UK Civil Aviation Authority

Runway Rehabilitation and Maintenance

CAP 781 DRAFT

Published by the Civil Aviation Authority 2025

Civil Aviation Authority
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

First published June 2008
Second edition August 2025

Enquiries regarding the content of this publication should be addressed to: asddocs@caa/co.uk

The latest version of this document is available in electronic format at: CAA Publications

Contents

CHAPTER 1

Introduction

1.1 The surface of a runway ~~(known previously as wearing course)~~ has a finite life expectancy. Due to deterioration of the surface, an aerodrome operator ~~Licence Holder (ALH)~~ may need to renew this surface course periodically.

1.2 In the rare event that a totally new runway is to be constructed, the work is usually isolated from other aerodrome activity, which enables it to proceed without interruption. In the final stages of construction, when it becomes necessary to integrate the new runway into the existing aerodrome infrastructure, a specific management plan will be required. In all other cases, aerodrome operators ~~ALHs~~ face the decision of whether to close an existing runway for the entire period of the rehabilitation work or to coordinate construction work with flying operations.

1.3 As runways can have up to a 30-year life span depending on traffic levels, it is quite possible that, at a number of aerodromes, those in charge of the project will never have attempted to rehabilitate a runway nor will ever be involved with such a project again. Only at the biggest, most heavily trafficked airports is it likely that resurfacing part or all of a runway occurs more frequently and hence a body of knowledge and experience can be assembled.

1.4 Over the last few years, the changes in the UK air transport industry have seen a number of factors affect aerodromes.

1.5 Due to the ~~national~~ increase in passengers travelling, smaller regional aerodromes have experienced a consequent increase in runway use accelerating the need for major maintenance.

1.6 Global warming related weather events has impacted aerodromes which have experienced pavement failure, slab curling as well as severe flooding events which have the potential to effect pavement subbases (washout), drainage and critical airport infrastructure.

1.7 Another important impact has been the loss of aviation operational experience from the industry and an increasing number of senior managers entering from other spheres, instead of rising through the operational ranks. These, together with recent experiences at a number of aerodromes, have led the CAA to identify an increased level of risk in the case of runway rehabilitation projects, especially those being undertaken by aerodrome operators ~~ALH~~s with little or no experience of such a project where public transport jet or turboprop movements are to continue during the work.

1.8 The CAA believes that the provision of guidance material regarding the management of a rehabilitation programme will be beneficial to industry in helping to reduce these risks.

1.9 This guidance ~~addresses issues in the latter case and~~ is intended to help aerodrome operators ~~ALHs~~ ensure that any such project is well planned, takes into account all potential hazards and remains safe for passengers, aircrew, and contractors.

1.10 By publishing this guidance, the CAA has not sought to offer a "How to do it" guide, since the variety and complexity of solutions are manifold. The intention is to provide a series of prompts with cross-references to other material as necessary, which should assist in identifying key project milestones and the assurances required to be in place at each one.

1.11 Although renewal of the runway surface is used to illustrate the procedures to be adopted, they are also applicable to other significant projects such as reprofiling, upgrading AGL or repainting surface markings.

1.12 Further information is contained in CAP168 and Regulation UK (EU) 139/2014 ~~in particular Appendices 2 and 3~~

.

Chapter 2

Planning ~~the~~ projects

2.1 The decision to resurface a runway, either in part or over the complete length is one not taken lightly. ~~Clearly,~~ The more aerodrome operators ~~ALHs~~ focus on planning and allowing adequate time for the project at all stages, the better prepared they will be for unforeseen events. Aerodrome operators ~~ALHs~~ should obtain sufficient data to inform the decision-making process, from a number of sources, well in advance.

These can include:

1. Runway Surface Friction Assessments;
2. Visual inspection records;
3. Specialist pavement condition surveys;
4. Traffic forecasts;
5. Long Range Weather Forecasts;
6. Capital budget plans;
7. Airside security
8. Other projects requiring runway access;
9. Other aerodromes' planned maintenance;
10. Environmental considerations; and
11. Consultation with stakeholders.

Airside security - Directed Airports

2.2 Directed airport operators should consider airside security and ensure that relevant access and escort controls are in place for contractors' personnel, vehicles and equipment engaged in airside works in order to protect the Critical Part (CP) and Security Restricted Area (SRA).

2.3 Aerodrome operators should consult their Security Manager or CAA AVSEC inspector to ensure security controls are adequate or for additional advice.

Airside Security - Non-Directed Aerodromes

2.4 Aerodromes that are not directed should ensure that suitable access controls are in place and escorts are available to allow the movement of contractor's personnel to and from the airside works area.

