



Advisory Circular

AC 139-20(0)

MARCH 2007

SAFE PLANNING AND CONDUCT OF AERODROME WORKS

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1. REFERENCES

- Civil Aviation Safety Regulations 1998 (CASR) Part 139, regulation 139.245
- Manual of Standards (MOS) Part 139
- ICAO Annex 14 - Aerodromes
- ICAO Airport Planning Manual Part 3 Guidelines for Consultant/ Construction Services
- ICAO Airport Services Manuals 1 - 9

2. PURPOSE

The purpose of this Advisory Circular (AC) is to assist aerodrome operators in the safe planning and conduct of aerodrome works. The AC covers aerodrome works of an extensive nature, which require the preparation of a Method of Working Plan, and routine aerodrome maintenance works which are carried out as time-limited works.

3. STATUS OF AC

This is the first AC to be written on the subject of planning and execution of aerodrome works.

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material. Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.

ACs should always be read in conjunction with the referenced regulations.

4. APPLICABILITY

4.1 This Advisory Circular applies to:

- Operators of certified and registered aerodromes;
- Aerodrome staff involved in the planning and execution of aerodrome works;
- Aerodrome Reporting and Works Safety officers;
- Construction companies engaged in aerodrome works;
- Consultants engaged in the planning and/or supervision of aerodrome works;
- Airlines conducting operations during aerodrome works;
- ATC co-ordinating aircraft activities with ground activities generated by aerodrome works; and
- Persons with a role in the safety management system of the aerodrome.

5. GENERAL

5.1 When the normal pattern of an aerodrome is disrupted through aerodrome works, the risk to aircraft operations is increased. This is because the normal routine is changed and everybody, particularly the pilots, has to operate in an unfamiliar environment. The purpose of this AC is to discuss the areas of safety concern and offer suggestions on how to minimise the hazard which may be created by aerodrome works. It should be noted that this AC does not obviate the need to observe the relevant standards specified in MOS Part 139.

5.2 Aerodrome works cover works on runways and associated runway strips, taxiways and associated taxiway strips, and aprons. Where the work is of maintenance nature, and the work is carried out in between aircraft operations without affecting aircraft operations, it is known as time-limited work. Time-limited work does not require the preparation of a Method of Working Plan (MOWP). At aerodromes without ATC, time-limited works are not allowed at night or during periods when the visibility is less than 5 kilometres.

5.3 Where the aerodrome work is of a development or major rectification nature, and the aerodrome is used by aircraft with more than 5700kg Maximum Take-Off Weight (MTOW), the aerodrome operator will need to prepare a MOWP before any work is carried out. A MOWP is required for runway and runway strip works that have direct impact on aircraft operations and pilots need to be advised of such works through the Notice to Airmen (NOTAM).

5.4 At an aerodrome used by airlines conducting passenger transport operations using aircraft of not more than 5700kg MTOW, the preparation of a MOWP is recommended if the nature of work involves significant changes to the movement area or disruption to aircraft operations.

5.5 A MOWP is not normally required if the works are confined to a section of taxiway or apron only, and the nature of work is such that aircraft operations will not be affected. If in doubt, check with the CASA Aerodrome Inspector. In this case, the works area needs to be adequately marked to ensure that there is no chance of inadvertent entry of aircraft or vehicles to the affected area.

5.6 A checklist of the matters to be dealt with and procedures for ensuring safety during aerodrome works is outlined in Appendix 1.

6. CONSULTATION WITH AERODROME USERS

6.1 When the physical conditions or environment of an aerodrome is disrupted due to aerodrome works, the risk to aircraft operations can be significantly increased if the disruption is not managed properly. The management of the disruption extends not only to aerodrome staff engaged in the works or the operation of the aerodrome, but also to external people and organisations that may be affected by the works.

6.2 Organisations like airlines and ATC often need a long lead time to plan for changes to their schedules or mode of operations. Where the proposed work is likely to affect aircraft operations, it is prudent to initiate dialogue with organisations concerned at an early date.

6.3 Also, if the nature of work is likely to temporarily affect the compliance with a relevant aerodrome standard, the aerodrome operator should liaise with a CASA Aerodrome Inspector early so that the effect on aerodrome safety of any non-compliance with the standard can be properly assessed, and mitigating measures developed, where appropriate.

