

Figure 10-6. Control of stop bar through position sensors — Aircraft crossing the stop bar without clearance

Chapter 11

Signs

11.1 GENERAL

11.1.1 The achievement of safe and efficient aircraft taxiing and ground movement at aerodromes requires the provision of a system of signs for the use of pilots and vehicle drivers on the movement area.

11.1.2 Pilots and vehicle drivers use the signs to identify their position on the movement area. By relating this data to ground map information available in the cockpit or in the vehicle, they can ensure that they are on their assigned route at all times. They can also, as required, report their position to ATC.

11.1.3 At some locations, the signs convey mandatory instructions related to that particular position, thus contributing to the safety of operations.

11.1.4 Signs at intersections expedite movements by indicating the layout of the taxiways at that position. Provided that the sign is seen in sufficient time, pilots and vehicle drivers can then easily identify the exit from the intersection that corresponds to their assigned route.

11.1.5 All signs are classified as either mandatory or information signs.

11.1.6 A mandatory sign shall be provided to identify a location beyond which a vehicle or taxiing aircraft shall not proceed unless authorized by the air traffic management service.

11.1.7 An information sign shall be provided where there is an operational need to indicate, by a sign, a specific location, or routing (direction or destination) information, or to provide other information relevant to the safe and efficient movement of aircraft and vehicles.

11.2 DESIGN

11.2.1 The system of signs specified in Annex 14, Volume I, Chapter 5, 5.4 and Appendix 4, meets a number of design criteria.

11.2.2 All signs conform to a colour code that clearly indicates the function of each sign. Mandatory signs use red and white, and information signs use yellow and black. The choice of colours was influenced by colour conventions in other modes of transport where colours have specific and well-understood meanings. It was also influenced by the need to use pairs of colours which, in combination, provide signs that are legible in the widest possible range of conditions. Contrast ratios between the elements of the sign are a major factor in determining the legibility of a sign.

11.2.3 There are four basic attributes related to the design of signs:

- a) conspicuity;
- b) legibility;
- c) comprehensibility; and
- d) credibility.

11.2.4 Each of these attributes is important. To meet the operational requirements, all signs must be readily seen in the complex aerodrome environment, and the inscription on the sign face must be easy to read. The message being conveyed by the sign must be readily understood by pilots and vehicle drivers, and it must also provide information that is clearly correct.

11.2.5 The overall size, colour and luminance of a sign determine the level of conspicuity. The size, font and layout of the inscriptions together with the luminance contrast between the inscription and the sign face determine the legibility of the signs.

11.2.6 Full compliance with the criteria in Annex 14, Volume I, Appendix 4, concerning the sign face size is necessary to maximize the conspicuity of the signs and to ensure that the sign characters are legible. The design criteria require a sign face that is always twice the height of the inscription. The width is determined by the overall length of the inscription to which must be added a border of at least 0.5 times the inscription height at either end of the sign. For signs containing only one designator, the lateral border width is required to be equal to the inscription height. This ensures that a sign face of suitable size is provided in all situations. The requirements of Annex 14, Volume I, Appendix 4, paragraph 11, should be met for mandatory signs.

11.2.7 The font size chosen depends on the maximum range at which the inscription is required to be legible. For an aircraft taxi speed of 30 kt and assuming a reading time of 10 seconds, plus a small allowance for an initial search time to locate the sign, the required font height is at least 30 cm. A font size of 40 cm is applied to enhance the sign performance especially in locations where the level of safety is of particular importance. The font to be used for signs is specified in detail in Annex 14, Volume I, Appendix 4.

11.2.8 The luminance of the signs is specified to maximize the useful range of the signs in reduced visibility conditions.

11.2.9 The position of signs and the location of the various elements of the sign message strongly influence the comprehensibility of the sign system. The layout of the signs, particularly for applications at complex intersections where several sign elements are collocated, is specifically designed to ensure the speedy and accurate assimilation of the information displayed. The inscriptions specified are chosen to ensure that the information is easily understood by all users. An example of a complex sign layout is given in Figure 11-1.