Engagement with Stakeholders

2.5 Early engagement of all stakeholders is vital in any runway rehabilitation project. Once an indication of either complete runway closure or phased reduced-length-working has been reached, all aircraft operators will need to assess the effects on aircraft performance and possibly make payload adjustments. If, for example, holiday charter airlines operate from the aerodrome, at least12 months' notice may be required due to the nature of seat sales. Part of the dialogue will be ensuring the roles and responsibilities for operations and tasks associated with the project are clearly understood and complied with by everyone concerned.

2.6 Typically, the following will require an early indication of planned runway works:

1. CAA
2. Airlines including aircrew;
3. Air Traffic Service Providers;
4. Local Runway Safety Teams;
5. Handling agents;
6. Ground Handling Service providers
7. Apron Management Services Providers
8. Emergency services including Local Authority contingency planners;
9. General Aviation Community;
10. Aeronautical Information Service (AIS);
11. Other aerodromes;
12. Consultative committees/local residents.

Hazard Identification

2.7 Once an aerodrome identifies the need to rehabilitate a runway by resurfacing, an important early task is the assessment of all the hazards that could affect the project. ~~examples of key areas for consideration are given in the following paragraphs.~~ ~~Key areas in which to look for hazards include,~~

Weather (both daily and seasonal);

2.8 The timing of the project can be critical and, bearing in mind prevailing weather conditions, a balance has to be made between winter with less traffic but potentially lower temperatures and the potential for LVP conditions and summer with better weather but with the potential for greater disruption.

2.9 Items that should be considered include:

1. Alerting for weather - how quickly the weather may change at different times of the year;
2. Likelihood and duration of Low Visibility Procedures;
3. Adverse weather including high winds, rain, snow & ice; consideration should be given to the potential impact on an immature/part reconstructed runway surface.

Aeronautical ground lighting (AGL)

Night Time Working

2.10 Where lead on and lead off centreline lighting is not available the exits should be lit with temporary blue edge lights.

2.11 During reduced runway length operations, mobile working lights should be positioned so as not dazzle or cause distraction to pilots and ATC.

Day time working

2.12 The use the use of temporary threshold and or wingbars lights in daylight will assist the identification of the revised threshold position.

2.13 PAPIs should not be displayed when a temporary threshold is established if landing operations are conducted over the works area.

2.14 Lighting beyond the temporary stop end position should not be displayed.

2.15 Temporary stop end lighting should be positioned and displayed at the revised stop end location.

Degraded AGL systems

2.16 Relevant information on the availability and revised lighting layout should be notified by AIP supplement.

Batching Plants

2.17 Aerodrome operators should carefully consider the positioning of batching plant and consider the effects of the steam which may affect ATC line of sight

2.18 Aerodrome safeguarding processes including the assessment of IFPs where applicable should be undertaken.

LVPs Cessation of works

2.19 Procedures should be in place for periods when the aerodrome enters LVPs and the visibility reduces to 300 m at which point the airside works area should be made safe and all works suspended, plant and equipment should be located to the nominated safe area and made safe, airside should then be vacated.

Nav aids maintenance during works and runway closures

2.20 During periods of runway closure the ILS system should be switched off

2.21 Routine maintenance of the ILS system should be as short in duration as possible.

NOTAM requirements

2.22 Aerodrome operators should ensure NOTAM or AIP supplements have been planned in advance of the works and published by AIS prior to the commencement of works.

2.23 NOTAM should be published when the availability of any IFP is affected by the works.

2.24 In the event of works overrunning NOTAM action may need to be reviewed particularly when a runway is returned to service daily following overnight works.

Aircraft performance

2.25 Aircraft performance may become critical if runway length is reduced, or performance of the runway surface is affected by rehabilitation during operations. It is particularly important that those aircraft types that have performance certification based upon certain types of runway surfaces, such as grooved asphalt, are taken into account in respect of those periods during the project when such surface enhancements are not available over the full length.

2.26 Items that should be considered include:

1. Effects of obstacles on Obstacle Limitation Surfaces (OLS) during WIP;
2. PANS OPS (ICAO Doc 4444) surfaces;
3. Management of aircraft operating criteria ~~(EU-Ops)~~ (UK Reg 965 /2012 (Air Operations)) to justify reduced design criteria;
4. Runway occupancy time;
5. Reduced lighting/marking;
6. Temporary Total Ungrooved Runway Length (TTURL).
7. Runway friction
8. Runway surface contamination

Reduced length runway operations

2.27 ~~If, as part~~ In the event of the project, work is divided up into phases where different parts of the runway remain operational with a reduced length available, restrictions may affect operators.