7. PLANNING OF AERODROME WORKS

7.1 The objective of planning aerodrome works should be such as to incur minimum costs on all concerned, whilst maintaining aerodrome safety. To achieve this objective, persons and organisations likely to be significantly affected should be given the opportunity to participate in the planning process.

7.2 There are occasions where an aerodrome facility may be temporarily taken out of service for the purpose of aerodrome works. Examples are a runway in a multiple runway system, or at a country aerodrome with light traffic, where a short period of aerodrome closure can be tolerated. As the service provider, the aerodrome operator needs to take into account the impact of any withdrawal of aerodrome facility to its users. If the aerodrome is used as an alternate aerodrome, the impact on other operations should also be given due consideration.

7.3 Where the aerodrome works are to be carried out with the aerodrome still serving aircraft operations, it will be necessary to plan the work in such a way that does not cause hazard to aircraft or confusion to pilots. To allow for periods of uninterrupted work, it is often necessary to close an aerodrome facility for a fixed period from aircraft operations. This will allow the works to be carried out in stages.

7.4 Planning for the aerodrome works needs to be done in the format of a MOWP. The standards of a MOWP are set out in MOS Part 139, Chapter 10. Essentially, the MOWP should clearly set out the following:

- the scope of work and the stages of carrying out the work;
- how the works are to be carried out and the restrictions on the works organisation;
- how the aircraft operators and pilots will be told, through NOTAM, of the restrictions to aircraft operations at each stage of the work;

- identify any changes necessary to aerodrome markings and lights as the works progress;
- drawings to illustrate work arrangements and changes to declared distances, taxiing routes, etc.; and
- identify persons responsible for the works and those accountable for ensuring safety of the aerodrome facilities to aircraft operations.

7.5 It should be noted that the responsibility for ensuring aerodrome safety during aerodrome works rests with the aerodrome operator. Accordingly, a MOWP does not require CASA approval. However, if there are aerodrome safety issues identified in the preparation of the MOWP, aerodrome operators are advised to liaise with CASA to have the safety issues resolved before finalising the MOWP. In any case, it is strongly recommended that CASA be advised of aerodrome works and a copy of the MOWP be provided to the relevant CASA office.

7.6 In preparing the MOWP, an important exercise is to assess the risks that the works may create. Arrange the works in such a way as to minimise risk, and where appropriate, use mitigating measures to minimise risks.

7.7 An important consideration in the planning of staged work is to ensure that at the end of each stage of the work, the aerodrome facility will be restored to an operational state. Where necessary, this may involve the repainting of markings. For newly placed bituminous material, this would include the provision of temporary longitudinal and transverse ramps in accordance with the standards set out in MOS Part 139, Chapter 10, and allowing adequate time for curing purposes.

7.8 The planning of work needs to provide for an adequate number of trained works safety officers. The respective roles of the works safety officer and the project manager need to be clearly defined. Where possible, the works safety officer should not be placed directly under a line manager controlling the work. This is to avoid the possibility of work expediency being given a higher priority than aerodrome safety.

8. WORKS SAFETY OFFICERS

8.1 Depending on the scope and spread of the works, an adequate number of works safety officers should be provided to monitor the works activities. The aim is to ensure that the safety aspect of the works will be constantly monitored. The rostering of the work and the workforce should include the provision of works safety officers. To cover the eventuality that there may be a period when the appointed works safety officer cannot be present, there should be arrangements in place to ensure that a competent person will be assigned the duty of the works safety officer to cover the period of the works safety officer's absence.

8.2 It is important to ensure that the works safety officers are made aware of the planning of the works, particularly the risk assessment and risk mitigating measures. A works safety officer must have full knowledge of the work arrangements, and be able to forcefully reject any deviations to the work arrangements.

8.3 To ensure that the works safety officers can effectively carry out their duties, the works contract needs to clearly require the works organisation and all personnel engaged in aerodrome works to comply with directions issued by the works safety officer.

