IFATCA

Survey Report

Published December 2008

Where are they used?
When are they used?
Who is their owner?
How is their integrity as a safety tool?
What procedures are in place in case they fail?

Runway incursions may take place in all visibility or weather conditions. The provision of stop bars at runway holding positions and their use at night and in visibility conditions greater than 550 m runway visual range can form part of effective runway incursion prevention measures. (Note in ICAO Annex 14)

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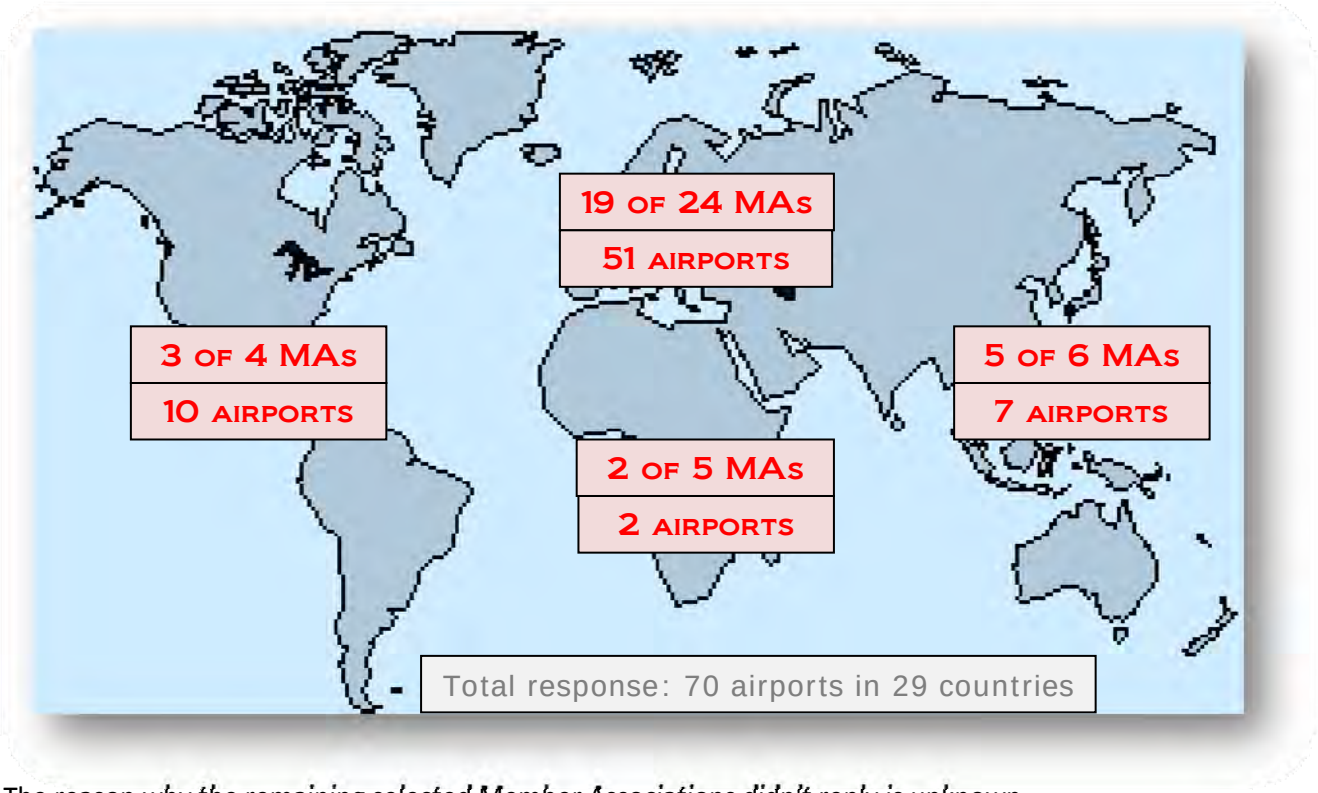
About the survey

In August 2008 the Airport Domain Team (ADT) of the International Federation of Air Traffic Controllers' Associations (IFATCA[1]) distributed a survey on the usage of stopbars at major airports to 39 selected Member Associations (MAs) in the four Regions of the Federation. Replies were collected until the end of December 2008, with a reminder to reply sent to several of the selected Member Associations earlier in December.

