 runway. However, the strip width reverted to 180 m and the buildings in the Bulla Road Precinct development were no longer identified as obstacles. Information was not published about the location of parts of the OLS and the misalignment of the transitional surfaces. However, MOS Part 139 did not require this information to be published.

Essendon Airport Pty Ltd comments

On 28 November 2022, in response to a draft of this report, EAPL stated:

> All the information required for pilots to establish spatial awareness of the obstacle free (and by exception, potentially obstacle-infringed) airspace in the approach, around the runway and in the take-off, is published in the AIP [En Route Supplement Australia] (its purpose is to provide all essential information for operators and users).

> In this respect we note that the AIP does not include the width of the inner edge of the approach surface, nor the ICAO or CASA standard for the width of the approach surface obstacle protection to be expected (only the slope).
>
> …
>
> The published information related to the smaller of the respective dimensions and so was conservative in managing risk (deviations in the approach were protected to a greater degree than pilots would assume from reading the AIP).

Civil Aviation Safety Authority comments

On 8 November 2022, in response to a draft of this report CASA stated:

> Pilots correctly expect that the RWS and OLS meet accepted standards.
>
> …
>
> All relevant information is available to pilots.
>
> …
>
> No risk assessment was required from pilots and aircraft operators regarding the RWS.

Delinking of aerodrome design as an operational limitation in Australia

In 2012, CASA's policy regarding runway width limitations was 'rationalised' in accordance with the intent of ICAO Annex 14. ICAO had stated that the standards and recommended practices prescribing the physical characteristics of the aerodrome (such as the runway strip) and OLS for an aerodrome were not intended to limit or regulate the operation of an aircraft (International Civil Aviation Organization, 2018a). The CASA policy was to 'delink the aerodrome design standards from the operational requirements of aeroplanes'.

As stated in CASA Civil Aviation Advisory Publication (CAAP) 235A-1(0), *Minimum Runway Width – for aeroplanes engaged in RPT [regular public transport] and charter operations with a maximum take-off weight greater than 5700 kg* (Civil Aviation Safety Authority, 2014), it was necessary to clarify that Part 139 MOS was not intended to limit or regulate operations from, and into aerodromes. The CAAP provided guidance to pilots and aircraft operators/owners for a performance-based assessment of aircraft operational capability on runways narrower[79] than that provided by using the aerodrome reference code (ARC) system.

The CAAP clarified that strip width requirements were also not to be applied as operational limitations. However, the CAAP stated the expectation of the aerodrome operator to provide for the OLS and runway strip width in accordance with the requirements of the ARC for the identification of obstacles and management of risk:

> The Obstacle Limitation Surface (OLS) requirements are based on runway Code Number which is a function of runway length requirements, not runway width. The OLS is an aerodrome operator responsibility dependent on the runway length equivalent Code number. Aeroplane operators and pilots may need to take into account specific obstacles, as published, in accordance with specific take-off and landing performance requirements. Aeroplane operating limitations for instrument approach obstacle clearance is based on Aircraft Approach Category which is a function of approach speeds.
>
> Strip width requirements in Part 139 MOS are not applied as aeroplane operational limitations. It is expected that the aerodrome design meets the requirements of the particular ARC. The runway to which an aeroplane is permitted to operate is expected to have the strip width applicable to the ARC permitted in accordance with Part 139 MOS. The aerodrome operator may limit certain aeroplanes if it is necessary to do so.

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[79] Narrow runway: A runway with a width less than the ICAO minimum width for the aeroplane, in accordance with the ARC system.

The En Route Supplement Australia also emphasised to pilots and aircraft operators that the ARC number was not intended to limit aircraft operations at an aerodrome. Pilots and aircraft operators were to ensure that the published aerodrome information met the requirements of their operations.

Safety analysis and findings

Expectations for assessment of risk

When grandfathered, the changes to return the 08/26 runway strip width to 180 m and relocate the part of the transitional surface alongside the strip, while leaving the approach surface inner edge at 300 m, reinstated the design characteristics that had been in place in 2003. Chapter 8 acknowledged that application of the grandfathering provisions in MOS Part 139 did not require the operator to assess the risk of applying an older standard to an aerodrome facility such as a runway strip and its OLS. However, an aerodrome operator's safety management system provided an expectation that risk would be assessed where there were deviations from the aerodrome standards. Consequently, prior to EAPL applying the MOS Part 139 grandfathering provisions, they assessed the risk of maintaining the runway 08/26 strip width at 180 m, less than the 300 m in MOS Part 139 for a code 4 precision approach runway. EAPL also considered the location of the transitional surface for runway 26 with a 180 m runway strip.

CASA stated that any risk had been considered as part of the continued policy of allowing grandfathering. However, additional statements were made about how safety was assured with operating conditions at Essendon Fields Airport. These included the aircraft weight limitation, the raised decision height for runway 26, and their observation that pilots will make their own decision on whether to use the runway on all the available information.

While the ATSB did not conduct a separate risk assessment, the ATSB has, however, sought to determine whether the statements and assessments of risk made by the aerodrome operator and the regulator were adequately informed by the information relevant to the risks the runway strip and OLS managed.

Runway veer-offs

Research has shown that a large proportion of accidents occur during the landing phase of flight and of the runway excursions, about half are veer-off events. The width of the runway strip, particularly the graded portion, provided protection for an aircraft that veered off the runway. Both CASA and EAPL referenced the graded portion of the runway 08/26 strip being maintained to the required 75 m from the runway centreline as evidence of adequate veer-off protection. However, while not mandatory, there was ICAO guidance for extending this out to 105 m for code 3 and 4 precision/non-precision approach runways. ICAO emphasised that the graded portion of the runway strip provided protection for aircraft should they veer-off from the runway with the potential for the wheels to come to the edge of this portion. However, this did not exclude consideration of the risk of a veer-off extending beyond the graded portion when there was a proposal to maintain the overall strip width less than the standard.

EAPL had assessed the risk of a veer-off for the 3 critical aircraft types using runway 08/26, noting the weight limitation of 50,000 kg. These were the Bombardier Global Express, British Aerospace 146-300 and Gulfstream G IV aircraft. For this, EAPL considered mechanical failures and pilot incapacitation, but did not address other factors such as human performance (outside the expectations for an engine failure), crosswind conditions or pavement contamination as identified in ICAO Doc 9981. Although EAPL later noted that runway 17/35 would be the preferred runway if unfavourable crosswind conditions were experienced on runway 08/26.

Consistent with ICAO guidance, EAPL also considered the certification requirements for the 3 critical aircraft types, determining that an engine failure during take-off was the most critical situation that could result in a lateral deviation. With this, EAPL concluded that the deviation should be contained within 9.1 m laterally of the runway centreline. EAPL's review of accident

data for these, and the Saab 340 aircraft, concluded that veer-offs were rare, but were generally contained well within a 180 m strip width. Similarly, ICAO noted a sharp reduction in veer-off events within 100 m from the runway centreline.

When reviewing EAPL's 2014 safety case, CASA noted a veer-off occurrence involving a Fokker 100, which was an aircraft type that had used Essendon Fields Airport. At the time, CASA stated that this accident showed the potential for aircraft using runway 08/26 to be involved in a veer-off event that exceeded the boundaries of the 180 m strip width. This example was not included in EAPL's 2019 safety case. In 2014, CASA had also noted a veer-off accident involving a Global Express aircraft that went about 65 m from the centreline, exceeding the graded portion of the strip. This was included in the 2019 EAPL safety case. While CASA noted (in 2014) that the swale drain and earth berms at the airport may have arrested the aircraft's energy, these safety features were not discussed in the 2019 EAPL safety case in the context of risk controls at Essendon Fields Airport.

The identification of veer-off events like that involving the Fokker 100 and Global Express aircraft did not prevent an assessment being made that the veer-off risk with maintaining a 180 m strip width was acceptable. However, this information is relevant for considering the risks the runway strip width and transitional surface managed when maintaining an overall strip width less than that required by the aerodrome standards.

Deviations in-flight during landing

Lateral deviations above the landing minima

Any risk to aircraft operating above the landing minima in PANS-OPS airspace created by existing objects or future developments had likely been addressed by the raised landing minima. Airservices Australia had previously considered proposals for a 180 m strip width and had no objections based on the raised minima keeping aircraft clear of obstacles while in PANS-OPS airspace.

Lateral deviations below the minima

The runway strip, including the flyover area, provided protection to aircraft flying over the runway and in the vicinity of the runway. The transitional surfaces, splaying from the side of the approach surface and the runway strip extended the obstacle protection for aircraft during a visual approach or visual segment of the instrument approach below the landing minima. The parts of the transitional surfaces alongside the runway 26 strip were determined by its 180 m width while the parts alongside the approach surface were determined by its 300 m inner edge.

EAPL took the view in the 2019 safety case that the landing minima for runway 26 provided adequate obstacle clearance for an aircraft flying instrument approach procedures and conducting a missed approach at the decision height. However, research by the Go-Around Safety Forum showed that go-arounds (missed approaches) do occur below the landing minima, which may present different challenges and risks with compromised obstacle clearances. As such, the risk of lateral deviations below the minima should also be assessed.

EAPL stated that they would monitor aircraft incident reports from Airservices Australia and aircraft operators for missed approach altitude breaches. However, the 2019 safety case did not incorporate a review of any data for airborne lateral deviations below the minima for the type of aircraft using runway 26.

The ICAO OLSTF deemed it necessary to review data to determine the extent of lateral deviations within the airspace protected by the transitional surfaces before proposing that the surfaces could be moved closer to the runway for certain aircraft types based on indicated airspeed at the threshold and wingspan. The type of review undertaken by the ICAO OLSTF was necessary to accurately inform its assessment of risk. However, it was noted from the advice of the aerodrome consultant engaged by the ATSB that, although an assessment of such

data would best inform an aerodrome operator's safety case, it would be challenging for them to access this data.