9. PROMULGATING INFORMATION ON AERODROME WORKS

9.1 Through an effective consultation process, airlines and affected organisations should not be surprised by the aerodrome works. When a MOWP is finalised, information on the aerodrome works can be promulgated in the following manner through the Aeronautical Information System (AIS):

- by producing an Aeronautical Information Circular (AIC) to provide early announcement of the work arrangements. This may be done three months before the proposed work. The information provided should allow a reader to understand the staging of the work, and the specific aerodrome facilities, which will be affected by each stage of the work. Readers should also be advised that notification of the actual timing of each stage of the work will be carried out through NOTAM, or
- by initiating NOTAM action before carrying out aerodrome works. One NOTAM may suffice for simple work. However if the works are carried out in stages, multiple NOTAMs will be required. Timing of the NOTAM is important particularly at aerodromes serving international operations: too early an announcement can cause confusion or be ignored, too late an announcement may not allow recipients time to notice changes or miss intended operators altogether. To allow for orderly processing of the NOTAM, aerodrome operators should initiate NOTAM action within five days and not later than two days of the actual work. The NOTAM should set out clearly changes, including the following where appropriate:
 - (1) actual aerodrome facilities affected by the work;
 - (2) amended declared distances;
 - (3) presence of obstacles;
 - (4) changes to existing aerodrome markings or lights, or the provision of new markings or lights;
 - (5) withdrawal of any facility such as Visual Approach Slope Indicator (VASI) or Instrument Landing System (ILS).

9.2 Where possible, drawings should be used to clearly illustrate the various stages of the works and the resulting changed situations of the aerodrome.