2.28 Items that should be considered include:

1. Aerodrome safeguarding including IFPs should be considered when reducing runway lengths wither temporarily or permanently.
2. Handover of possession - temporary closure and reconfiguration
3. Safety areas;

   a) at either end to protect from the risks of undershoot or overrun

   b) with reduced distances the need for extensive safety areas may be increased;

4. Temporary runway lighting;
5. Plane-out and ramping of the surface;
6. Surface laying trial on non-runway area including a friction test on the ungrooved surface
7. Contractor access routes;
8. Human factors issues, such as misunderstanding and miscommunication;
9. Adherence to planned closures and opening times of the runway
10. Circumstances that might cause the project to be suspended;
11. Hand back at the end of each possession and inspection procedures;
12. Communications of phases to stakeholders

2.29 If any part of the runway has been resurfaced but not yet grooved the runway could have to be promulgated as slippery ~~when~~ wet. Correct interpretation of CFME readings should indicate this; see CAP 683. ~~Edition 3.~~

2.30 For a runway that normally can support CAT lll operations with CAT III ILS still useable the aerodrome operator ~~ALHs~~ should liaise with airlines regarding their minima for a runway temporarily without full CAT lll AGL (normally Touch Down Zone and centreline lights would be removed during resurfacing projects). The impact of reduced AGL should be continuously assessed at each stage of the project with ongoing photometric checks to confirm compliance with licensing and operating requirements.

Runway pavement overlays - Runway ramping

2.31 The aerodrome operator should ensure that when a runway is to be returned temporarily to an operational status before resurfacing is complete and before operations recommence, the surface ~~should be~~ is inspected to ensure that temporary ramps have been constructed as follows;

1. The longitudinal slope of the temporary ramp, measured with reference to the existing runway surface or previous overlay course, should be:

   a) 0.5 to 1.0 % for overlays up to and including 5 cm in thickness; and

   b) not more than 0.5 % for overlays more than 5 cm in thickness.

2.32 Before a runway being overlaid is returned to a temporary operational status, a runway centre line marking conforming to the applicable specifications should be provided.

2.33 The location of any temporary threshold should be identified by a 3.6 m wide transverse stripe

1. Ungrooved runway surface;
2. Control of obstacles
3. ~~Bird~~ Wildlife hazard control;
4. Rescue and Firefighting Services (RFFS);
5. Runway Incursion
6. Runway Excursion
7. Control of Contractors;
8. ATC Procedures.
9. Airside driving

2.34 These are further discussed below, but a wide-ranging hazard identification process should be employed to help ensure all scenarios are examined. Bringing together different stakeholder representatives as a group to list these can prove fruitful.

Runway markings

2.35 Runways markings may be incorrectly positioned when the temporary runway threshold is in use specifically the aiming point or TDZs. Relevant information should be notified by AIP supplement.

2.36 Lead off markings should be applied as required to assist aircraft vacating the runway

Chapter 3

Regulatory Compliance

~~Risk Assessment~~ Safety Assurance

~~There are many publications offering advice on the completion of risk assessments including~~

3.1 It is the aerodrome operators ~~ALH~~'s responsibility to ensure that, before construction starts, the CAA has given approval to start the project ~~(as is required by Aerodrome Licence condition No 3.)~~ using the following to notify and engage the CAA as detailed in CAP791.

10. Certificated aerodromes submit form SRG 2011 to notify the CAA of any changes to the aerodrome that require prior approval in accordance with UK Regulation (EU) No 139/2014.

11. Licensed aerodromes submit form SRG 2006.changes that require prior approval.

3.2 The CAA will expect to ~~see~~ receive and approve comprehensive safety assurance documentation addressing the risks to aircraft, which shows all identified hazards have been assessed and reduced to tolerable levels or otherwise mitigated ~~-~~before work starts.

3.3 In order to provide safety assurance to the CAA, aerodrome operators should refer to the following documents;

1. CAP ~~729~~ 791 ~~Guidance on Aerodrome Development Procedures~~ Procedures for changes to aerodrome infrastructure; and

2. CAP 760 Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases.

3.4 The CAA will ~~also~~ expect to receive a statement of compliance and as part of the CAP791 process a completed compliance matrix ~~This could take the form of a matrix~~ which will assist the CAA in identifying areas of concern at an early stage. This should also help focus attention on the opportunity to eradicate or minimise existing licence variations or in the case of a certificated aerodrome, special conditions.