The main questions asked were:

- When are stopbars used at the airport?
- Who owns the stopbars?
- Are aircraft and/or vehicles normally expected to cross an active stopbar?
- Does ATC routinely instruct aircraft/vehicles to cross an active stopbar?
- If a pilot/driver were to refuse to cross an active stopbar, would there be another route available or possible to reach the desired destination at the airport?
- Is there a special "contingency procedure" for cases where an aircraft or a vehicle is in front of an active stopbar that cannot be switched off?

The ADT received reply forms from 29 Member Associations for a total of 70 airports (see illustration for the Regional distribution).



The reason why the remaining selected Member Associations didn't reply is unknown.

[1] IFATCA is the worldwide organisation representing more than fifty thousand air traffic controllers in 130 countries

ICAO provisions for stopbars

Before presenting the results of the survey here is a brief review of the existing ICAO provisions for stopbars. The provisions are listed in a hierarchical "top down" order in blue text. The full text from ICAO Annex 14 on the application, location and characteristics of stopbars is reproduced in the Appendix to this report.

ICAO Annex 2 Rules of the Air: 3.2.2.7.3 An aircraft taxiing on the manoeuvring area shall stop and hold at all lighted stop bars and may proceed further when the lights are switched off.

ICAO Annex 14 Aerodromes: 5.3.19.13 *Note 1.— A stop bar is switched on to indicate that traffic stop and switched off to indicate that traffic proceed.*

IFATCA Observations:

- The text in Annex 2 refers only to "aircraft"; the text of the note (!) in Annex 14 refers to "traffic" which comprises aircraft and vehicles.
- The text in both Annex 2 and Annex 14 does not mention that a clearance from Air Traffic Control (ATC) is required in order to proceed when the stopbar is switched off.
- There is no mention of stopbars in Annex 6 Operation of Aircraft nor in Annex 11 Air Traffic Services.

ICAO Doc 4444 PANS-ATM: **7.15.7 Stop bars**

Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed.

Note.— Stop bars are located across taxiways at the point where it is desired that traffic stop, and consist of lights, showing red, spaced across the taxiway.

Elevated stopbar lights

IFATCA Observations:

- The text in Doc 4444 refers to "all traffic" which comprises aircraft and vehicles. This is in line with the text of the note in Annex 14, but not fully so with the text in Annex 2.
- The text in Doc 4444 also does not mention that a clearance from Air Traffic Control (ATC) is required in order to proceed when the stopbar is switched off.

ICAO Doc 9870 Manual on the Prevention of Runway Incursions:

4.4 Recommendations to Pilots

4.4.1 Pilots should never cross illuminated red stop bars when lining up on, or crossing, a runway unless contingency procedures are in use that specifically allow this.

4.5 Recommendations for Air Traffic Services Providers and Air Traffic Controllers

4.5.4 Stop bars should be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed.

4.5.5 Aircraft or vehicles should never be instructed to cross illuminated red stop bars when entering or crossing a runway. In the event of unserviceable stop bars that cannot be deselected, contingency measures, such as follow-me vehicles, should be used..

Appendix B – Best practices on the flight deck

6.3.3 Red stop bars should never be crossed when lining up on or crossing a runway unless, in exceptional cases, the stop bars, lights or controls are reported to be unserviceable, and contingency measures, such as using follow-me vehicles, are in force. In these circumstances, whenever possible, alternative routes should be used.

The objective of this Standard is to maintain the integrity of the stop bars, which are intended to protect the relevant part of a manoeuvring area

Appendix C – Air Traffic Control best practices

5. STOP BARS

5.1 Annex 2, 3.2.2.7.3, states: "An aircraft taxiing on the manoeuvring area shall stop and hold at all lighted stop bars and may proceed further when the lights are switched off."