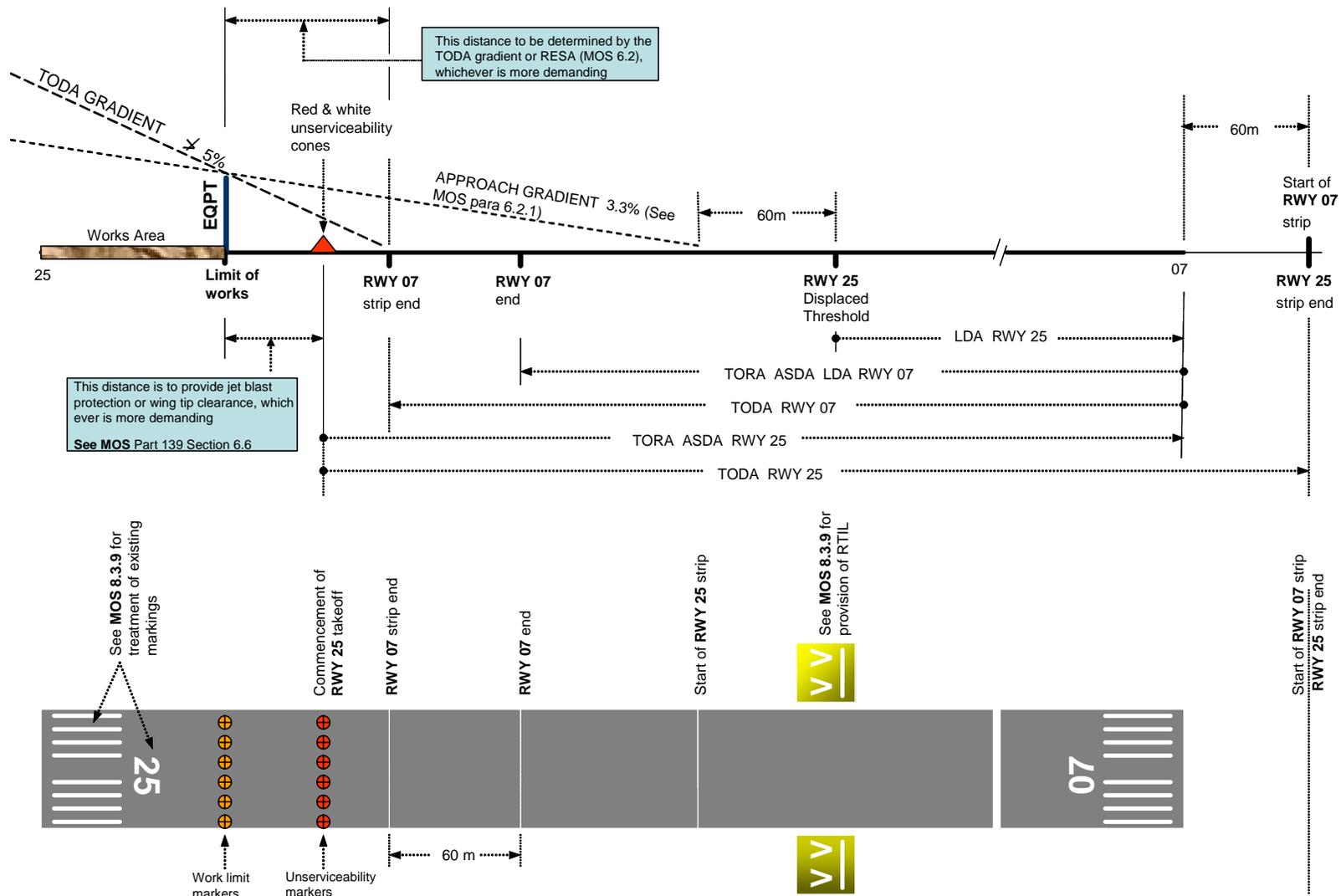
10. AERODROME MARKINGS AND LIGHTS

10.1 Aerodrome markings and lights provide pilots with the necessary visual cue to operate at the aerodrome. Where an existing marking or lighting has to be temporarily altered as a result of aerodrome works, new visual cues are normally provided. Careful consideration needs to be taken on how the new visual cues will be perceived by a pilot. This is particularly so with respect to markings where, to save costs, existing markings may not be completely obliterated. Using additional markers and lights may be necessary to make the runway or taxiway closure obvious, especially where pilots have become accustomed to landing and taxiing via standard routes.

10.2 MOS Part 139, Chapter 8 specifies the standards on the treatment of existing markings. Where an existing threshold has to be displaced as a result of aerodrome works, the main concern is with the existing threshold markings. This is because the threshold marking provides a strong visual cue to indicate the beginning of the runway. Where the existing threshold markings have to be obliterated, aerodrome operators should choose the most effective method to carry out the task. Options include painting the markings with a paint similar to the colour of the runway, cover the area with hessian or similar material, and if jet blast or prop wash is not a problem, dark coloured soil may do the job.

10.3 It is important to highlight the location of the new threshold. Besides marking the new location, it has been found that runway threshold identification lights (strobe lights) can provide a very effective visual cue to pilots. The strobe light is a requirement for aerodromes used in international operations, but operators of other aerodromes are encouraged to use the strobe lights to enhance the sighting of the new threshold location.

10.4 Works on a runway end will result in changed declared distances and will require the provision of new markings and markers to delineate the works area. An example on how to calculate the position of the displaced threshold and revised declared distances is outlined in Appendix 2. See MOS 139, Chapter 8, paragraph 8.3.9 for new markings required when a permanent threshold is temporarily displaced. The following diagram illustrates how the area should be marked and the new declared distances derived.



CALCULATION OF DECLARED DISTANCES FOR WORKS IN PROGRESS ON A RUNWAY

10.5 *Use of Markers* – Often unserviceability markers are used to delineate the boundary of work area beyond which aircraft must not enter. The markers are required to be light weight and frangible. If the markers have to be placed at a spot which is subject to jet blast or prop wash, securing them firmly can be a problem. Under no circumstance should the marker be held down by weighty objects such as steel cage, length of steel rods, batteries etc. as these can present a hazard to aircraft running over the markers. Materials that have been found suitable include sand and tent pegs. In some circumstance, markers on a heavier base may provide the necessary stability.

10.6 *Extinguish Unnecessary Lights* – Aerodrome lighting must show only the usable aerodrome facilities. Where because of aerodrome works, a portion of the runway or taxiway is not usable, the lights on those portions of runway or taxiway must be extinguished so as not to create confusion. One method of extinguishing a light is to place masking tape over the light, another is the use of a bucket to cover the light.

10.7 *Use of Temporary Lights* – Occasionally, temporary lights may need to be used to delineate new locations, such as a taxi-holding position. The lights selected for a function should be as close as possible to the specifications of the permanent lights, in terms of colour and intensity.

11. CONTROL OF AERODROME WORKS

11.1 It is most important that all personnel engaged in aerodrome works are made aware of, and be required to, observe the safety procedures under which the aerodrome works are conducted. A good way is to include a safety highlight message in the briefing at the commencement of each day's work.

11.2 Access routes to and from the worksite should be carefully planned and sign posted. Where vehicles are used to move excavated or backfill material, the loading and condition of the vehicles need to be checked to avoid any spillage. Where vehicles are allowed to travel on or cross taxiways or runways, dedicated clean up resources need to be made available to remove any spilled material from the pavement and adjacent areas.