With respect to the work of the OLSTF, their review led to proposals for a narrower approach surface inner edge of 155 m for runways accommodating aircraft like the Fokker F100. Both CASA and the aerodrome consultant engaged by the ATSB had judged this aircraft type to fit within the aircraft categorisation that would apply this dimension based on airspeed over the threshold and wingspan. If applied, this would result in a transitional surface, which would be connected to the approach surface inner edge but not the runway strip, located closer to the runway. CASA referenced the ICAO OLSTF analysis for the purpose of their advice that the 180 m runway strip and associated OLS for runway 26 was safe. While the work of the ICAO OLSTF was indicative of changes that could be implemented with an acceptable level of safety with OLS closer to the runway for certain categories of aircraft, at the time this report was published the proposals were still subject to consultation with States.

In addition, it should be noted that the ICAO OLSTF's proposals were not limited to the obstacle free surfaces. The OLSTF had proposed a set of obstacle evaluation surfaces establishing a volume of airspace where obstacles trigger an aeronautical study. This would include surfaces similar to the PANS-OPS basic ILS surfaces protecting an instrument approach using an ILS. It was proposed to have an approach surface with an inner edge of 300 m and an associated transitional surface. These surfaces would not be prohibitive of obstacles, but the obstacles penetrating them would need to be assessed for their effect on the instrument approach procedure with consideration given to such actions as raising the landing minima. This is also relevant to the discussion on obstacle assessments below.

Guidance on risks managed by the obstacle limitation surfaces

EAPL's safety cases were seeking to demonstrate that a strip width less than the current standard of 300 m was safe. The dimensions of the strip width affected the location of the transitional surface and the protections that it afforded. An aerodrome operator needed to have a good understanding of the risks managed by the different surfaces to undertake an assessment of deviations from the standard. CASA was of the view that the aviation industry and aerodrome operators had a demonstrated understanding of the function of the OLS.

The safety cases showed that EAPL understood the purpose of the OLS to protect aircraft from obstacles. However, they may have been supported by more detailed guidance. The OLSTF has stated that there was a need to provide greater clarity on the application of the surfaces, recommending new surfaces to be established having regard to the indicated airspeed at the threshold and wingspan of the critical aircraft types using the runway. These factors were considered more relevant to identifying the risk of a lateral deviation for aircraft during the approach than the factors determining the OLS by use of the aerodrome reference code number.

The ICAO Secretariat advised the ATSB that it was not practicable to provide guidance on how to provide deviations to a published standard. However, they did provide guidance on the considerations for assessing risks with aircraft operations at aerodrome facilities including the runway strip width in ICAO Doc 9981. They further acknowledged there is ongoing work to review the OLS provisions and guidance material, and that additional guidance could be considered. Such guidance may not only inform contracting States and aerodrome operators in circumstances where there are deviations from the standards, but also with obstacle assessments when an object penetrates the OLS. Noting the work already done by ICAO through the OLSTF, there was opportunity for CASA to consider supplementing its guidance prior to the promulgation of any new standards by ICAO in 2028.

Obstacle assessment

With the change in published runway strip width from 300 m to 180 m and relocation of part of the transitional surface in 2019, the buildings in the Bulla Road Precinct development were no

longer identified as obstacles. This also meant that other buildings and structures could be placed higher and closer to the runway in the future without being referred to CASA as obstacles for a hazard assessment. Both EAPL and CASA had regard to the historical publication of the 180 m strip width for accepting this outcome. Further, EAPL's view was that any such future development would still form part of the airport planning process under the Airports Act. For the purpose of the Airports Act, any new developments around the aerodrome would be considered in the airport master plan and major development plans. Although objects to the side of the runway that did not penetrate the transitional surface from a 180 m strip width would not be assessed for the purposes of Part 12 of the Act (if the transitional surface was constructed on the basis of the MOS Part 139 definition).

More generally, the risk around changes to the surfaces triggering an obstacle assessment is contextualised by consideration of the risks discussed above of maintaining the dimensions of the surfaces less than what was prescribed by MOS Part 139. However, the BIWT risks associated with obstacles requires further attention noting that BIWT is a risk with buildings placed beyond the areas protected by the OLS.

Building-induced windshear and turbulence

The NASF guidelines for BIWT, developed in 2012, defined a trigger area for a risk assessment of buildings around an aerodrome. EAPL's 2019 safety case noted the monitoring requirements for the OLS around the runway and stated that the potential for new obstacles to present a wind turbulence problem was a business-as-usual issue. Although not mentioned in the safety case, by 2019, the NASF guidelines were in place. The guidelines provided trigger areas extending beyond the OLS and the aerodrome. Application of these guidelines would ensure that buildings associated with future developments were adequately assessed for BIWT.

The guidelines, however, were not retrospective. The buildings within the Bulla Road Precinct development were within the trigger area specified by the guidelines and EAPL advised that some of them penetrated the 1:35 surface. However, EAPL indicated that the buildings had not been subject to assessment, and they were under no obligation to conduct an assessment retrospectively.

The location of the OLS could affect whether an object was subject to a hazard assessment that included BIWT. Airservices Australia identified the transitional surface as a risk control for this purpose when the 2003 airport master plan was subject to consultation. At that time, they had recommended that the buildings be subject to an assessment although they did not penetrate the transitional surface.

EAPL and CASA both advised that, where a crosswind on runway 08/26 was more than 20 kt, the preferred runway for use would be runway 17/35. The ATSB acknowledges that using another runway could be considered a risk control for BIWT, although this may limit operations in weather conditions where an ILS approach to runway 26 was required. However, and while the 1:35 surface in the NASF guidelines was a conservative threshold, an assessment of any BIWT effects associated with the presence of the buildings that penetrated the surface would further enhance the understanding and management of any potential risks.

PANS-OPS

Chapter 4 acknowledged the potential for a gap to be created between the OLS transitional surface and the PANS-OPS basic ILS transitional with a reduced runway strip width. The Part 139 MOS 2019 clarified the obligation on an aerodrome operator to monitor both the OLS and transitional surfaces. However, correspondence between the ATSB and Airservices Australia indicated that there was still the potential for misinterpretation of the obstacle monitoring obligations where there was a gap between the OLS and the basic ILS transitional surfaces. This view was formed having regard to the limited detail that Airservices Australia indicated instrument flight procedure designers provide aerodrome operators for surfaces

around the runway, where there was normally reliance on the OLS for obstacle detection and reporting.

There is evidence of confusion around the expectations for monitoring and reporting in these circumstances extending back to the letter that was provided by a CASA officer in 2003 to EAPL. This letter advised EAPL to monitor the part of the transitional surface alongside the approach surface (based on a 300 m inner edge) and notify CASA of any infringements. They were also instructed to monitor the airspace between the transitional surface alongside the published strip width of 180 m and the transitional surface for a 300 m runway strip width, and report intrusions to Airservices Australia.

The ATSB did not have any evidence to indicate that the gap between the OLS and basic ILS transitional surfaces was a particular concern at Essendon Fields Airport for runway 08/26. EAPL had emphasised that due-diligence and planning would mean that any potential for a problem at the airport would be limited. Further, Airservices Australia had advised that the highest points of the buildings in the Bulla Road Precinct development were included in the collision risk model used for determining the obstacle clearance altitude/height for the runway 26 ILS approach procedure.

While there may not be an issue for runway 08/26, the comments from Airservices Australia demonstrated a need for clearer guidance on the expectations for aerodrome operators monitoring and reporting intrusions of the basic ILS transitional surface when the OLS transitional surface was closer to the runway than that required by the standards. This may be addressed in the future by the adoption of obstacle evaluation surfaces to ensure instrument procedures are safe and accessible for intended operations. These would be in addition to the obstacle free surfaces that would likely be closer to the runway.

Pilot assessment of risk

To make informed decisions about the suitability of a particular aerodrome for landing, pilots and aircraft operators utilised information about the runway and obstacle intrusions as published by aerodrome operators. From 2019, the En Route Supplement Australia indicated that runway 08/26 was a code 4 runway with a strip width of 180 m. EAPL's view was that the information about the dimensions of the runway strip was sufficient for pilots to establish awareness of the obstacle free airspace in the approach and around the runway. EAPL also noted that the 180 m strip width was less than the 300 m inner edge for the approach surface. As the dimension of the inner edge of the approach surface was not published, EAPL believed that deviations during the approach were protected to a greater degree than what pilots would assume from the information provided in the En Route Supplement Australia.

The ATSB acknowledges that published information about the strip width is indicative of the obstacle free space as part of the obstacle restriction area. While not being aware of the OLS, a pilot or aircraft operator having knowledge of the function of the strip width could assume that obstacles could be placed outside that protected area. Nonetheless, while aerodrome design was not intended to impose operational limitations, the CASA advisory circular emphasised the need for aerodrome operators to nominate the design criteria for each facility so that pilots and aircraft operators could make informed decisions. The En Route Supplement Australia only advised that the runway was a code 4 runway. There was no information about the design criteria for the 180 m runway strip width from the Aerodrome Engineering Instructions and neither was there any requirement to publish these details.

Pilots and aircraft operators would not necessarily know the basis on which risk was assessed and accepted by the aerodrome operator and regulator for the 180 m wide runway strip for the code 4 runway. An aircraft operator may consider this information relevant to making an informed decision about the use of the facility.

Summary

CASA's position was that a risk assessment was not required for the 180 m runway 08/26 strip width and associated change to the transitional surface based on the risk being accepted with the application of the grandfathering provisions in 2019. They further indicated that safety was assured through risk mitigators such as weight limitations and the raised landing minima.

However, it was unlikely that all the relevant risk information was considered when EAPL completed its 2019 safety case for the changes to the strip width and transitional surface. For example, the minimum graded portion of the strip width was provided for the veer-off risk. However, the veer-off assessment did not include all accident and incident data for the critical aircraft types that could use the runway. Further, consideration was only given to a missed approach being performed at or above the landing minima. While it was acknowledged that it would be difficult for an aerodrome operator to obtain data, the assessment did not include information about lateral deviations below the minima. CASA's most recent comments referenced the work of the OLSTF, which had assessed data on lateral deviations on the approach to land. These assessments indicated standards that may be adopted in the future, which may show an acceptable level of safety with the published dimensions of the runway 08/26 strip width. However, this information was not available at the time grandfathering of runway 08/26 was accepted in 2019.