3.5 During the life of the project, oversight of the continuing status of compliance should be afforded the highest priority and action taken where non-compliances are detected

3.6 The accountable manager should sign off all the documentation prior to submission to CAA.

3.7 Projects such as this often test the aerodromes' safety management system (SMS). The aerodrome operator ~~ALH,~~ through the SMS, should ensure that the project is safely managed. This will involve initial and continued coordination with all stakeholders, both those directly involved with the project and those impacted.

.

Chapter 4

Maneuvering Area Closure

Closed runway lighting

4.1 When a runway is closed lighting should be provided to indicate to aircraft that the runway is closed.

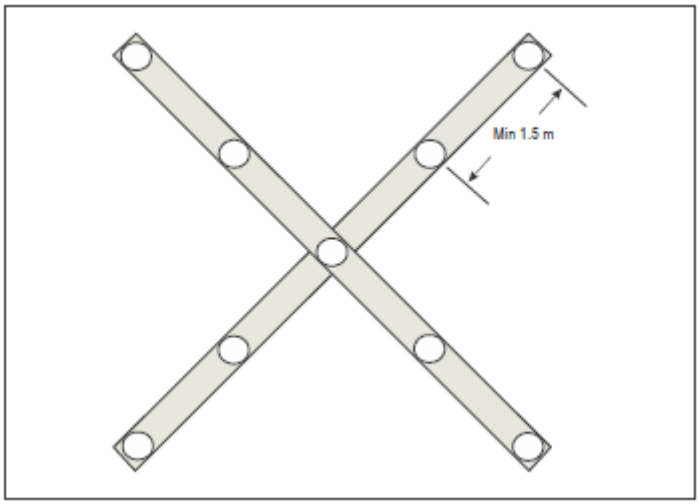
4.2 The purpose of the closed runway lighting is to reduce the likelihood of unintended landings during periods of poor visibility or at night whenever the runway lighting must be switched on for electrical maintenance.

4.3 In dusk or poor visibility conditions by day, lighting can be more effective than markings.

4.4 The closed runway lighting is intended to be controlled either automatically or manually by air traffic services or by the aerodrome operator.

4.5 A closed runway lighting shall be placed on the centre line near each extremity of the runway temporarily declared closed.

4.6 The aerodrome operators should use of a mobile or fixed runway closed sign for the duration of the closure, the sign shown below. Placement of a closed runway lighting enhances the situational awareness of the runway closure to the pilot.



1. Closed runway lights should show flashing variable white in the direction of approach to the runway, at a rate of one second on and one second off.
2. Closed runway lights should automatically revert to fixed lights in the event of the flashing system failure.

4.7 Should there be another parallel operational or standby runway, then mitigation needs to be in place to ensure the closed runway isn't mistaken for the operational runway and any parallel taxiway isn't mistaken for the alternative operational or standby runway

4.8 Where pilot-controlled lighting (PCL) is installed, this should be disabled and locked down during planned works to prevent activation by aircraft.

RFFS and Emergency Planning

4.9 Inevitably runway closures, which involve areas being closed to operational traffic, may restrict access to other parts of the aerodrome, such as the closure of particular taxiway routes or runway crossing points. If aircraft operations are to continue during resurfacing, for each phase of the project, access routes will need to be devised and agreed with the aerodrome RFFS, with suitable training for their crews and Air Traffic Services.

4.10 Runway closures, which involve restricting areas to operational traffic, may limit access to other parts of the aerodrome, such as specific taxiway routes or runway crossing points. If aircraft operations are to continue during resurfacing, access routes for each phase of the project must be devised and agreed upon with the aerodrome Rescue and Fire Fighting Services (RFFS), along with appropriate training for their crews and Air Traffic Services.

4.11 As part of the stakeholder consultation the Local Authority responders should be kept informed of changes that may affect their emergency response.

ATC Procedures

4.12 Runway closures/reduced distance operations can have a significant effect on ATC procedures, both in the air and on the ground. Often, the alternative operational full- length runway or existing reduced distance runway has limited navaids or infrastructure, which require increased spacing on approach. As a consequence, ATC workload increases and capacity decreases. At busy airports this can happen at night when ATC ~~manning~~ staffing levels are normally reduced.

~~Further guidance is available in the form of ATSINs and NOTALs.~~

~~NOTAL 2/2008 On Aerodrome Development~~

Runway Incursion / Excursion

4.13 Under conditions of total runway closure, incursion risks could be regarded as nil but at some aerodromes helicopter flying, the movement of aircraft for maintenance purposes or the use of subsidiary runways including grass strips may occur.