11.2.10 For operations that take place in low visibility or at night, the illumination of the sign face is an important design parameter. The sign luminances that are specified in Annex 14, Volume I, Appendix 4, have been found to meet the operational criteria in these circumstances. Two sets of luminances are given. The higher luminances are only essential during operations in runway visual range conditions less than a value of 800 m. At night in good visibility conditions, the luminance of signs can be reduced as indicated provided that sign conspicuity and legibility criteria are maintained.

11.2.11 To maximize legibility, it is important that the equipment is designed to have a uniform luminance over the complete sign face. Similarly, the specified luminance ratios between the colours of the sign should always be complied with.

11.3 VARIABLE MESSAGE SIGNS

11.3.1 Conventional signs displaying a fixed message show the same information at all times irrespective of the operational circumstances. This can result in situations that are at least illogical and which could cause operational problems. For example, a pilot taxiing for departure in VMC will be expected to pass a mandatory Category I, II, III or joint II/III holding position sign without obtaining clearance from ATC. This procedure is followed on the basis that the sign is not applicable at the time when the manoeuvre takes place. The potential for any misunderstanding could be removed if the sign information were only visible when the information being displayed is applicable. Selective use of taxiways as part of a full surface movement guidance and control system or as a means of maintaining separations between very large aircraft on close parallel taxiways are other examples of the need for more flexibility in the way in which sign information is displayed. It is recommended in Annex 14, Volume I, 5.4.1.2, that variable message signs be provided to meet the operational needs described above.

11.3.2 Therefore, a variable message sign should be provided when:

- a) the instruction or information displayed on the sign is relevant only during a certain period of time; and/ or
- b) there is a need for variable pre-determined information to be displayed on the sign to meet the requirements of surface movement guidance and control systems.

11.3.3 Variable message signs can be designed to provide high brightness without glare and facilitate the selective display of information. Technologies that could be used include fibre optic or light emitting diodes. The use of such technologies to create the sign message enhances range performance compared with that obtained by using transilluminated signs. The luminance of a fibre optic or light emitting diode light point can be approximately 10 000 cd/m² compared with the value of 300 cd/m², which is the highest value normally used for transilluminated signs.

11.3.4 The following guidelines should be applied to the design of any variable message sign to be used on an aerodrome movement area:

a) the sign should have a blank face when not in use.
A pilot must not see an image or "ghost" of the message;

- b) the sign should not present a message that could lead to an unsafe action by a pilot in the event of failure of the sign;
- c) the sign should have a short response time, i.e. the time required for the message to change should be not greater than five seconds;
- d) different luminance levels will be required for day/ night operations and in good/poor visibilities;
- e) care should be taken to ensure that the field of view of the sign is sufficient over the full range of viewing angles that are required for taxiway signs; and

 f) the sign should only include colour and inscription elements that conform to the basic conventions that are to be followed in the design of mandatory and information signs.

11.4 MANDATORY INSTRUCTION SIGNS

11.4.1 A mandatory instruction sign identifies a location on the movement area that a pilot or vehicle driver should not pass without specific authorization by ATC. Mandatory instruction signs are therefore an important element of the safety provisions on movement areas.



Figure 11-1. Example of a complex sign layout

11.4.2 Mandatory instruction signs shall always be located on each side of the taxiway or the runway. This enables pilots to have an uninterrupted view of the signs at all times. It also ensures early acquisition of the signs when they are located close to an intersection that can be approached from more than one direction.

11.4.3 Mandatory instruction signs include runway designation signs, Category I, II or III holding position signs, runway-holding position signs, road-holding position signs and NO ENTRY signs. Examples of such signs are shown in Figure 11-2.

11.4.4 A mandatory instruction sign shall always be provided at a taxiway/runway intersection or a runway/

runway intersection on each side of the runway-holding position. Thus Annex 14, Volume I, specifies that:

- a pattern "A" runway-holding position marking shall be supplemented at a taxiway/runway intersection or a runway/runway intersection with a runway designation sign; and
- b) a pattern "B" runway-holding position marking shall be supplemented with a Category I, II or III holding position sign.