There were other considerations in the overall assessment of risk with the changes to published information and the presence of the buildings in the Bulla Road Precinct. Although not required, and recognising it was a very conservative threshold, the buildings that breached the 1:35 surface had not been subject to a BIWT assessment. With respect to an obstacle assessment for PANS-OPS, any issues with the gap between the basic ILS and OLS transitional surfaces were unlikely to have affected Essendon Fields Airport. However, it was identified that better guidance could assist aerodrome operators with fulfilling their monitoring and reporting obligations when there was a gap between the surfaces.

In addition, while there was a responsibility on pilots and aircraft operators to make decisions about the safety of the runway, for runway 08/26 they were not provided all the relevant information to assess risk. It was reasonable that pilots and aircraft operators may consider information about the design criteria used for the runway strip width relevant to making an informed decision about using the facility. This was on the basis that the design criteria on which it was based was different to the aerodrome reference code design criteria nominated for the runway.

ATSB finding

The policy permitting grandfathering, conservative aerodrome design principles, the graded portion of the runway strip, aircraft weight limitations, and the raised landing minima were mitigating factors for maintaining the runway 08/26 strip width less than that required by aerodrome standards in 2019 and location of the associated transitional surfaces. However, while not preventing the acceptance of risk, the risk assessment undertaken by the aerodrome operator and statements made about safety by the regulator for these changes did not consider all the relevant risk information.

ATSB finding

There was limited guidance from the International Civil Aviation Organization and the Civil Aviation Safety Authority on risk considerations for the obstacle limitation surfaces around the runway strip protecting aircraft during the approach to land. There is an opportunity to provide greater clarity on the application of the surfaces through the work of the International Civil Aviation Organization's Obstacle Limitation Surface Taskforce.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition, 'other findings' may be included to provide important information about topics other than safety factors.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the aerodrome design changes and Bulla Road Precinct development at Essendon Fields Airports.

- The wording of the International Civil Aviation Organization (ICAO) Annex 14 and the Australian standards for the transitional surfaces was not clear on how they should be applied when the runway strip width (as permitted) was less than the standard. Both standards worked in practice where the strip width and associated OLS met the standard dimensions. However, the wording of the respective standards was open to different interpretations for addressing the misalignment between the runway strip width and the inner edge of the approach surface. Neither ICAO or the Civil Aviation Safety Authority provided guidance in support of their respective interpretations.
- Since 1972, successive aerodrome operators had published a 180 m strip width for runway 08/26. However, in 2005, when the Bulla Road Precinct was developed, it was unlikely that the aerodrome standards against which the strip width was based had been adequately determined to assure compliance against those standards.
- In 2005, the transitional surfaces were likely being maintained in accordance with the standards applicable at the time, which were interpreted to allow part of the transitional surface to be located along the side of the approach surface and the other part along the side of the published runway strip. With the different dimensions of the inner edge of the approach surface and runway strip, the transitional surfaces were misaligned.
- Aerodrome operators used the Australian aerodrome standards to establish the obstacle limitation surfaces. For the purpose of building control around federally leased aerodromes, the Australian Airports (Protection of Airspace) Regulations referenced the international aerodrome standards. These standards may be applied differently with respect to the structure of the transitional surface.
- **In 2004, the Department of Transport and Regional Services did not have an agreed assurance framework with the Civil Aviation Safety Authority for assessing the safety information in draft major development plans. This increased the risk of plans being approved with incorrect dimensions for runway facilities and obstacle limitation surfaces.** (Safety issue)
- In 2019, the grandfathering provisions of the Manual of Standards Part 139 made it uncertain how the provisions could be applied to a runway strip width that had been published as compliant with those standards. Further, there was ambiguity in the older standards being applied with respect to non-scheduled international operations. It was unclear how the regulator had addressed these matters when they accepted grandfathering and the publication of the 180 m strip width.

- The Manual of Standards Part 139 did not require submission of a safety case to the Civil Aviation Safety Authority to consider for acceptance of grandfathering. However, a safety case was prepared by Essendon Airport Pty Ltd, completed in accordance with its safety management system. As this was not a standard application of the grandfathering provisions, greater safety assurance could have been provided for the changes in 2019 for runway 08/26 by the regulator's consideration of that safety case.
- The policy permitting grandfathering, conservative aerodrome design principles, the graded portion of the runway strip, aircraft weight limitations, and the raised landing minima were mitigating factors for maintaining the runway 08/26 strip width less than that required by aerodrome standards in 2019 and location of the associated transitional surfaces. However, while not preventing the acceptance of risk, the risk assessment undertaken by the aerodrome operator and statements made about safety by the regulator for these changes did not consider all the relevant risk information.
- There was limited guidance from the International Civil Aviation Organization and the Civil Aviation Safety Authority on risk considerations for the obstacle limitation surfaces around the runway strip protecting aircraft during the approach to land. There is an opportunity to provide greater clarity on the application of the surfaces through the work of the International Civil Aviation Organization's Obstacle Limitation Surface Taskforce.

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out or are planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions will be provided separately on the ATSB website on release of the final investigation report, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website after the release of the final report as further information about safety action comes to hand.

Assurance framework

Safety issue description

In 2004, the Department of Transport and Regional Services did not have an agreed assurance framework with the Civil Aviation Safety Authority for assessing the safety information in draft major development plans. This increased the risk of plans being approved with incorrect dimensions for runway facilities and obstacle limitation surfaces.

Issue number:	AI-2018-010-SI-04
Issue owner:	Department of Infrastructure, Transport, Regional Development, Communications and the Arts
Transport function:	Aviation: Airports
Current issue status:	Closed - Adequately addressed
Issue status justification:	The safety issue was raised for a point in time in 2004 and not reflective of contemporary practices. The ATSB is satisfied that the arrangement established by the Department will ensure that advice on the safety and operational aspects of an airport draft major development plan will be provided by the Civil Aviation Safety Authority and Airservices Australia. This will reduce the potential for plans being approved with incorrect safety information affecting whether approvals are required under Part 12 of the Airports Act for buildings around an aerodrome.

Proactive safety action taken by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts

Action number:	AI-2018-010-PSA-53
Action organisation:	Department of Infrastructure, Transport, Regional Development and Communications
Action status:	Closed

As a result of this investigation, the Department of Infrastructure, Transport, Regional Development and Communications advised the ATSB on 13 February 2020, that the following safety action had been taken:

The *Airports Act 1996* (the Act) establishes the requirements for the Minister's decision on Master Plans and Major Development Plans (MDPs) to have regard to the views of the Civil Aviation Safety Authority (CASA) and Airservices Australia (Airservices) in so far as they relate to safety aspects and operational aspects of the plan (specifically ss. 81(3)(d) and 94(3)(e) respectively).

The Department acknowledges the views of CASA were not included in the Bulla Road Precinct MDP submitted to the Minister for consideration in 2004. However, the Department's method of mitigating risk from not receiving the CASA advice within the statutory timeframe was to recommend a condition be imposed on the development. This condition required Essendon Airport Pty Ltd 'to consult with CASA during the construction of the proposed development and comply with any safety requirements specified by that agency'.

The Department's MDP process now includes an arrangement with CASA and Airservices for seeking advice on safety in accordance with the requirements under the Act. A specific format for receiving these views in the assessment of MDPs is not prescribed in the Act. This ensures advice from CASA and Airservices is in a format that is flexible and fit for purpose.

The Department has received confirmation from CASA and Airservices of their ongoing commitment to provide safety and operational advice on Master Plans and MDPs. The Department will continue to work closely with CASA and Airservices to ensure the existing approach remains fit for purpose.

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Essendon Airport Pty Ltd
- Civil Aviation Safety Authority
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts
- Airservices Australia
- International Civil Aviation Organization
- Unites States Federal Aviation Administration
- European Aviation Safety Agency
- New Zealand Civil Aviation Authority
- airsight GmbH (aerodrome safeguarding consultant)
- AvCorp Solutions (aerodrome safety consultant)

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Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- Essendon Airport Pty Ltd
- Civil Aviation Safety Authority
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts
- International Civil Aviation Organization
- Airservices Australia.

Submissions were received from:

- Essendon Airport Pty Ltd
- Civil Aviation Safety Authority
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts
- International Civil Aviation Organization
- Airservices Australia.

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Glossary

APEIs	Airport Engineering Instructions
ARC	Aerodrome reference code
BIWT	Building-induced windshear and turbulence
CASA	Civil Aviation Safety Authority
DA/H	Decision altitude/height.
The Department	Department of Transport and Regional Services
	Department of Infrastructure, Transport, Regional Development and Local Government
	Department of Infrastructure, Regional Development and Cities
	Department of Infrastructure, Transport, Cities and Regional Development
	Department of Infrastructure, Transport, Regional Development and Communications
	Department of Infrastructure, Transport, Regional Development, Communications and the Arts
DFO	Direct factory outlet
EAPL	Essendon Airport Pty Ltd
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
ILS	Instrument landing system
IMC	Instrument meteorological conditions. See chapters 3 and 4
Instrument Approach Procedure	See chapters 3 and 4
MOS	Manual of Standards
MTOW	Maximum take-off weight
NASF	National Airports Safeguarding Framework
OCA/H	Obstacle clearance altitude/height
OFS	Obstacle free surfaces
OES	Obstacle evaluation surfaces
OLS	Obstacle limitation surface
OLSTF	Obstacle Limitation Surface Task Force
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
Published runway strip width	The runway strip width published in the Aeronautical Information Publication, maintained by Airservices Australia
ROC	Retail outlet centre
RPAs	Rules and Practices for Aerodromes

RWS	Runway strip
RWY	Runway
‘Standard’ runway strip width	The runway strip width stipulated in the aerodrome standards
VFR	Visual flight rules

Appendices

Appendix A – Extracts from standards and regulations

Aerodrome standards 1960s to 1970s

Table 9: Extracts from Annex 14 (Aerodromes) to the Convention on International Civil Aviation (5th edition 1969)