4.14 Where runway centreline lights together with some lead-on taxiway centreline lights have been removed, consideration should be given to the potential risk of aircraft lining up on the runway edge lights.

4.15 Where taxiway green lead-off routes are replaced with temporary blue LED edge lights, consideration should be given to pilots that may experience difficulty identifying runway exits due an increase in the mass of blue edge lights on successive exit routes.

4.16 Where part of the runway is given over to the contractor the risk of incursion is greatly increased. In all cases a robust plan to prevent any incursion must be in place with adequate safeguards to ensure continuous mitigation. This can include variations to the "normal" routes to and from the runway, which should be clearly marked and promulgated in advance.

Chapter 5

Wildlife ~~and Bird~~ Hazard Control

~~During major construction work the normal pattern of bird movements may be altered, construction work may create new bird attractants or there may be areas into which the bird hazard control team cannot gain access. An assessment of the potential changes should be made during the planning process and procedures revised as required. Increased Bird Control Unit activity during the project may require extra resources~~.

5.1 During major construction work, the hazards posed by wildlife, particularly birds, due to changes in their normal movement patterns which may be altered.

5.2 Construction activities might introduce new bird attractants or create areas that are inaccessible to the bird hazard control team.

5.3 Disturbed and re-instated grass areas can be a bird attractant it can also attract wildlife such as voles which is a food source of birds of prey.

5.4 An assessment of these potential changes should be conducted during the planning process, and procedures should be revised as necessary. Additionally, increased activity by the Bird Control Unit during the project may require additional resource

Chapter 6

Selection of contractors

6.1 ~~Contractor selection and tendering on major capital projects is covered by European Directives to ensure fair competition~~. ~~The Official Journal of the EU is usually used to advertise any tender invitations and early engagement with prospective bidders to discuss partnering can bring cost benefits~~. The importance of concise Employers' Requirements cannot be over emphasised or the need to assess bids on a whole life cost basis. ~~Larger aerodromes may have framework or term contracts in place with pre-qualified organisations, but generally, for one-off rehabilitation projects, no previous contractual relationship will exist~~. The success or failure of the project can rest upon selection of the appropriate designers, contractor and sub-contractors for the project.

Control of Contractors

6.2 ~~As above,~~ The risks of incidents happening due to plant, equipment and operatives' presence on the aerodrome cannot be underestimated. Consideration should be given to areas of aerodrome land given over to the Principal Contractor for a site compound, assembly areas for work parties in advance of runway handover and storage of arisings from each shifts' work with respect to the impact on obstacle limitation surfaces etc. Specific access routes from offices and compounds should be provided and promulgated.

6.3 Where possible, the aerodrome operator ~~ALHs~~ should use organisations with a proven track record and experience of working airside.

6.4 The aerodrome operators ~~ALH's~~ staff should exercise extra vigilance until confidence with the contractors reaches an acceptable level. Particularly, the on-site creation of hazards such as waste, standing water and bird attractants should be monitored.

6.5 Effective project management of operational aspects by the aerodrome operator ~~ALH~~ and by the project- managing contractors of the work itself, are essential to a successful development. Collaborative Decision Making (CDM) can assist in meeting this objective, see http://www.euro-cdm.org/ for more information.

6.6 To help inform the decision the following non-financial points should be covered:

1. Demonstrated competence on previous projects;
2. Health and Safety training;
3. Competence of employees;
4. Traditional design or design and build experience;

5. Sub-contractor selection and project management of sub-contractors.

Chapter 7

Selection of surfacing materials

7.1 ~~Since the 1980s, Porous Friction Course (PFC) has been replaced by grooved Marshall Asphalt at many of the larger aerodromes in the UK. Additionally~~, The introduction of new materials into the UK has seen a shift towards a wider choice for runway surface rehabilitation programmes.

7.2 These include:

1. ~~Asphalt~~ Marshall Hot Rolled asphalt (HRA);
2. Beton Bitumineux Aeronautique (BBA);
3. Stone Mastic Asphalt (SMA;)
4. Porous Friction Course (PFC);
5. Pavement Quality Concrete (PQC);
6. Slurry seal may still be used on occasion at some aerodromes.