This Standard applies both to runways and taxiways where fitted with stop bars. The objective of this Standard is to maintain the integrity of the stop bars, which are intended to protect the relevant part of a manoeuvring area.

5.2 PANS-ATM (Doc 4444), 7.14.7, states: "Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed."

As such, a controller should never issue a clearance to cross a stop bar without first switching off the stop bar. The only exception to this should be when contingency measures are required due to unserviceability. An example of a contingency measure is the use of a follow-me vehicle.

A controller should never issue a clearance to cross a stop bar without first switching off the stop bar

IFATCA Observations:

- In Doc 9870 ICAO introduces the notion of stopbar "contingency measures", which is not mentioned in any of the other quoted documents.
- In the explanatory text with paragraph 5.2 of Appendix C there is an inference that a clearance to proceed is required from ATC after a stopbar is switched off.

Recommendation

✈ The anomalies in the ICAO provisions that are identified in the observations above are to be communicated to ICAO.

When are stopbars used?

Survey question:

Where are stopbars used at this airport? (Multiple answers possible;)

- ☐ There are no stopbars at this airport
- ☐ H24 (i.e. permanently on)
- ☐ Only when a specific runway is active (i.e. in use, available to ATC)
- ☐ Only during Low Visibility Procedures
- ☐ Only at night time (i.e. in the dark)
- ☐ Other (please specify):
- ☐ Combination of the options above (please specify):

Airports without stopbars

There were 14 replies for airports that have no stopbars. These airports are listed in the tables below.

ICAO	IATA
BIKF	KEF
EDDR	SCN
EDRZ	ZQW
EDXW	GWT
LICR	REG
KBOI	BOI
KCRW	CRW

ICAO	IATA
KIAD	IAD
KLGB	LGB
KROC	ROC
MMMX	MEX
MMMY	MTY
YBBN	BNE
YSSY	SYD

Stopbar light

According to the information provided, the implementation of stopbars is planned for the near future at the airports of **Mexico City** (Mexico) and **Sydney** (Australia).

Airports with stopbars

The replies that were received for airports that do have stopbars are presented in the two tables on the following pages.

For some airports there are multiple "ticks" in the columns of the table. At those airports there are typically some stopbars that are used permanently, or when a specific runway is active (regardless of the weather conditions), and other stopbars that are activated during Low Visibility Procedures (possibly in addition to the stopbars related to the specific runway). Other combinations, e.g. with "specific runway" and "during night time", occur as well.

Replies for major international airports

Airport ICAO	Airport IATA	Permanently on	With specific runway	During LVP	During night time	Other
CYUL	YUL			X		
CYVR	YVR			X		
EBBR	BRU		X	X	X	
EDDF	FRA	X		X	X	
EDDH	HAM			X		
EDDL	DUS			X		
EDDM	MUC	X		X	X	
EDDT	TXL			X		
EFHK	HEL	X		X		
EHAM	AMS	X	X	X		
EKCH	CPH		X	X		
ENGM	OSL			X		X[1]
ESSA	ARN	X				
FAJS	JNB	X				
KSFO	SFO				X	X[2]
LEMD	MAD					X[3]
LFPG	CDG			X		
LFPO	ORY			X		
LGAV	ATH			X		
LHBP	BUD			X		
LIML	LIN		X	X		
LIRF	FCO	X	X	X		
LKPR	PRG			X		
LPPR	OPO			X		
LPPT	LIS		X	X		
LROP	OTP	X				
LSGG	GVA	X				
LSZH	ZRH	X				
NZAA	AKL			X		
OJAI	AMM			X		
RCTP	TPE			X		
ULLL	LED			X		
VHHH	HKG		X		X	X[4]
VIDP	DEL			X		X[5]
YMML	MEL	X				

1 Specific weather; personal preference of air traffic controllers
2 Sometimes in daytime
3 Below 3000m visibility
4 Specific weather
5 During simultaneous operations of runway 28/10 and runway 27/09

At 6 of the major international airports in the survey the stopbars are permanently on. 5 other airports from the list have one or several stopbars that are permanently on, while additional stopbars are activated during Low Visibility Procedures (LVP). Replies for 7 airports indicate that stopbars are used whenever a specific runway, or combination of runways, is active. Only 5 of the 35 major airports use stopbars during night time (outside LVP).