Note: Australia had a difference with the application of some of the standards based on whether they were to be applied at 'international aerodromes' or 'domestic aerodromes'. Australia explained in its difference that 'international aerodromes' refers to and aerodrome as defined in Part I, chapter 2, 2.3 or Annex 14 being: *(a) an aerodrome used or intended to be used as regulars or alternates by international air services; and* *(b) other aerodromes determined by the Competent Authority as being in general use by aircraft of foreign registry operated in accordance with the requirements of Annex 6 (such operations include, for example, international charter flights).* *A 'domestic aerodrome' referred to were other aerodromes open to public use.*	
Width of strips	Part III – Chapter 1 1.11.1 The strip including a precision approach runway shall, wherever practicable, extend to a distance of at least 150 m (500 ft) on each side of the centre line of the runway or stopway throughout the length of the strip.
	Note: Australia notified the following difference: *At domestic aerodromes used by aircraft of maximum weights of 50 000 lb or less the following strip widths are permitted:* *(a) a prepared strip width of 300 feet plus supplementary or "fly over areas" 150 feet wide on each side for operations in IMC [Instrument Meteorological Conditions] and operations by night.* (b) *A prepared strip width of 300 feet for operations in VMC [Visual Meteorological Conditions] by day.*
Approach surface inner edge	Part IV – Chapter 1 1.3.3 The dimensions of the approach area measured horizontally shall be not less than the appropriate dimensions specified in Table IV-2 Table IV-2 provided the length of the inner edge for an instrument approach area should be 300 m (1000 ft)
	Note: Australia notified the following difference: *At domestic aerodromes a dimension of 600 feet for the length of the inner edge of the instrument approach is permitted.*
Transitional surfaces	Part IV – Chapter 1 1.1.8 Transitional surface. A specified surface sloping upwards and outwards from the edge of an approach surface and from a line originating at the end of the inner edge of each approach area, drawn parallel to the runway centre line in the direction of landing. The transitional surface establishes the heights above which it may be necessary to take one or more of the following actions: restrict the creation of new obstructions; remove objects or mark objects in order to ensure a satisfactory level of safety and regularity for aeroplanes flying at low altitude and displaced from the runway centre line in the approach, or missed approach phases. 1.6.1 Transitional surfaces shall be established for each runway direction intended to be used for the landing of aircraft

Airport Engineering Instructions (amended text 1966-1973)

Table 10: Extracts from the Airport Engineering Instructions (amended text 1966-1973)

Note: The Airport Engineering Instructions were amended by replacing pages in the hard copy document or by hand annotations. The extracts are reproduced as they existed in the standards.

Runway strip width	Volume II – Part 4 – Section 8 8.3 – Width of Strips & SUPPLEMENTARY OR FLY-OVER AREAS. 8.3.1 – The width of the strip shall vary with the type of aeroplane operations envisaged as indicated in Section 8.3.3, 8.3.4, 8.3.5 and 8.3.6. 8.3.2 – Where associated with a runway (and stopway if provided) the strip shall by symmetrical about the runway for the full length of the strip. 8.3.3 – The width of the strip shall be at least 1,000 feet where associated with a precision approach runway. NOTE: I.C.A.O. Annex 14, fifth edition May, 1969 recommends that the width of strip should be at least 1,000 feet where associated with an instrument approach runway. However, it has been determined that there are no instrument approach runways in Australia within the meaning of the I.C.A.O. definition of this runway which is "a runway served by a non-visual aid providing at least directional guidance adequate for a straight in approach". 8.3.4 – The width of the strip shall be at least 500 feet plus 50 feet wide supplementary "fly over" areas on either side (See Section 8.3.7, 8.3.8 and 8.3.9) where any of the following operations are likely to take place:- (i) international aeroplane operations other than those involving precision approach aids; (ii) domestic aeroplane operations where the maximum allowable all up weight of the aeroplane is in excess of 50,000 lb. except DC4 aeroplanes.
Approach surface	Volume II – Part 4 – Section 13 13.3 – Approach Area and Surface 13.3.1 – The dimensions of the approach area shall be 1000 feet wide at the end of the strip for international precision approach landings and 600 feet wide for domestic precision approach landings extending for a distance of at least 25,000 feet from the end of the strip with the edges diverging at a horizontal angle of 15 per cent (8°32'). 13.3.2 – The dimensions of the approach area shall be 600 feet wide at the end of the strip, extending for a distance of at least 25,000 feet from the end of the strip with edges diverging at a horizontal angle of 12.5 per cent (7°08') for (i) all international landings except precision approach landings (ii) all IMC landings except precision approach landings (iii) all landings at night except precision approach landings and those other than under night V.M.C. (iv) VMC landings, by aeroplanes with a maximum all up weight in excess of 50,000 lb. except DC4 aeroplanes.
Transitional surface	Volume II – Part 4 – Section 13 13.5 – Transitional Surfaces 13.5.1 – The inclined planes comprising the transitional surfaces shall slope upwards and outwards until they intersect the horizontal surface. The gradient of these inclined planes shall be 1 in 7 from the edges of the approach surfaces and from lines originating at the ends of the inner edge of each approach area drawn parallel to the runway centre line in the direction of landing. For these purposes the widths of the inner edges of the approach areas are as follows:- (i) 1000 feet for international precision appraoch landings. (ii) 600 feet for domestic precision approach landings. (iii) 500 feet for all IMC landings (except precision approach landings), VMC landings by aeroplanes with a maximum all up weight in excess of 50,000 lb. except DC4 aeroplanes and for all night landings except for night V.M.C. operations

Aerodrome standards late 1990s to early 2000s

Table 11: Extracts from (Annex 14) Vol 1 to the Convention on International Civil Aviation (3rd edition 1999)

Width of runway strips	Chapter 3 3.4.3 A strip including a precision approach runway shall, wherever practicable, extend laterally to a distance of at least: - 150 m where the code number is 3 or 4; and - 75 m where the code number is 1 or 2; on each side of the centre line of the runway and its extended centre line throughout the length of the strip.
	Note: Australia notified a difference but not until 2005. The difference stated: *Narrower landing strip widths are permitted in some circumstances, subject to landing minima adjustments.* *Remark: the landing minima adjustment is in accordance with ICAO's Collision Risk Model.*
Approach surface inner edge	Chapter 4 4.2.16 The heights and slopes of the surfaces [Obstacle Limitation Surfaces] shall not be greater than, and their other dimensions not less than, those specified in Table 4-1. Table 4-1 The length of the inner edge for a precision approach category I, code 3 or 4 runway was 300 m.
Transitional surface	Chapter 4 4.1.13 *Description – Transitional surface.* A complex surface along the side of the strip and part of the side of the approach surface, that slopes upwards and outwards to the inner horizontal surface. 4.1.14 *Characteristics.* – the limits of a transitional surface shall comprise: (a) A lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centreline: and (b) An upper edge located in the plane of the inner horizontal surface.

Table 12: Extracts from the Rules and Practices for Aerodromes (2002)

Grandfathering	Chapter 1 1.6 It should be noted that there is no requirement for the aerodrome operator to apply RPA standards retroactively to an existing facility where such an application would involve a significant cost. However, the standards are to be applied to all new facilities and to every case of a major upgrade of an aerodrome facility. The aerodrome operator is to seek from CASA a written concession to cover the interim period prior to an existing facility being upgraded to meet the new standards, and details of the concession are to be noted in the Aerodrome Manual.
Concessions	Chapter 1 2.2 In general terms, aerodrome operators are bound to comply with the standards, but where meeting a specific standard would cause major difficulties or impose a heavy monetary penalty on the aerodrome operator, CASA should be approached for a written concession against the standard. It may be necessary, when granting a concession, for CASA to impose compensating restrictions which will ensure an equivalent overall level of safety to that which was originally expected. Interim concessions may also be granted covering the period until it becomes practicable to adhere to the standard.

<table>
<tr><td>Standards and recommended practices</td><td>Chapter 1

3.1 This volume of RPAs contains both standards (i.e. mandatory requirements) for aerodromes, which have the force of law, and some recommended practices, which are based on experience and are intended to assist in achieving the implementation of the standards in a cost effective manner. Standards are phrased in the text as direct requirements, i.e. “is to or “are to”. Recommended practices are phrased as discretionary matters, i.e. “should” or “may”.</td></tr>
<tr><td>Runway strip width</td><td>Chapter 7

7.17.6. A precision approach runway is to be centrally located within a runway strip consisting of a graded portion and a fly-over area such that the overall runway strip width is as shown in table 7-9

Table 7-9: Runway strip width for precision approach runways
<table><tr><th>Aerodrome facility reference code</th><th>Overall strip width</th></tr><tr><td>1,2</td><td>150 m</td></tr><tr><td>3,4</td><td>300 m</td></tr></table>
7.17.7. Where it is not practicable to provide the full runway strip width, a lesser graded only strip width not less than 90 m for code 1 and 2 and 150 m for code 3 and 4 respectively may be provided subject to landing minima adjustments.</td></tr>
<tr><td>Approach surface</td><td>Chapter 10

2.6 The approach surface is an included plane or combination of planes which originate from the inner edge associated with each runway threshold, with two sides originating at the ends of the inner edge

2.7 the inner edge associated with each runway threshold has a specified length, and is located horizontally and perpendicularly to the runway centreline, at a specified distance before the threshold.

…

Table 10.1 – Approach runways
<table><tr><td rowspan="3"></td><td colspan="3">Precision instrument</td></tr><tr><td colspan="2">I</td><td>II & III</td></tr><tr><td colspan="2">Code No</td><td>Code No</td></tr><tr><td>1,2</td><td>3,4</td><td>3,4</td></tr><tr><td>Approach Length of inner edge</td><td>150 m</td><td>300 m</td><td>300 m</td></tr></table></td></tr>
<tr><td>Transitional surface</td><td>Chapter 10

2.12 The transitional surface comprises inclined planes which originate at the lower edge from the side of the runway strip (the overall strip), and the side of the approach surface which is below the inner horizontal surface, and finishes where the upper edge is located in the plane of the inner horizontal surface.

…</td></tr>
</table>

Table 13: Extracts from the Manual of Standards Part 139 - Aerodromes (2003)

<table>
<tr><td>Grandfathering</td><td>Chapter 2

2.1.2.1 Standards are subject to change from time to time. In general, unless specifically directed by CASA, subject to Paragraph 2.1.2.3, existing aerodrome facilities do not need to be immediately modified in accordance with the new standards until the facility is replaced or upgraded to accommodate a more demanding aircraft.