7.3 Selection of the appropriate materials should take into account a range of factors including:

1. Availability of local materials;
2. Use of virgin materials
3. Recycled materials
4. Texture (Micro/Macro);
5. Grooving (depth and width);
6. Surface drainage
7. Local Authority policies;
8. Environmental impact (carbon footprint).
9. Global warming extreme weather events

~~7.4~~ ~~There is a wide range of references containing detailed technical information on the various construction methodologies and some of these are listed in Appendix 2.~~

7.5 ~~Additionally, the CAA has recently issued additional guidance that aerodrome operators ALHs may find useful in the form of NOTALS. See www.caa.co.uk/NOTALS~~.

7.6 Relevant ICAO documentation includes:

1. Annex 14 Volume 1 ~~Paragraph 2.6;~~
2. ICAO Aerodrome Design Manual Parts 1 and 3 (Doc 9157);
3. ICAO Airport Services Manual Part 2 (Doc 9137).

Chapter 8

Project Management

8.1 Although day-to-day management of the project will be vested in the Principal Contractor, as per the Construction Design and Management Regulations 2007, it is imperative the aerodrome operator ~~ALH~~ retains oversight to ensure that the SMS process is being followed.

8.2 The following topics should be kept under continuous assessment:

1. Daily oversight and review, both of construction and operations;
2. Auditable records - sign-off each day;
3. Regulatory compliance;
4. Handover procedures;
5. Phasing plans for access during closures for aircrew and drivers;
6. Environmental considerations;
7. Local noise considerations;
8. Meeting production targets;
9. RTF/communications onsite and to ATC etc;
10. Communications with stakeholders.

8.3 Overall responsibility rests with the aerodrome's accountable manager and cannot be devolved to the contractor.

8.4 A system to ensure open lines of communication throughout and an auditable trail of documentation recording processes, day-to-day meetings, design changes, actions and decisions should be in place. Relevant documents should be made available for audit by agencies affected by the work.

8.5 An Issues Log is effective for transmitting important outstanding decisions up the line. ~~The need for a~~ A communications plan so that the correct lines of reporting and cascading ~~are established~~ should ~~be self-evident~~ established.

8.6 Where contractors are given night time possession of the entire runway, or phased access to part of the runway permitted, pre- and post-shift handover briefings between the appropriate staff should take place every time. The contents of this brief should be recorded and made subsequently available for audit.

8.7 It is important to continue liaison with stakeholders during work periods on both tactical and strategic issues. Promulgation of information will help answer queries in advance and reduce the possibility of misunderstandings.

8.8 A number of key issues can affect how the project runs, and these include:

1. Reduced provision of AGL/Navaids;
2. New obstacles in the OLS;
3. Friction reduction
4. Weather;
5. Public Holidays.

Reduced provision of AGL/Navaids

8.9 CAP 168 and UK Reg (EU) 139/2014 sets out the minimum extent of markings, lighting and navaids required to support certain categories of operation. ~~EU Ops (previously JAR Ops 1~~) UK Air Operations Regulation UK Reg (EU) 965/2012 sets out operating limitations for aircrew and details minimum services required. Maintaining adequate guidance to aircrew at all stages should be afforded the highest priority and in particular the benefits of runway centreline lighting, where normally provided, are emphasised. It is ~~therefore~~ important that any changes in the extent of provision of runway services are communicated to users via NOTAM at the time of the change so that operators have accurate information available to them.

8.10 If CAT I ILS operations are supported by Human Observed Runway Visual Range (HORVR) measurement, sufficient edge lights visible from the ROP should be maintained throughout the project.

New obstacles in the OLS

8.11 As work progresses along a runway, contractors' plant and materials may pose a hazard by penetrating obstacle limitation surfaces.

FOD

8.12 During runway construction activities FOD may be present particularly in grassed areas adjacent the runway edge, hand over inspections should include careful examination of these areas.

8.13 A tools on and tools off checks should take place in order to account for any missing tools or equipment. Missing tools or equipment should be notified to the aerodrome operations staff at the earliest opportunity

Weather

8.14 Contingency plans for weather that stops work partway through a shift should be in place. Furthermore, due consideration to the effect on a programme of long-term weather forecasts should be given and options to account for different scenarios developed.

Public Holidays

8.15 Should a rehabilitation project extend over the period of a Public Holiday, any extended shutdown by the contractor should not leave the runway with either excessive areas of ungrooved new surface course or temporarily refilled planed-off areas that could break out under repeated trafficking.

Temporary Total Ungrooved Runway Length (TTURL)

8.16 Once renewal of the surface course has started a three-part method of shift working may be employed:

1. Planing-off
2. Laying
3. Grooving (if required)

8.17 Decisions that can affect aircraft safety will have been made during planning and it is important that the accountable manager ensures no deviation from plan and those nightly targets are met in full.