11.3 If there are aircraft operations at night, the lights from vehicles engaged in night work must not cause confusion to pilots. Vehicle light fittings should be checked to ensure that the lights are not directed unduly upwards. Drivers must be told that as a matter of course, high beam is not to be used.

11.4 The parking and storage areas of vehicles, equipment and building material should be carefully chosen and identified to avoid infringement of the runway or taxiway strip standard or any of the OLS surfaces.

11.5 Excavation work along the runway or taxiway strips should be carefully planned as the area needs to be restored before the next aircraft operation. See MOS 139, Chapter 10, paragraph 10.10.12 regarding restrictions when carrying out works on a runway strip. There should be a contingency plan to cover equipment breakdown, rain stoppage and other occurrences which may disrupt the work.

11.6 *Men with hand tools carrying out work on the runway strip of an active runway* – There are certain restrictions governing the conduct of workers with hand tools carrying out works on the graded runway strip of an active runway. NOTAM

action is required if the work area requires more than 10 minutes to be restored. At a controlled aerodrome, the ATC would normally only permit such works when:

- (a) the mean cross wind component does not exceed 15 knots;
- (b) the visibility is equal to or greater than 5000 metres;
- (c) the ceiling is equal to or greater than 1000 feet;
- (d) the runway surface is dry;
- (e) the working party can be visually monitored by the ATC at all times.

11.7 The works safety officer is required to maintain a communication link with the ATC and be at the site at all times. Work can be carried out on one side of the runway only and may be suspended during period of heavy aircraft operations. ATC will advise pilots of the work. At a non-controlled aerodrome, similar restrictions should be followed.

11.8 Jet aircraft are susceptible to foreign object damage (FOD). This means that loose material must not be left on or adjacent to runways and taxiways which can be blown away or sucked up by the aircraft engines. An important aspect of restoring the work site to an operational state is to remove any loose material at the end of each work period.

12. CHECKING RESPONSES OF OTHER PEOPLE AND ORGANISATIONS TO AERODROME WORKS

12.1 Informing organisations about aerodrome works is only one aspect of ensuring aerodrome safety. As part of its safety management system, aerodrome operators should also follow up with checks to ensure that the procedures of relevant organisations do take into account the aerodrome works and do not create new risk. Examples of these include revised planning for, and table top exercise of, Aerodrome Emergency Plan (AEP) and new routes or assembly points for emergency responding agencies and airside drivers awareness of restrictions arising from aerodrome works.

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APPENDIX 1**AERODROME WORKS SAFETY CHECKLIST**

There are so many matters to consider in the planning and execution of aerodrome works that it is easy to overlook certain matters. The purpose of this checklist is to allow the works planners and works supervisors to systematically double check that safety matters or necessary procedures are not overlooked. This checklist is general in nature, and may not address unique local situations.

PLANNING OF AERODROME WORKS:

In preparing for works on an aerodrome, be it for Method of Working Plan works or time-limited works, have all of the following been considered and incorporated:

- Clear identification of the scope of works?
- Clear identification of all of the facilities affected?
- Clear identification of the different stages of works?
- Clear identification of the hours of work?
- Clear identification of what happens during inclement weather?
- Clear identification of the closure times of the affected areas?
- Clear identification of the operational restrictions?
- Clear identification of the access routes to the work site?
- Clear identification of the markings required at the work site?
- Clear identification of the arrangements for protecting electrical services and control cables?
- Clear provision for airside security?
- Clear identification of the arrangements for airport emergencies?
- Clear identification of what happens in poor visibility?
- Clear identification of the limit of the works area?
- Clear identification of conditions for the marking and lighting of vehicles?
- Clear identification of the arrangements for keeping pavements clean?
- Clear identification of the maximum height of vehicles allowed on site?
- Clear identification of the conditions for excavations on site?
- Clear identification of conditions for filling of trenches?
- Clear identification of conditions for hot cutting and welding?
- Clear identification of conditions for the use of explosives on site?
- Clear identification of conditions for smoking on site?