2.1.2.2 Unless otherwise directed by CASA, an existing facility that does not meet the standard specified in this Manual must continue to comply with the standard that was applicable to it.

2.1.2.3 At a certified aerodrome, an existing aerodrome facility that does not comply with this MOS must be identified and recorded in the Aerodrome Manual, described in Chapter 3 must include the date or period when that facility was first introduced or last upgraded and an indication from the aerodrome operator of a plan or timescale to bring the facility in compliance with the MOS. As part of CASA audit, evidence to demonstrate efforts to implement the plan or timescale may be required.

2.1.2.4 This MOS applies to a new facility that is brought into operation, and to an existing facility that is being replaced or improved. Subject to agreement by the relevant CASA office, changes to an existing facility of a minor or partial nature may be exempted.</td></tr>
<tr><td rowspan="2">Exemptions to standards</td><td>Chapter 2

2.1.3.1 An exemption granted to an existing facility continues to apply until its expiry date.

2.1.3.2 Application for new exemptions must be supported, in writing, by cogent reasons including, where appropriate, an indication of when compliance with the current standards can be expected.

2.1.3.3 Those standards which include phrases such as “if practicable”, “where physically practicable”, etc., still require an exemption to standards when aerodrome operators wish to take advantage of the non-practicability of full compliance.

2.1.3.4 Exemptions to standards, granted to an aerodrome, must be recorded in the Aerodrome Manual. The Manual must contain details of the exemption, reason for the granting, any resultant limitations imposed, and similar relevant information.</td></tr>
<tr><td>The standards were made subject to the requirements for obtaining an exemption from the regulations under Subpart 11F of the Civil Aviation Safety Regulations 1998. Subpart 11F was introduced into the regulations into 2004.

Regulation 11.170(3) required that in making its decision, CASA must regard the preservation of a level of aviation safety that is at least acceptable as paramount.

Originally, under regulation 11.230, exemptions could not be granted for longer than two years. This was later amended to three years.</td></tr>
<tr><td>Runway strip width</td><td>Chapter 6

6.2.18.3 In the case of a precision approach runway, the width of the runway strip, including the fly-over area, must not be less than that given in Table 6.2.7

Table 6.2-7: Runway strip width for precision approach runways

<table><tr><td>Aerodrome reference code</td><td>Overall runway strip width</td></tr><tr><td>1 or 2</td><td>150 m</td></tr><tr><td>3 or 4</td><td>300 m</td></tr><tr><td colspan="2">1. Where it is not practicable to provide the full runway strip width, a lesser strip width may be provided subject to landing minima adjustments. However, the standard width of the graded area must be provided.
2. For precision approach runways code 3 and 4, it is recommended that an additional width of graded runway strip be provided. In this case, the graded width extends to a distance of 105 m from the runway centreline, except that the width is gradually reduced (over a distance of 150 m) to 75 m from the runway centreline at both ends of the strip, for a length of 150 m from the runway ends as shown in figure 6.2-3.</td></tr></table></td></tr>
</table>

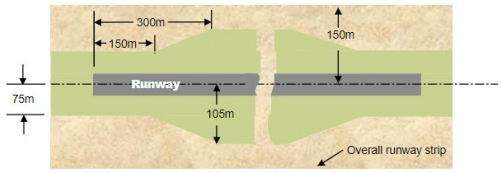
<table>
<tr><td></td><td>


Figure 6.2-3: Runway Strip for Precision Approach Runways

6.2.18.4 If an aerodrome operator wishes to provide a lesser runway strip width to that specified in the standards, the aerodrome operator must provide CASA with a safety case justifying why it is impracticable to meet the standard. The safety case must include documentary evidence that all relevant stakeholders have been consulted.
</td></tr>
<tr><td>Obstacle restriction and limitation</td><td>
Chapter 7

7.1.2.1 Objects, except for approved visual and navigational aids, must not be located within the obstacle restriction area of the aerodrome without the specific approval of CASA.

7.1.3.1 An aerodrome operator must establish the OLS applicable to the aerodrome.
</td></tr>
<tr><td>Procedures for an aerodrome operator to deal with an obstacle</td><td>
Chapter 7

7.1.4.1 The aerodrome operator must monitor the OLS applicable to the aerodrome and report to CASA any infringement or potential infringement of the OLS.
</td></tr>
<tr><td>Monitoring of obstacles associated with instrument runways</td><td>
Chapter 7

7.1.7.1 For a precision approach runway, the aerodrome operator must monitor any object that may penetrate the applicable OLS.

There was no requirement to separately monitor the PANS-OPS surfaces for a precision approach runway. However, 7.1.7.2 required PANS-OPS surfaces to be monitored for non-precision approach runways.
</td></tr>
<tr><td>Approach surface</td><td>
Chapter 7

7.3.2.5 (a) The approach surface is an inclined plane or combination of planes which originate from the inner edge associated with each runway threshold, with two sides originating at the ends of the inner edge

(b) the inner edge associated with each runway threshold has a specified length, and is located horizontally and perpendicularly to the runway centreline, at a specified distance before the threshold.

…

Table 7.1-1 – Approach runways
<table>
<tr><td rowspan="3"></td><td colspan="3">Precision instrument</td></tr>
<tr><td colspan="2">I</td><td>II & III</td></tr>
<tr><td colspan="2">Code No</td><td>Code No</td></tr>
<tr><td>1,2</td><td>3,4</td><td>3,4</td></tr>
<tr><td>Approach Length of inner edge</td><td>150 m</td><td>300 m</td><td>300 m</td></tr>
</table>
</td></tr>
<tr><td>Transitional surface</td><td>
Chapter 7

7.3.2.6 (a) The transitional surface comprises inclined planes which originate at the lower edge from the side of the runway strip (the overall strip), and the side of the approach surface which is below the inner horizontal surface, and finishes where the upper edge is located in the plane of the inner horizontal surface.

…

Note: For the purpose of drawing the transitional surface, the lower edge of the transitional surface along the runway strip may be drawn as a straight line joining the corresponding ends of the approach surfaces at each end of the runway strip. However, when assessing whether an object may penetrate the transitional surface, the standard of the transitional surface applies.
</td></tr>
</table>

Civil Aviation Safety Regulations 1998 – transitional provisions for aerodrome licensing and certification (adoption of Part 139)

Part 139 of the Civil Aviation Safety Regulations 1998 came into effect 2 May 2003. Subpart 202.FY covering the transitional provisions for the regulations came into effect on 23 April 2003.

Table 14: Extracts from the transitional provisions for Part 139 of the Civil Aviation Safety Regulations 1998

Aerodrome Licences issued under the Civil Aviation Regulations 1988	Subpart 202.FY Transitional Provisions for Part 139 (Aerodromes) 202.701 An Aerodrome licence in force under Part 9 of the old regulations [Civil Aviation Regulations 1988] immediately before the commencement of this regulation continues in force after that commencement as if it were an aerodrome certificate granted under regulation 139.050. A licence that continued in force under regulation 202.701 was a transitional aerodrome licence.
Previous aerodrome manuals and standards for aerodromes	Subpart 202.FY Transitional Provisions for Part 139 (Aerodromes) 202.704 (1) This regulation applies to the operator of an aerodrome if the operator holds a transitional aerodrome licence for the aerodrome. … (3) The operator is taken to comply with regulation 139.165 if the operator complies with any requirements or standards for the physical characteristics of the movement area [includes the runway strip width] of an aerodrome that: (a) are set out or referred to in the Rules and Practices for Aerodromes; and (b) applied to the operator in respect of the aerodrome immediately before the commencement of this regulation. … (6) The operator is taken to comply with regulation 139.355 if the operator complies with any requirements and standards for the establishment of obstacle limitation surfaces [includes the approach and transitional surfaces] for an aerodrome that: (a) are set out or referred to in the Rules and Practices for Aerodromes; and (b) applied to the operator in respect of the aerodrome immediately before the commencement of this regulation.
Physical characteristics of the movement area	Part 139 139.165 The operator of a certified aerodrome must ensure that the physical characteristics of the movement area comply with the standards set out in the Manual of Standards.
Establishment of the Obstacle Limitation Surfaces	Part 139 139.355 An aerodrome operator must ensure that the obstacle limitation surfaces are established for the aerodrome in accordance with the standards set out in the Manual of Standards.

Aerodrome standards early 2020s

Table 15: Extracts from Annex 14 (Aerodromes) Vol I to the Convention on International Civil Aviation (eighth edition 2018)

Width of runway strips	Chapter 3 3.4.3 A strip including a precision approach runway shall, wherever practicable, extend laterally to a distance of at least: - 140 m where the code number is 3 or 4; and - 70 m where the code number is 1 or 2; on each side of the centre line of the runway and its extended centre line throughout the length of the strip.
Approach surface inner edge	Chapter 4 4.2.16 The heights and slopes of the surfaces [Obstacle Limitation Surfaces] shall not be greater than, and their other dimensions not less than, those specified in Table 4-1. Table 4-1 The length of the inner edge for a precision approach category I, code 3 or 4 runway was 280 m.
Transitional surface	Chapter 4 4.1.13 *Description – Transitional surface.* A complex surface along the side of the strip and part of the side of the approach surface, that slopes upwards and outwards to the inner horizontal surface. 4.1.14 *Characteristics.* – the limits of a transitional surface shall comprise: (a) A lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centreline: and (b) An upper edge located in the plane of the inner horizontal surface.

Table 16: Extracts from the Part 139 (Aerodromes) Manual of Standards 2019 (2020)

Grandfathering	Chapter 2 2.0.4 The standards in the MOS for an aerodrome facility and the obstacle limitation surfaces of a runway (the OLS) do not apply to a grandfathered facility of the same kind if the grandfathered facility: (a) complies, and continues to comply, with the standards which applied to the aerodrome facility and the OLS immediately before the commencement of this MOS, as if they continued in force (the grandfathered rules); and (b) is not: (i) replaced; or (ii) upgraded: and (c) is maintained in accordance with the requirements of this MOS for the same kind of facility.

<table>
<tr><td>Approval</td><td>
Chapter 2

2.06

(1) CASA may approve in writing that an operator is not required to meet a standard specified in this MOS.