IFATCA Observation

- There appear to be no LVP requirements for activating the stopbars at the airports of **San Francisco** (USA) and **Hong Kong** (China). *NB Those airports may nevertheless comply with the provisions in ICAO Annex 14 – see the text in the Appendix to this report.*

Replies for other international/regional airports

Airport ICAO	Airport IATA	Permanently on	With specific runway	During LVP	During night time	Other
EDDB	SXF			X		
EDDC	DRS			X		
EDDE	ERF			X		
EDDG	FMO			X		
EDDK	CGN			X		X[6]
EDDN	NUE		X	X		
EDDP	LEJ			X		X[7]
EDDS	STR			X		
EDDW	BRE			X		
EDFH	HHN			X		X[8]
EDLV	LRC			X		
EDMA	AGB		X			
EDNY	FDH			X		
EGNS	IOM		X			
EGPF	GLA			X	X	X[9]
LEBB	BIO		X	X	X	
LEPA	PMI	X		X		
LFBO	TLS		X	X		
LFML	MRS		X	X		
LIMC	MXP			X		X[9]
MMGL	GDL			X	X	

6 On taxiways for by-pass purpose (available permanently to ATC)
7 Closures (maintenance work)
8 ILS calibration
9 Specific weather/specific locations

Of the other international/regional airports there is just 1 where certain stopbars are permanently on. At 6 airports from this list the use of stopbars is associated with the use of a specific runway (of which 4 airports also use the stopbars during LVP). In total 19 of the 21 other international/regional airports use stopbars during LVP – the 2 remaining airports only use stopbars with a specific runway. Just 3 of the 21 airports in this category use stopbars during night time (outside LVP).

IFATCA Observations

- The use of stopbars that are permanently on appears to be more common at the major international airports than at the other international/regional airports.
- The use of stopbars during night time appears to be applied by a relatively low number of airports in this survey (8 out of 56).
- At slightly more than 40% of the airports in the survey (23 out of 56) stopbars are exclusively used during LVP. This means of course that nearly 60% of the airports in the survey apply stopbars in the spirit of the note in ICAO Annex 14 that is quoted here below (and also is quoted at the cover page of this report).

Runway incursions may take place in all visibility or weather conditions. The provision of stop bars at runway holding positions and their use at night and in visibility conditions greater than 550 m runway visual range can form part of effective runway incursion prevention measures. (note, ICAO Annex 14)

Recommendations

- Aviation authorities should be encouraged to study the desirability of using stopbars at airports in their area of jurisdiction additionally to the use of stopbars during LVP.
- It should be understood that ICAO-compatible procedures for operations with stopbars are a prerequisite to the meaningful and effective implementation of stopbars.

Who owns the stopbars?

At nearly all airports in the survey the stopbars are owned by the Airport Authority. The only exceptions are **Auckland** (New Zealand) and **Taipei** (Taiwan) where the stopbars are owned by the Air Navigation Service Provider. In **Helsinki** (Finland) the Airport Authority and the Air Navigation Service Provider are part of the same organisation.

Most respondents indicated that stopbars are operated (i.e. switched off/switched on) by ATC[2]. **Zürich** airport (Switzerland) reported that they have certain stopbars on taxi tracks that are operated by the Airport Authority.

At nearly all airports in the survey the stopbars are owned by the Airport Authority

How is the integrity of stopbars?

Survey questions:

Are aircraft and/or vehicles normally expected to cross an active stopbar?	(Y/N)
Does ATC routinely instruct aircraft/vehicles to cross an active stopbar?	(Y/N)

[2] For labour reasons the IFATCA MA in the USA is opposed to controller operated stopbars.