- Clear identification of conditions for parking of vehicles on site?
- Clear identification of conditions for waste control?
- Clear identification of conditions for the control of works personnel?
- Clear identification of conditions that apply at the end of the works?
- Clear identification of any obstacles created by the works?
- Clear identification of the markings to be used for marking the unserviceable areas?
- Clear identification of who the Contractor carrying out the work is?
- Clear identification of who the Project Manager is?
- Clear identification of who the Work Safety Officers are?
- Clear identification of what the Work Safety Officers are responsible for?
- Clear identification of who the Works Organiser is?
- Clear identification of who the Safety Co-ordinator is?
- Clear identification of the conditions under which the MOWP can be varied?
- Clear identification of the person who has approved the MOWP?
- A set of clear and easy to read drawings setting out the impact of the works?
- Do the drawings clearly show the limit of works?
- Do the drawings show the planned set out of temporary markers and markings?
- Do the drawings show the access routes to and from the works?

CONDUCT OF AERODROME WORKS

In the conduct of the works, have the following been considered:

- Is there a system to audit the works to ensure MOS compliance?
- Does the system include a process for investigating incidents and accidents?
- Are the works being conducted so that there is minimal disruption to the normal operations at the aerodrome?
- Are the access routes being followed to and from the work site?
- Are the access routes adequately supervised?
- Are the markings for the work site obvious?
- Are the markings for electrical services and control cables adequate?
- Are the provisions for airside security enough?
- Are staff aware of what happens in reduced visibility?
- Are the markings and lighting of vehicles adequate?
- Are pavements used or crossed during the work being kept clean?

- Are the controls on the maximum height of vehicles on site adequate?
- Are there adequate controls over excavations on site?
- Are trenches being filled correctly?
- Are the controls on hot cutting and welding adequate?
- Are the controls over smoking on site working?
- Are the controls of parking of vehicles on site enough?
- Do the waste control methods prevent FOD?
- Are the controls over works personnel adequate?

WORKS SAFETY OFFICER

In terms of the safety management of the work site, are the following requirements for works supervision being met:

- Has a works safety officer been trained to MOS Part 139?
- Have the works safety officer/s been formally appointed?
- Are there adequate numbers of works safety officers to cover all aspects of the works; i.e. access gates, access routes, escorts, site supervision?
- Do the works safety officers have a radio to communicate with ATC and/or aircraft?
- Does the works organiser understand the role of the work safety officer?
- Does the works safety officer have a formal reporting process?

APPENDIX 2**USE OF OVERLAY ON RUNWAY PROFILE TO CALCULATE POSITION OF DISPLACED THRESHOLD AND REVISED DECLARED DISTANCES**

1. Determine the chainage of the limit of the works area and the height of equipment that would be used in the area. In the case of partial runway closure due to disabled aircraft, the tail height of the aircraft may be the critical obstacle. In locating the Works Limit markers, remember to leave enough space for the movement of vehicles and plant around the works area or disabled aircraft.
2. Place the overlay over this position on the runway with the side scale (height of equipment) set to the relevant height. The overlay stays in this position.

Declared distances associated with take-off and landing from the displaced threshold end

3. Read off the chainage where the 3.3% gradient intersects the runway (for a code 3 runway, if it is desirable to maximise the LDA, a higher gradient up to 4% is permissible). Add 60m to the chainage and that is the displaced threshold location. Place the temporary V-bar markers and DTILs at this location.
4. LDA is read off from the displaced threshold chainage to the runway end.
5. Next establish the chainage where aircraft commence their take-off. The requirement is for adequate clearance between the works area and where aircraft commence take-off. This is dependent on the aircraft wing tip clearance or jet blast protection requirement, whichever is more demanding. Use the critical aircraft to establish this chainage. When established, this chainage is the origin of the TORA, ASDA and TODA and the location for the unserviceability cones.

Declared distances associated with take-off and landing from the other end

6. Read off the chainage where the 5% gradient intersects the runway. Check whether the position satisfies the RESA requirement. If yes, this is the temporary runway strip end and the TODA gradient is 5%. If not, locate the temporary runway strip end by using the required RESA dimension. Read off the gradient to that position and that becomes the TODA gradient.
7. The distance from the take-off runway end to the temporary runway strip end chainage is the revised TODA.

8. Add 60m to the chainage of the temporary strip end to establish the temporary runway end. TORA, ASDA and LDA are the same and terminate at this chainage.
9. Establish the 1.6%, 1.9%, 2.2% and 2.5% gradients from the top of equipment to intersect the runway. The distances from the take-off runway end to these locations are the supplementary take-off distances associated with the respective gradient.