(2) An approval under subsection (1) must specify the provisions which the approval applies, and may be 1 or more of the following:

(a) time-limited or open-ended as to its duration;

(b) made subject to conditions.

(3) For subsection (1), CASA may grant an approval if the aerodrome operator:

(a) applies in writing for an approval; and

(b) identifies each of the relevant standards, by reference to the specific provision in the MOS, which it is proposed will not be met, and explains why it will not be met; and

(c) states the length of the period during which each relevant standard will not be met; and

(d) sets out in an accompanying safety assessment:

(i) the effect on aerodrome and aviation safety of not meeting each of the relevant standards; and

(ii) either:

(A) The measures proposed to mitigate those effects; or

(B) The measures proposed to achieve the same safety outcome as the relevant standards in the MOS would achieve; and

(e) satisfies CASA that the approval will not have any adverse effect on aviation safety.
</td></tr>
<tr><td>Exemptions</td><td>The Part 139 (Aerodromes) Manual of Standards 2019 did not include a reference to granting exemptions. However, Subpart 11F of the Civil Aviation Safety Regulations still applied so that an aerodrome operator could seek an exemption from compliance with the regulations. This could include regulations in Part 139 requiring compliance with standards.</td></tr>
<tr><td>Runway strip width</td><td>
Chapter 6

6.2.18.3 In the case of a precision approach runway, the width of the runway strip, including the fly-over area, must not be less than that given in Table 6.2.7

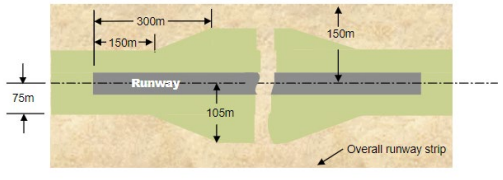
Table 6.2-7: Runway strip width for precision approach runways
<table>
<tr><td>Aerodrome reference code</td><td>Overall runway strip width</td></tr>
<tr><td>1 or 2</td><td>150 m</td></tr>
<tr><td>3 or 4</td><td>300 m</td></tr>
<tr><td colspan="2">1. Where it is not practicable to provide the full runway strip width, a lesser strip width may be provided subject to landing minima adjustments. However, the standard width of the graded area must be provided.
2. For precision approach runways code 3 and 4, it is recommended that an additional width of graded runway strip be provided. In this case, the graded width extends to a distance of 105 m from the runway centreline, except that the width is gradually reduced (over a distance of 150 m) to 75 m from the runway centreline at both ends of the strip, for a length of 150 m from the runway ends as shown in figure 6.2-3.</td></tr>
</table>


Figure 6.2-3: Runway Strip for Precision Approach Runways
</td></tr>
</table>

<table>
<tr><td></td><td>6.2.18.4 If an aerodrome operator wishes to provide a lesser runway strip width to that specified in the standards, the aerodrome operator must provide CASA with a safety case justifying why it is impracticable to meet the standard. The safety case must include documentary evidence that all relevant stakeholders have been consulted.</td></tr>
<tr><td>Obstacle restriction and limitation</td><td>Chapter 7
7.01
(1) Both of the following must be monitored and maintained free from obstacles in accordance with this MOS:
(a) the airspace around the aerodrome;
(b) the manoeuvring area of an aerodrome [including the runway strip].
7.02
(1) Objects or structures, other than approved visual and navigational aids, must not be constructed or erected within the obstacle restriction area of an aerodrome without the written approval of CASA.
7.03
(1) An aerodrome operator must establish and monitor the obstacle limitation surfaces (OLS) applicable to the aerodrome.
…
(4) As far as possible the aerodrome operator must ensure that the OLS within the aerodrome boundary is maintained clear of obstacles.</td></tr>
<tr><td>Approach surface</td><td>Chapter 7
7.3.2.5 (a) The approach surface is an inclined plane or combination of planes which originate from the inner edge associated with each runway threshold, with two sides originating at the ends of the inner edge
(b) the inner edge associated with each runway threshold has a specified length, and is located horizontally and perpendicularly to the runway centreline, at a specified distance before the threshold.
…
Table 7.1-1 – Approach runways
<table>
<tr><td rowspan="3"></td><td colspan="3">Precision instrument</td></tr>
<tr><td colspan="2">I</td><td>II & III</td></tr>
<tr><td colspan="2">Code No</td><td>Code No</td></tr>
<tr><td>1,2</td><td>3,4</td><td>3,4</td></tr>
<tr><td>Approach Length of inner edge</td><td>150 m</td><td>300 m</td><td>300 m</td></tr>
</table></td></tr>
<tr><td>Transitional surface</td><td>Chapter 7
7.3.2.6 (a) The transitional surface comprises inclined planes which originate at the lower edge from the side of the runway strip (the overall strip), and the side of the approach surface which is below the inner horizontal surface, and finishes where the upper edge is located in the plane of the inner horizontal surface.
…
Note: For the purpose of drawing the transitional surface, the lower edge of the transitional surface along the runway strip may be drawn as a straight line joining the corresponding ends of the approach surfaces at each end of the runway strip. However, when assessing whether an object may penetrate the transitional surface, the standard of the transitional surface applies.</td></tr>
<tr><td>Dealing with obstacles in the OLS</td><td>Chapter 7
7.18
(1) An aerodrome operator must:
(a) monitor the OLS for the aerodrome; and
(b) report to CASA, in writing, any infringement, or potential infringement, of the OLS.</td></tr>
</table>

Monitoring obstacles associated with instrument runways	(1) An aerodrome operator must monitor any object or structure that may infringe the aerodrome's OLS and PANS-OPS airspace associated with instrument approach procedures (2) An aerodrome operator must: (a) Establish procedures to monitor: (i) the OLS; and (ii) such obstacles, associated with the aerodrome terminal instrument flight procedures, as are determined by the instrument flight procedure designer to be critical obstacles; and (iii) include the procedures in the aerodrome manual. (3) The aerodrome operator must inform the designer of a terminal instrument flight procedure at the aerodrome of the following: (a) any change in the status of an existing critical obstacle; (b) any proposed development that is to be higher than the critical obstacles within the area depicted by the designer; (c) any new object or structure that is higher than the critical obstacles within the area depicted by the designer.
	3.01 Definitions ***Critical obstacle*** means the obstacle within the take-off climb area, or within the approach area, or within both areas, which subtends the greatest vertical angle when measured from the inner edge of the take-off climb surface and/or approach surface.

Civil Aviation Safety Regulations 1998 – transitional provisions for aerodrome licensing and certification

Part 139 of the Civil Aviation Safety Regulations 1998 came into effect 2 May 2003. Subpart 202.FY covering the transitional provisions for the regulations came into effect on 23 April 2003.

Table 17: Extracts from the transitional provisions for Part 139 of the Civil Aviation Safety Regulations 1998

Aerodrome Licences issued under the Civil Aviation Regulations 1988	Subpart 202.FY Transitional Provisions for Part 139 (Aerodromes) 202.701 An Aerodrome licence in force under Part 9 of the old regulations [Civil Aviation Regulations 1988] immediately before the commencement of this regulation continues in force after that commencement as if it were an aerodrome certificate granted under regulation 139.050. A licence that continued in force under regulation 202.701 was a transitional aerodrome licence.

Previous aerodrome manuals and standards for aerodromes	Subpart 202.FY Transitional Provisions for Part 139 (Aerodromes) 202.704 (2) This regulation applies to the operator of an aerodrome if the operator holds a transitional aerodrome licence for the aerodrome. … (4) The operator is taken to comply with regulation 139.165 if the operator complies with any requirements or standards for the physical characteristics of the movement area [includes the runway strip width] of an aerodrome that: (c) are set out or referred to in the Rules and Practices for Aerodromes; and (d) applied to the operator in respect of the aerodrome immediately before the commencement of this regulation. … (7) The operator is taken to comply with regulation 139.355 if the operator complies with any requirements and standards for the establishment of obstacle limitation surfaces [includes the approach and transitional surfaces] for an aerodrome that: (c) are set out or referred to in the Rules and Practices for Aerodromes; and (d) applied to the operator in respect of the aerodrome immediately before the commencement of this regulation.
Physical characteristics of the movement area	Part 139 139.165 The operator of a certified aerodrome must ensure that the physical characteristics of the movement area comply with the standards set out in the Manual of Standards.
Establishment of the obstacle limitation surfaces	Part 139 139.355 An aerodrome operator must ensure that the obstacle limitation surfaces are established for the aerodrome in accordance with the standards set out in the Manual of Standards.

Appendix B – Evidence of declared dimensions for the runway 08/26 strip width, runway 26 approach surface, and transitional surfaces

Table 6 in Chapter 5 summarised changes to the declarations of runway 08/26 at Essendon Fields Airport for the runway strip width, inner edge of the runway 26 approach surface, and the transitional surface between 1960 and 2019. The table is reproduced below.

Year	Aerodrome reference code	Runway strip width (m)	Approach inner edge (m)	Transitional surface (m)[1]	Source
1960	N/A	~300	Unknown	Unknown	Aerodrome landing chart
1972	N/A	180	180	90	Clearance surfaces chart
2000	4	180	180	Not stated	OLS survey, published data
2001	4	180	300	Unconfirmed	OLS survey, published data, Essendon Airport Ltd aerodrome manual
2003	4	180	300	90	OLS survey, Essendon Airport Proprietary Limited aerodrome manual, En Route Supplement Australia
2015	4	300	300	150	Civil Aviation Safety Authority, En Route Supplement Australia
2019	4	180	300	90	Essendon Airport Proprietary Limited aerodrome manual

The changes in the tables were discussed in Chapter 5 with reference to evidence contained in this Appendix.