To the first question an unconditional "YES" was provided for **San Francisco** (USA), **Rome/Fiumicino** (Italy) and **Munich** (Germany) airports. The airports of **Zurich** (Switzerland) and **Paris/Orly** (France) replied "YES" with respect to vehicles to this question. All other airports replied "NO".

The second question received a "YES" for the following airports: **San Francisco** (USA), **Rome/Fiumicino** (Italy), **Madrid** and **Palma de Mallorca** (Spain), **Guadalajara** (Mexico) and **Hong Kong** (China). **Stuttgart** (Germany) replied with "YES, sometimes"; **Paris/Orly** (France) said "YES" but only for vehicles. All other airports replied "NO".

IFATCA Observations

- The practice to have aircraft and/or vehicles cross active stopbars is not in accordance with the ICAO provisions as listed in the beginning of this report.
- Airports where aircraft are expected or instructed to cross active stopbars are potentially breaching the integrity of the protection that stopbars are meant to provide at other airports. (NB This statement doesn't apply as much to the crossing of active stopbars by vehicles, for the drivers of those vehicles are not likely to frequently operate at other airports. For pilots this is different though.)

From comments provided with the survey forms it is evident that the reason why aircraft and/or vehicles at those airports are expected or instructed to cross active stopbars often is that the stopbars concerned are not switchable by ATC. There appears to be a mismatch between the owner of the stopbars (usually the Airport Authority, see above) and the operator of the stopbars (usually ATC, see above) with regard to how stopbars should be used.

Recommendations

- The aviation regulatory authorities of the USA, Italy, Germany, Switzerland, France, Spain, Mexico and China are to be notified of the potential threat to the integrity of stopbars that is posed by the practices to cross active stopbars at the identified airports in their area of jurisdiction.
- The authorities at the identified airports should ensure that all stopbars on taxi tracks and intersections where aircraft and vehicles are expected to operate are made switchable for ATC.

Availability of alternative routing at the airport

Survey question:

If a pilot/driver were to refuse to cross an active stopbar, would there be another route available or possible to reach the desired destination at the airport? (Y/N)

For 16 airports there was a positive reply to this question, i.e. there is an alternative route available for both aircraft and vehicles. At 5 airports there is an alternative route for vehicles, but not for

aircraft. Of the airports that have no alternative route available, 13 airports do have a contingency procedure that can be applied to help aircraft or vehicles pass a stopbar that cannot be switched off (see the next section of this report). There are 25 airports identified in the survey that have no alternative route for aircraft and also no contingency procedure available (see the table below).

There are 25 airports identified in the survey that have no alternative route for aircraft and also no contingency procedure available

Airports without alternative routing for aircraft and without a contingency procedure

CYVR	YVR
EDDC	DRS
EDDE	ERF
EDDF	FRA
EDDH	HAM
EDDM	*MUC*
EDDN	NUE
EDDS	*STR*
EDDW	BRE

EDFH	HHN
EDMA	AGB
EDNY	FDH
ENGM	OSL
KSFO	*SFO*
LEBB	BIO
LEMD	*MAD*
LEPA	*PMI*
LIMC	MXP

LPPR	OPO
LPPT	LIS
LROP	OTP
MMGL	*GDL*
RCTP	TPE
VHHH	*HKG*
VIDP	DEL

Note: airports indicated in italics were also identified in the previous section of the survey.

IFATCA Observations

- If an aircraft taxies to an active stopbar that cannot be switched off at an airport where there is no alternative routing available and no contingency procedure, it would seem unavoidable that the aircraft is allowed to cross the active stopbar – which is contrary to the ICAO provisions, and damaging to the integrity of stopbars (as discussed before in this report).
- In a situation where a stopbar cannot be switched as a result of a technical malfunction at one of the airports from the table above, the controllers and pilots involved will have to "invent" a solution on-the-spot. Such a solution may vary from occasion to occasion, and differ at one airport from that applied at the next airport. It would seem preferable to have a uniform and preconceived contingency procedure available for use when required.