11.4.5 As a consequence, where a single runwayholding position is provided at an intersection of a taxiway and a precision approach Category I, II or III runway,



Figure 11-2. Mandatory instruction signs

the runway-holding position marking shall always be supplemented with a runway designation sign. Where two or three runway-holding positions are provided at such an intersection, the runway-holding position marking closest to the runway shall be supplemented with a runway designation sign, and the markings farthest from the runway shall be supplemented with a Category I, II or III holding position sign, as appropriate.

11.4.6 Examples of sign positions at taxiway/runway intersections are shown in Figure 11-3.

Note.— A runway-holding position is defined as a designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower.

11.4.7 A runway-holding position shall be established on a taxiway if the location or alignment of the taxiway is such that a taxiing aircraft or vehicle can infringe an obstacle limitation surface or interfere with the operations of radio navigation aids. At such runway-holding positions, Annex 14, Volume I, specifies that a pattern "A" runwayholding position marking shall be supplemented with a runway-holding position sign (the "B2" sign in Figure 11-2) on each side of the runway-holding position.

11.4.8 Location signs should be associated with a runway designation sign wherever it is important to ensure that there can be no possible ambiguity in the authorization process. Without exact knowledge of location, it is possible for pilots taxiing at an aerodrome that has multiple runway/ taxiway intersections to misinterpret an authorization issued for another aircraft as being applicable to their movement and mistakenly manoeuvre onto the runway. Thus, Annex 14, Volume I, recommends that a runway designation sign at a taxiway/runway intersection should be supplemented with a location sign in the outboard (farthest from the taxiway) position, as appropriate.

11.4.9 A NO ENTRY sign shall always be provided when entry into an area is prohibited.

11.4.10 For road-holding positions where a road enters a runway, the provisions of Annex 14, Volume I, 5.4.7, should be applied. An example of a road-holding position sign is shown in Figure 11-4. Since these signs are to be used by aerodrome personnel, it is important that the inscriptions on the sign face are in a language that is comprehensible to all road users at that location.

11.5 INFORMATION SIGNS

11.5.1 Information signs enable pilots and vehicle drivers to continuously monitor their position on the movement area. These signs are intended to be an aid to the safe and efficient navigation of all aircraft and vehicles.

11.5.2 Information signs shall include: direction signs, location signs, destination signs, runway exit signs, runway vacated signs and intersection take-off signs.

11.5.3 Examples of information signs are shown in Figure 11-5. Sign systems displaying a combination of location and direction information are the most commonly used. In Figure 11-5, four examples are given of this type of application. The two simplest examples are alternative ways of indicating prior to a position, where only two taxiways intersect, the designation of the taxiway on which the aircraft or vehicle is currently located and the designation of the crossing taxiway. From this information and reference to an aerodrome map, pilots and vehicle drivers can uniquely identify their exact location and the direction that they must take at the junction to remain on their assigned route.

11.5.4 It is only for this simplest of taxiway layouts that the option of placing the location information at the end of the sign array is permitted. At all other, more complex intersections the position of the location sign and the associated direction signs must correspond to the convention that the sign layout should directly reflect the intersection geometry. All taxiways requiring a turn to the left must be indicated by a sign inscription placed to the left of the location sign, and all turns to the right must be indicated by a sign inscription placed to the right of the location sign. In addition, the order in which the crossing taxiway information is displaced from the location sign is determined by the magnitude of the turn required to enter that designated taxiway. Thus taxiways that require the smallest change of direction are placed closest to the location sign and those requiring the greatest change of direction are placed furthest from the location sign.

11.5.5 During the development of the signage system, it was demonstrated that by using the sign layout adopted in the standard described above, pilots needed less time to read and interpret the information than with any other layout. Furthermore, they did not make the mistakes in interpreting the taxiway configuration that occurred when testing other sign layouts.