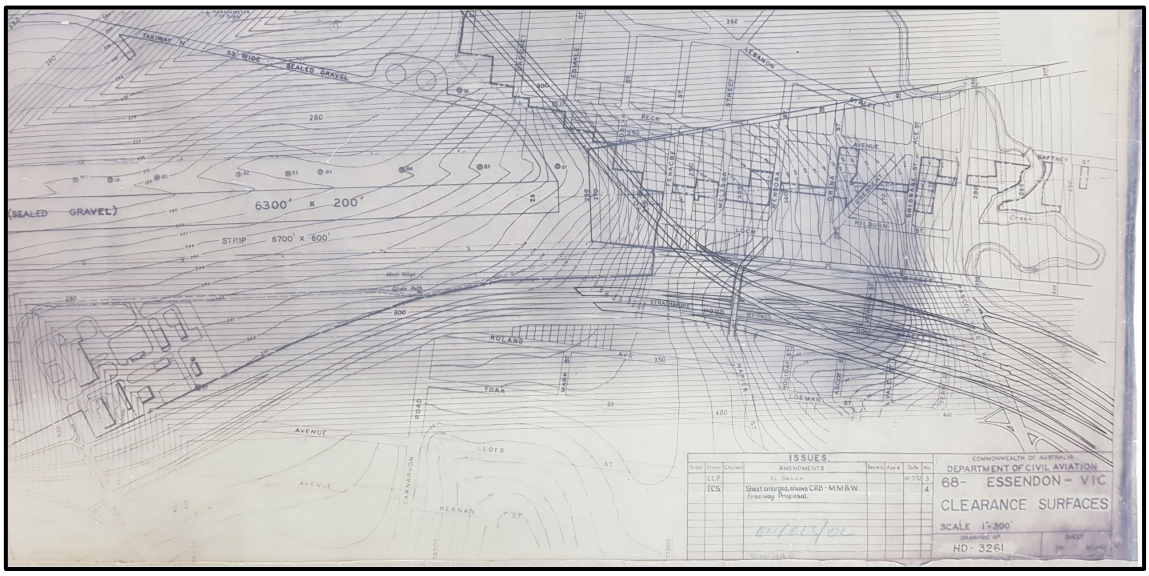
Changes between 1960 and 1972

Year	Aerodrome reference code	Runway strip width (m)	Approach inner edge (m)	Transitional surface (m)[1]	Source
1960	N/A	~300	Unknown	Unknown	Aerodrome landing chart
1972	N/A	180	180	90	Clearance surfaces chart

The change in dimensions for the runway strip width between 1960 and 1972 coincided with the commissioning of Tullamarine Airport as the international airport for Melbourne. When Essendon Airport was Melbourne International Airport, an approach landing chart from 1960 showed a 300 m runway strip width for runway 08/26.

Around the time international operations ceased at Essendon, a 1972 clearance surfaces chart showed a 180 m strip width. The inner edge of the approach surface appeared to match the strip width, and the transitional surfaces originated at the ends of the inner edge and followed the length of the runway strip.

Figure 21: Essendon Airport 1972 clearance surfaces chart



Note: The approach surface and transitional surfaces were part of the 'Clearance Surfaces' under the former Airport Engineering Instructions. Measurements are displayed in ft. The 600 ft strip width converts to 180 m.
Source: Aviation Museum Essendon

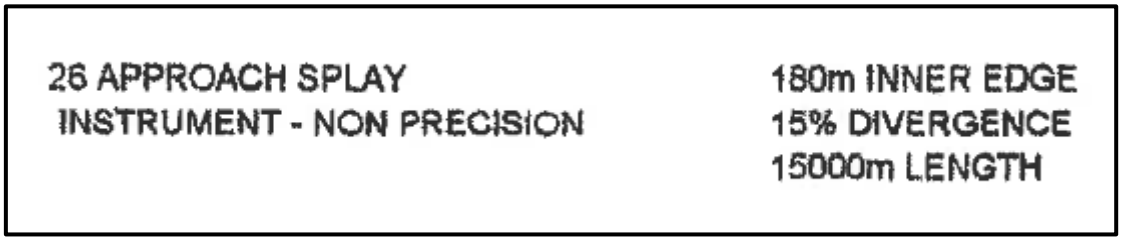
The 1972 revised 180 m strip width and associated obstacle limitation surfaces matched the requirements in the Airport Engineering Instructions (APEIs). The APEIs were the standards that preceded the Rules and Practices for Aerodromes (RPAs). The APEIs contained different requirements for the runway strip and associated obstacle limitation surfaces (OLS) depending on whether the runway was likely to have international operations conducting precision approaches.

Changes between 2000 and 2001

Year	Aerodrome reference code	Runway strip width (m)	Approach inner edge (m)	Transitional surface (m)[1]	Source
2000	4	180	180	Not stated	OLS survey, published data
2001	4	180	300	Unconfirmed	OLS survey, published data, Essendon Airport Ltd aerodrome manual

An OLS survey undertaken in November 2000 identified a 180 m runway strip width and inner edge of the approach surface for runway 26 on the basis that the runway was an instrument non-precision approach runway. There was no survey data for the transitional surface.

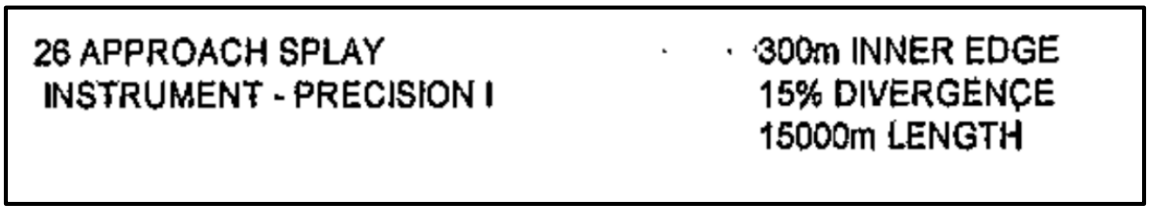
Figure 22: Extract from OLS survey for runway 26, November 2000



Source: Civil Aviation Safety Authority

A subsequent OLS survey in February 2001 identified a 300 m inner edge of the approach surface for runway 26 on the basis that the runway was an instrument-precision approach runway. Again, there was no survey data for the transitional surface.

Figure 23: Extract from OLS survey for runway 26, February 2001



Source: Civil Aviation Safety Authority

An internal Civil Aviation Safety Authority email in February 2001 responding to the new survey referred to the then applicable RPAs as the source of the requirements for determining the gradient of the approach surface. A 10.6% gradient had been adopted for the first section of the gradient instead of 2%. The change to 2% was due to additional obstacles infringing the surface.

A copy of a safety inspection for Essendon Airport Limited in April 2001 acknowledged the change in dimensions used for the inner edge of the runway 26 approach surface and change in gradient.

There was no evidence available to the investigation that showed a similar change to the runway strip width. An *Aerodrome Operations Manual* for Essendon Airport dated February 2001 listed the runway strip width as 180 m. Section 5 of the manual referenced the Rules and Practices for Aerodromes and International Civil Aviation Organization Annex 14 as the source of the standards for determining facilities (such as the runway strip) and the obstacle limitation surfaces (OLS).

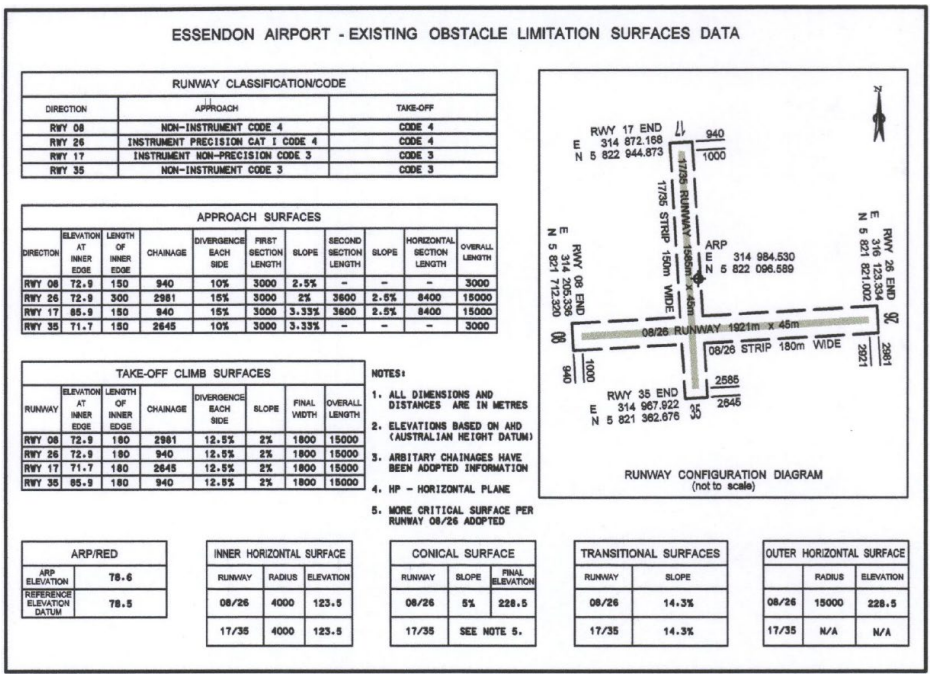
2003 dimensions

Year	Aerodrome reference code	Runway strip width (m)	Approach inner edge (m)	Transitional surface (m)[1]	Source
2003	4	180	300	90	OLS survey, Essendon Airport Proprietary Limited aerodrome manual, En Route Supplement Australia

A March 2003 copy of the En Route Supplement Australia, published a 180 m runway strip width for runway 08/26 at Essendon Fields Airport. On 27 March 2003, the Minister for Transport and Regional Services approved the master plan for Essendon Fields Airport. The references to the runway strip in the master plan were unclear on the dimensions for the strip and the location of the transitional surfaces (see Chapter 6).

An OLS diagram of Essendon Fields Airport dated 16 October 2003 showed that runway 26 was surveyed with a 300 m inner edge of the approach surface and a 180 m runway strip width. The location of the transitional surface was not described, but it was shown on the chart. One part of the transitional surface appeared to extend outwards from the side of the approach surface with a 300 m inner edge. Another part of the transitional surface appeared to extend outwards from the side of the runway strip with a 180 m width. The part alongside the runway strip width appeared to ‘step-up’ to meet the approach surface and provide congruity between the 2 parts. The survey data and chart for the transitional surfaces are reproduced below.