Recommendation

✈ The authorities at the identified airports without a stopbar contingency procedure should develop such a procedure as a matter of urgency.

Contingency procedure

Survey question:

Is there a special "contingency procedure" for cases where an aircraft or a vehicle is in front of an active stopbar that cannot be switched off? (Y/N)

The replies of all respondents are presented in one table (below, continued on next page). The respondents who answered with "YES" to this question were also asked to provide information on the type of contingency procedure used.

35 of a total of 56 airports with stopbars have no contingency procedure, of which only 10 do have an alternative routing available (see previous section of this report).

At 7 airports the contingency procedure consists of an instruction by radiotelephony (R/T) to cross the stopbar, sometimes with the use of specific phraseology. A procedure involving a Follow Me vehicle is used at 10 other airports. At 2 airports the contingency procedure comprises switching off all runway and/or taxiway lights, while 1 airport has a comparable procedure in which the lights of the failed stopbar are switched off and additional restrictions apply. There is 1 airport at which rerouting is always possible in case a stopbar cannot be switched off.

Airport		No contingency procedure	R/T instruction to cross	Use of a Follow Me Vehicle	Other
ICAO	IATA				
CYUL	YUL	X			
CYVR	YVR	X			
EBBR	BRU			X	
EDDB	SXF	X			
EDDC	DRS	X			
EDDE	ERF	X			
EDDF	FRA	X			X[1]
EDDG	FMO		X		
EDDH	HAM	X			
EDDK	CGN	X			
EDDL	DUS			X	
EDDM	MUC	X			
EDDN	NUE	X			
EDDP	LEJ	X			
EDDS	STR	X			
EDDT	TXL	X			X[1]
EDDW	BRE	X			
EDFH	HHN	X			X[1]
EDLV	LRC	X			
EDMA	AGB	X			
EDNY	FDH	X			
EFHK	HEL		X		
EGNS	IOM			X	

Airport		No contingency procedure	R/T instruction to cross	Use of a Follow Me Vehicle	Other
ICAO	IATA				
EGPF	GLA			X	
EHAM	AMS			X	
EKCH	CPH		X		
ENGM	OSL	X			
ESSA	ARN				X[2]
FAJS	JNB			X	
KSFO	SFP	X			
LEBB	BIO	X			
LEMD	MAD	X			
LEPA	PMI	X			
LFBO	TLS	X			
LFML	MRS	X			
LFPG	CDG				X[3]
LFPO	ORY	X			
LGAV	ATH	X			
LHBP	BUD				X[3]
LIMC	MXP	X			
LIML	LIN			X	
LIRF	FCO			X	
LKPR	PRG			X	
LPPR	OPO	X			
LPPT	LIS	X			
LROP	OTP	X			
LSGG	GVA		X		
LSZH	ZRH		X		
MMGL	GDL	X			
NZAA	AKL			X	
OJAI	AMM		X		
RCTP	TPE	X			
ULLL	LED		X		
VHHH	HKG	X			
VIDP	DEL	X			
YMML	MEL				X[4]

1 An airport authority vehicle will come to inspect the situation and decide on the appropriate course of action (which may result in an R/T instruction to cross the stopbar)

2 Always by rerouting

3 Runway and/or taxiway lights are switched off so the stopbar extinguishes

4 Permanently turn off stopbar. If visibility > 800m the intersection with the failed stopbar can be used but restrictions apply. If visibility <800m the relevant taxiway will be closed and no departures are permitted from that holding point.