11.5.6 The clear differentiation between location signs and all other information signs that is secured by the



Note.— Distance X is established in accordance with Annex 14, Volume I, Chapter 3, Table 3-2. Distance Y is established at the edge of the ILS/MLS critical/sensitive area.



reversal of the yellow/black colour combination is also an important element of the system. Location signs are an essential element of the signage at taxiway intersections, but they also have an important function wherever it is necessary to uniquely identify a position on the movement area. For example, a suitably sited location sign can expedite position reporting when an aircraft is manoeuvring off the runway.

11.5.7 Where information is displayed to a pilot on the runway, location information is omitted from the sign system. Only direction information is displayed in this situation.

11.5.8 Where it is necessary to provide intermediate holding positions on a taxiway at locations other than a runway/taxiway intersection, the location signs should consist of the taxiway designator supplemented by a number.

11.5.9 An example of the way in which designating letters are assigned to a taxiway system is shown in Figure 11-6. In this figure, taxiways A, C and D are typical taxiways that may require the designation of intermediate holding positions to facilitate ground movement operations.

11.6 SIGN LOCATION

11.6.1 Signs have to be readily seen by pilots and vehicle drivers as they manoeuvre their aircraft/vehicles on the movement area. This is best achieved when the signs can be read when pilots are following the guidance that is derived from their view of the taxiway ahead of the aircraft. Signs should therefore be placed as close to the edge of the pavement as is practicable.

11.6.2 When choosing the location of a sign, the provisions of Annex 14, Volume I, 5.4, shall be followed. The taxiway environment is such that the guidance on siting must be followed if damage due to impact with engine pods or propellers or as a result of jet blast effects is to be avoided.

11.7 SIGN EVALUATION

General

11.7.1 The physical characteristics of taxiway signs are determined by the operational requirements reflected in the provisions of Annex 14, Volume I, Appendix 4. The colours used in any sign should conform to the specifications given in Annex 14, Volume I, Appendix 1, Figures 1.2 to 1.4.

11.7.2 To achieve the specified luminance performance for lighted signs, it is generally found that transilluminated signs best meet the requirements. The uniformity of the illumination influences the legibility of a sign. Unevenly lit signs are difficult to read and are therefore not acceptable in a taxiway signage system.

11.7.3 Before a sign is installed, it should be demonstrated that the requirements of Annex 14, Volume I, Appendix 4, are met by the sign design. It is important that both luminance and colour specifications are fully complied with. To demonstrate this compliance, it is necessary to carry out tests on a sign that fully represents the size, colour, inscription layout and lighting system that will be used in service.

11.7.4 The dimensions and location of the reference grid points used for testing sign luminance should always be



Figure 11-4. Road-holding position sign



Figure 11-5. Information signs

strictly in accordance with the specifications of Annex 14, Volume I, Appendix 4, Figure 4.1. Relaxation of the test specifications in terms of grid size or grid point location is not an acceptable means of making a specific sign compliant with the requirements.

11.7.5 When a sign is tested for compliance, all parameters should be evaluated including font size, inscription location, the size of the borders around the inscription and the overall dimensions of the sign face.

11.7.6 Taxi guidance signs shall be frangible but shall also be able to withstand significant wind velocities. For design purposes, a wind speed of at least 60 m/s can be used. In some places, such as any location that is close to the point on a runway where large aircraft are rotated during the take-off run, higher design wind speed values may be appropriate. However, at some locations in the movement area, signs may be exposed to wind velocities of up to 90 m/s caused by jet blast.

11.7.7 Structural members supporting a sign face should not constitute part of the sign face dimensions. When the structure of the design overlaps the sign face, the dimensions of the face should be adjusted accordingly to ensure that the correct area of sign face is provided.

11.7.8 The rear of the sign should be marked in a single conspicuous colour except where signs are mounted back-to-back.



Figure 11-6. Assignment of letters to taxiways