Figure 24: Essendon Fields Airport OLS survey data, October 2003



ESSENDON AIRPORT - EXISTING OBSTACLE LIMITATION SURFACES DATA

RUNWAY CLASSIFICATION/CODE		
DIRECTION	APPROACH	TAKE-OFF
RWY 08	NON-INSTRUMENT CODE 4	CODE 4
RWY 26	INSTRUMENT PRECISION CAT I CODE 4	CODE 4
RWY 17	INSTRUMENT NON-PRECISION CODE 3	CODE 3
RWY 35	NON-INSTRUMENT CODE 3	CODE 3

APPROACH SURFACES

DIRECTION	ELEVATION AT INNER EDGE	LENGTH OF INNER EDGE	CHAINAGE	DIVERGENCE EACH SIDE	FIRST SECTION LENGTH	SLOPE	SECOND SECTION LENGTH	SLOPE	HORIZONTAL SECTION LENGTH	OVERALL LENGTH
RWY 08	72.9	150	940	10%	3000	2.5%	-	-	-	3000
RWY 26	72.9	300	2981	15%	3000	2%	3600	2.5%	8400	15000
RWY 17	85.9	150	940	15%	3000	3.33%	3600	2.5%	8400	15000
RWY 35	71.7	150	2645	10%	3000	3.33%	-	-	-	3000

TAKE-OFF CLIMB SURFACES

RUNWAY	ELEVATION AT INNER EDGE	LENGTH OF INNER EDGE	CHAINAGE	DIVERGENCE EACH SIDE	SLOPE	FINAL WIDTH	OVERALL LENGTH
RWY 08	72.9	180	2981	12.5%	2%	1800	15000
RWY 26	72.9	180	940	12.5%	2%	1800	15000
RWY 17	71.7	180	2645	12.5%	2%	1800	15000
RWY 35	85.9	180	940	12.5%	2%	1800	15000

NOTES:
1. ALL DIMENSIONS AND DISTANCES ARE IN METRES
2. ELEVATIONS BASED ON AHD (AUSTRALIAN HEIGHT DATUM)
3. ARBITARY CHAINAGES HAVE BEEN ADOPTED INFORMATION
4. HP – HORIZONTAL PLANE
5. MORE CRITICAL SURFACE PER RUNWAY 08/26 ADOPTED

RWY 17 END E 314 872.168 N 5 822 944.873
RWY 08 END E 314 205.338 N 5 821 712.320
ARP E 314 984.530 N 5 822 096.589
RWY 26 END E 316 123.334 N 5 821 821.002
RWY 35 END E 314 967.922 N 5 821 362.676
17/35 RUNWAY 1585m x 45m
17/35 STRIP 150m WIDE
08/26 RUNWAY 1921m x 45m
08/26 STRIP 180m WIDE

RUNWAY CONFIGURATION DIAGRAM (not to scale)

ARP/RED	
ARP ELEVATION	78.6
REFERENCE ELEVATION DATUM	78.5

INNER HORIZONTAL SURFACE		
RUNWAY	RADIUS	ELEVATION
08/26	4000	123.5
17/35	4000	123.5

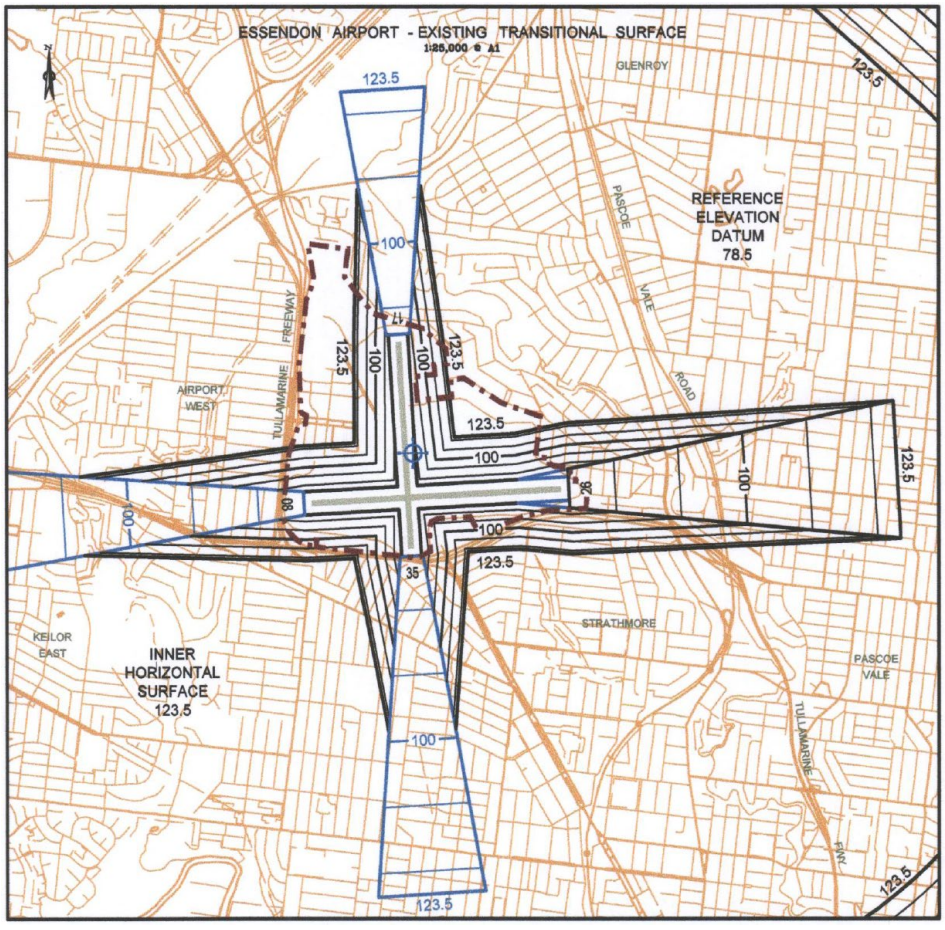
CONICAL SURFACE		
RUNWAY	SLOPE	FINAL ELEVATION
08/26	5%	228.5
17/35	SEE NOTE 5.	

TRANSITIONAL SURFACES	
RUNWAY	SLOPE
08/26	14.3%
17/35	14.3%

OUTER HORIZONTAL SURFACE		
	RADIUS	ELEVATION
08/26	15000	228.5
17/35	N/A	N/A

Source: Essendon Fields Airport Pty Ltd

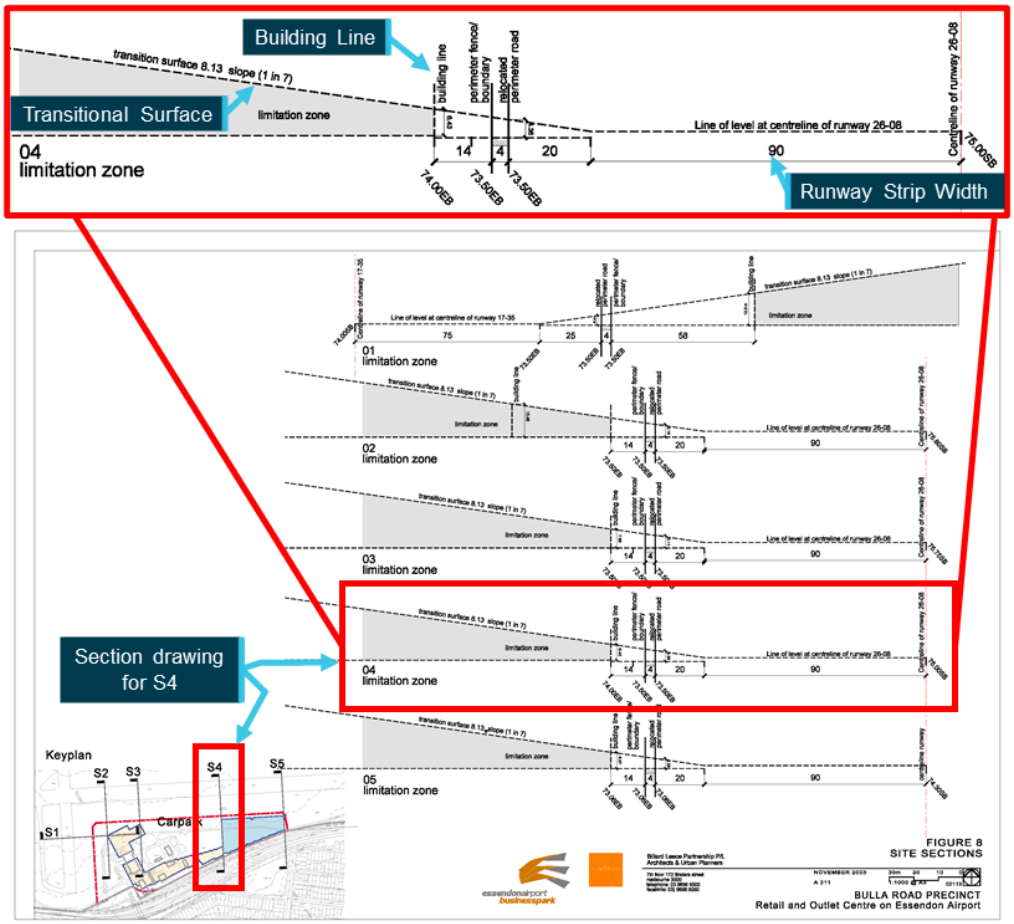
Figure 25: Essendon Fields Airport OLS diagram with transitional surfaces, October 2003 (see also Figure 10)



Source: Essendon Fields Airport Pty Ltd

Consistent with the survey data above, the major development plan for the Bulla Road Precinct, which was approved by the Minister in December 2004, used a 180 m strip width with the part of the transitional surface alongside the strip located 90 m from the runway centreline. A figure from the major development plan using these dimensions is reproduced below.

Figure 26: Extract from the 2004 major development plan for the Bulla Road Precinct (see also Figure 11)



Note: Figure 8 from page 13 of the 2004 major development plan.
Source: Essendon Fields Airport Pty Ltd

Changes between 2015 and 2019

Year	Aerodrome reference code	Runway strip width (m)	Approach inner edge (m)	Transitional surface (m)[1]	Source
2015	4	300	300	150	Civil Aviation Safety Authority, En Route Supplement Australia
2019	4	180	300	90	Essendon Airport Proprietary Limited aerodrome manual

The evidence for these changes is set out in chapter 8.

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, international agreements.

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.