8.18 Laying new material follows removal of the surface course, which is usually done by planing-off. If Marshall Asphalt is specified this is delivered hot and rolled into place. Because of the time taken to cure, grooving cannot generally start for at least 72 hours thereafter.

8.19 A decision about temporary total ungrooved runway length (TTURL) has ~~therefore~~ to be made. An arbitrary figure based on asphalt batch production and laying speed may not meet the operational requirement if the runway is to be returned to service after each night shift. 100m of TTURL on a 3km long runway will have less significance than on one 1100m long so there should be a balance against declared distances available. It should also be borne in mind that more than one area can be ungrooved over the full runway length.

Similarly, if more material is planed-off than can be re-laid during the shift, ramps may have to be formed to carry aircraft across the join between the two different surfaces. This can also result in Binder Course material being left exposed to trafficking.

Chapter 9

RETURN TO SERVICE

9.1 As the project enters the final phase, a number of important checks should be completed prior to returning the runway to full service. Depending on the extent of the works carried out the following may need to be considered:

1. Runway Surface Friction Characteristics;
2. Evaluation of the aircraft mix and Critical Design Factor (CDF)
3. Production of a revised Pavement Classification Rating (PCR)
4. Update the aerodrome AIP detailing the revised PCR
5. Clear and Graded area and grass restoration;
6. FOD
7. Delethalisation;
8. AGL Flight Check;
9. Navaids Flight Check;
10. Notification of reopening date to stakeholders;
11. Cancelation of NOTAMs
12. As built drawings;
13. CAA acceptance.

Runway Surface Friction Characteristics

9.2 Before any runway that has been the subject of a major rehabilitation project can be returned to service, the friction characteristics of the new surface should be assessed in line with CAP 683. This should include investigations into the wet friction characteristics under natural rain conditions. The use of high-speed runs can indicate the presence or otherwise of good macro-texture surface which aids surface water runoff and helps maintain adequate aircraft braking performance when wet.

9.3 The paint markings, if reapplied following resurfacing, should use materials that maintain the friction characteristics of the surrounding surface. A number of proprietary paint additives are available.

9.4 Newly laid asphalt materials can exhibit reduced levels of grip whilst the surface releases volatile materials.

Clear and Graded area and grass restoration

9.5 If, as part of the project, excavation work in the Clear and Graded Area (CGA) of the runway strip has disturbed the ground, a careful check to ensure that it has been restored to comply with CAP 168 Chapter 3 (licensed aerodromes) and UK Reg (EU) 139/2014 (Certificated Aerodromes). should be made.

9.6 ~~At the same time,~~ Aerodrome operators should assure themselves ~~check to ensure~~ that any new construction below ground level in the CGA that features buried vertical faces ~~has~~ have been ramped to the correct level of delethalisation. ~~should be made,~~ licensed aerodromes refer to CAP 168 Chapter 3, certificated aerodromes refer to UK Reg (EU)139/2014 and relevant CS/ AMC/GM.

9.7 Disturbed ground can prove an attraction to a variety of bird species that forage for food. Restricting the amount of grass contractors can have access to will help to minimise the problem, ~~but~~ timely action to restore the grass should be planned. ~~In any case,~~ Active bird dispersal by the Bird Control Unit, enhanced ~~if necessary~~ as required ~~should be maintained~~ throughout the project.

~~9.8~~ ~~Treatment of~~ Disturbed earth may provide additional food source for birds, the aerodrome operator should access and mitigate the risk as appropriate ~~with the appropriate pesticide can reduce the amount of food available, though soil analysis may be required to identify which invertebrates are present.~~

AGL Flight Check

9.9 In addition, ground alignment checks aerodrome operators should ensure that a commissioning flight checks of new AGL installations, including (A) PAPI, is be conducted prior to their operational use. The CAA may choose to participate in or conduct such checks.

9.10 Should the flight check be delayed for any reason the aerodrome operator should contact their allocated aerodrome inspector in the first instance for further advice.

Flight Checking of Navaids

9.11 In addition to the AGL flight check, as part of the return to service, it may be necessary to engage a specialist flight-checking organisation for Navaids such as ILS or DME.

~~9.12~~ ~~If any NAVAID has been repositioned, the Directorate of Airspace Policy http://www.caa.co.uk/DAP will need to be informed in case of an impact on Standard Instrument Departure (SID) or Standard Arrival Route (STAR) distances.~~

Notification of reopening

9.13 Once the project is complete and any performance restrictions lifted, normal operations can resume. It is important to give adequate notice to stakeholders of this date so that planned flights can take advantage of the improvement immediately.