IFATCA Observations

- While a stopbar malfunction may be a recurring event at some airports, it remains a relatively unusual situation for a pilot to be at a stopbar that cannot be switched off. It would therefore help to have a contingency procedure with identical elements at all airports where stopbars are used, so pilots can be prepared for what will be done to assist them to pass the stopbar.
- From a pilot's perspective an R/T instruction to cross an active stopbar may still appear to be contrary to the ICAO provisions, even if an explanation is provided that there is a stopbar malfunction at the time. Just by looking at the active stopbar, it is difficult for a pilot to tell whether switching off that stopbar is not possible due to a malfunction (i.e. just at that moment) or because it simply is not designed as a switchable stopbar (i.e. permanently).
- The use of a Follow Me vehicle to help an aircraft pass an active stopbar serves as an indication and confirmation to the pilots that the situation is unusual, particularly so if this is also explained via R/T.
- A contingency procedure that uses just R/T phraseology to instruct pilots to cross a stopbar that cannot be switched off is therefore less desirable than a procedure that involves the use of a Follow Me vehicle.
- Switching off the electrical circuit of a failing stopbar (i.e. a stopbar that remains on and cannot be switched anymore) is of course a useful contingency procedure, provided no additional problems can arise as a result of the extinguishing of other lights that may be part of the same electrical circuit. This option may therefore not be practicable at all airports.
- A stopbar contingency procedure should be applied only to assist those aircraft or vehicles that are "stuck" at a failing stopbar. After those aircraft/vehicles have passed the position concerned, the use of the affected runway or taxiway should be discontinued until the stopbar is repaired.

Recommendation

✈ The authorities at airports that don't have a stopbar contingency procedure involving the use of a Follow Me car should investigate the desirability of developing and implementing such a procedure.

Conclusion

This survey has shown there is considerable diversity in the application of stopbars and the associated procedures around the world. The diversity in the application (i.e. when and where are stopbars used) is in itself not a safety issue, yet it may become one because of the existing diversity in the procedures associated with stopbars. As long as there are airports where pilots are instructed or expected to cross an active stopbar, the integrity of the protection that stopbars are intended to provide is breached. This also applies for instructions to cross a stopbar that are

As long as there are airports where pilots are instructed or expected to cross an active stopbar, the integrity of the protection that stopbars are intended to provide is breached

given as a contingency measure, e.g. in case of stopbar malfunctioning. At other airports, where pilots are expected to never cross an active stopbar except under the guidance of a Follow Me vehicle (contingency measure), the breach in integrity described above can lead to safety incidents or even accidents.

The IFATCA ADT is of the opinion that the existing diversity in procedures can be remedied relatively simply:

- The ICAO provisions for stopbar related procedures should be made consistent and unambiguous in all relevant ICAO documents;
- Stopbars at taxiways and intersections where aircraft and vehicles are intended to operate should be made switchable;
- Pilots and vehicle drivers should be trained to never cross an active stopbar, except when under the guidance of a Follow Me vehicle (as part of a contingency measure);
- Air traffic controllers should never instruct a pilot or vehicle driver to cross an active stopbar, except when the aircraft or vehicle is under the guidance of a Follow Me vehicle (as part of a contingency measure);
- All airports where stopbars are used should develop and implement a contingency procedure for use in the event that an aircraft or vehicle is at an active stopbar that cannot be switched off. This contingency procedure should comprise the use of a Follow Me vehicle to guide the aircraft or vehicle over the stopbar.

To put it differently, once the **ICAO** provisions for stopbar related procedures are less ambiguous and more consistent across the various documents, it becomes a training issue for **pilots**, **vehicle drivers** and **controllers**. **Airport authorities** (the owners of nearly all stopbars) should ensure that stopbars are made switchable where required, and together with the **ATC authorities** they should develop and implement a stopbar contingency procedure involving the use of a Follow Me vehicle.

The steps described above will help ensure that stopbars can function as part of effective measures to prevent runway incursions, as is the stated intention of ICAO (see the note in Annex 14).

Appendix

The text from ICAO Annex 14 on the application, location and characteristics of stopbars is reproduced on the following two pages.