"As built" drawings

9.14 Whether traditional design or design and build is employed, appropriate "as built" drawings showing all relevant layers of information must be submitted by the contractor. Of particular importance is a record of all underground works and their location.

Learning Points

9.15 Major projects involving multiple organisations are bound to encounter issues. Therefore, after the runway has been returned to service but before the contractors are released, a final joint review of the project should be conducted. This review should aim to capture all relevant learning points for the mutual benefit of each organisation. The review should examine:

1. What could be improved;
2. Decisions;
3. Processes;
4. Procedures;
5. Actions;
6. MORs;
7. Suspensions;
8. Regulatory action;
9. Human Factors.
10. What went right;
11. Decisions;
12. Processes;
13. Procedures;
14. Actions.

9.16 ~~By using the guidance offered in this paper and applying the appropriate resources effectively (especially in the planning stages), communicating with~~

~~everyone concerned and maintaining vigilance throughout, ALHs aerodrome operators will afford themselves the best possibility of a successful project~~.

9.17 By following the guidance provided in this document, effectively utilising resources (especially during the planning stages), maintaining clear communication with all stakeholders, and staying vigilant throughout the process, aerodrome operators can maximise their chances of a successful project.

9.18 It is crucial to emphasise that projects of this nature require continuous monitoring due to their dynamic nature. Aerodrome operators should also ensure that any lessons learned are applied to ongoing aerodrome procedures.

~~9.19 It cannot be stressed too much that projects of this nature require continuous monitoring due to the dynamics of the situation. ALHs Aerodrome operators must should also bear in mind that any lessons learnt should be applied to ongoing aerodrome procedures.~~

9.20 The CAA expects the aerodrome operators planning runway rehabilitation projects to have read and noted the contents of this guidance.

Chapter 10

Pavement sustainability

Pavement sustainability practices

10.1 Overall, sustainable airport pavement practices aim to create infrastructure that is durable, cost-effective, environmentally friendly, and beneficial to society. Aerodrome operators should consider the use of natural resources, conservation and social responsibility.

10.2 Airport pavement sustainability focuses on creating and maintaining airport pavements in ways that reduce environmental impact, enhance economic efficiency, and provide social benefits. Airport pavement sustainability focuses on creating and impact, economic efficiency, and provision of social benefits.

10.3 Key aspects include;

1. Materials and design

   a) Design life maximising the design life of the pavement, design beyond fatigue cycles

   b) Construction methods Implementing methods that do not deplete resources or harm natural cycles, efficiently using resources like water, energy, and raw materials to minimise waste and environmental footprint

   c) Material selection, consider the use of new materials

   d) Consideration of the life cycle costs

10.4 Construction practices should consider energy efficient construction methods, the sourcing of local materials to reduce transport costs and related emissions and minimising waste and pollution during the construction phase, other factors to consider are;

1. Dust
2. CO^2
3. VOCs (Volatile Organic Compounds)
4. Noise pollution
5. Delay times
6. Energy
7. Recycling of materials to reduce the use of virgin material where possible.

Maintenance and Rehabilitation

10.5 Airport operators should undertake preventive maintenance to extend pavement life and conserve resources whilst considering the effects of pavement overloading in the maintenance plan.

10.6 When undertaking pavement rehabilitation or repairs aerodrome operators should consider the possibility of applying in-place recycling techniques and utilising advanced materials and technologies for efficient repairs, therefore reducing operational disruptions.

Environmental Considerations

10.7 Environmental considerations include;

1. Managing stormwater runoff and improving water quality with permeable pavements and ensure drainage systems are adequately maintained and can cope with extreme rainfall events preventing pavement flooding.
2. Reducing the urban heat island effect through the use of reflective and cooler pavement materials
3. Lowering greenhouse gas emissions through more efficient pavement systems

Economic and Social Factors

10.8 These factors focus on lifecycle costs, including initial construction, maintenance, and disposal whilst enhancing safety and comfort for airport users by maintaining high-quality pavement conditions and should include community and stakeholders input to ensure pavement solutions meet local needs and priorities.

New Technologies and Materials

10.9 Consider the use of new materials and technologies such as;

1. Warm Mix Asphalt
2. Half-Warm Mix Asphalt
3. Increased amount of recycled materials
4. Concrete admixtures
5. Supplementary Cementing Materials (SCM)

Example - Warm Mix Asphalt

WMA reduces temperatures by 25° to 55° C reducing energy usage, reduces emissions and worker exposure and when considering placement where there may be a longer haul from batching plant to site given the temperature of the material is lower