~~***Location***~~

~~5.3.17.3 **Recommendation.**— *Taxiway edge lights on a straight section of a taxiway and on a runway forming part of a standard taxi-route should be spaced at uniform longitudinal intervals of not more than 60 m. The lights on a curve should be spaced at intervals less than 60 m so that a clear indication of the curve is provided.*~~

~~*Note.— Guidance on the spacing of taxiway edge lights on curves is given in the* Aerodrome Design Manual, *Part 4.*~~

~~5.3.17.4 **Recommendation.**— *Taxiway edge lights on a holding bay, de-icing/anti-icing facility, apron, etc. should be spaced at uniform longitudinal intervals of not more than 60 m.*~~

~~5.3.17.5 **Recommendation.**— *Taxiway edge lights on a runway turn pad should be spaced at uniform longitudinal intervals of not more than 30 m.*~~

~~5.3.17.6 **Recommendation.**— *The lights should be located as near as practicable to the edges of the taxiway, runway turn pad, holding bay, de-icing/anti-icing facility, apron or runway, etc. or outside the edges at a distance of not more than 3 m.*~~

~~***Characteristics***~~

~~5.3.17.7 Taxiway edge lights shall be fixed lights showing blue. The lights shall show up to at least 30° above the horizontal and at all angles in azimuth necessary to provide guidance to a pilot taxiing in either direction. At an intersection, exit or curve the lights shall be shielded as far as practicable so that they cannot be seen in angles of azimuth in which they may be confused with other lights.~~

~~5.3.18 Runway turn pad lights~~

~~***Application***~~

~~5.3.18.1 Runway turn pad lights shall be provided for continuous guidance on a runway turn pad intended for use in runway visual range conditions less than a value of 350 m, to enable an aeroplane to complete a 180 degree turn and align with the runway centre line.~~

~~5.3.18.2 **Recommendation.**— *Runway turn pad lights should be provided on a runway turn pad intended for use at night.*~~

~~***Location***~~

~~5.3.18.3 **Recommendation.**— *Runway turn pad lights should normally be located on the runway turn pad marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.*~~

~~5.3.18.4 **Recommendation.**— *Runway turn pad lights on a straight section of the runway turn pad marking should be spaced at longitudinal intervals of not more than 15 m.*~~

~~5.3.18.5 **Recommendation.**— *Runway turn pad lights on a curved section of the runway turn pad marking should not exceed a spacing of 7.5 m.*~~

~~***Characteristics***~~

~~5.3.18.6 Runway turn pad lights shall be unidirectional fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on or approaching the runway turn pad.~~

~~5.3.18.7 Runway turn pad lights shall be in accordance with the specifications of Appendix 2, Figure A2-13, A2-14 or A2-15, as appropriate.~~

5.3.19 Stop bars

Application

Note 1.— The provision of stop bars requires their control either manually or automatically by air traffic services.

Note 2.— Runway incursions may take place in all visibility or weather conditions. The provision of stop bars at runway holding positions and their use at night and in visibility conditions greater than 550 m runway visual range can form part of effective runway incursion prevention measures.

5.3.19.1 A stop bar shall be provided at every runway-holding position serving a runway when it is intended that the runway will be used in runway visual range conditions less than a value of 350 m, except where:

a) appropriate aids and procedures are available to assist in preventing inadvertent incursions of aircraft and vehicles onto the runway; or

b) operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:

1) aircraft on the manoeuvring area to one at a time; and

2) vehicles on the manoeuvring area to the essential minimum.

5.3.19.2 A stop bar shall be provided at every runway-holding position, serving a runway when it is intended that the

runway will be used in runway visual range conditions of values between 350 m and 550 m, except where:

a) appropriate aids and procedures are available to assist in preventing inadvertent incursions of aircraft and vehicles onto the runway; or

b) operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:

1) aircraft on the manoeuvring area to one at a time; and

2) vehicles on the manoeuvring area to the essential minimum.

5.3.19.3 **Recommendation.—** *A stop bar should be provided at an intermediate holding position when it is desired to supplement markings with lights and to provide traffic control by visual means.*

5.3.19.4 **Recommendation.—** *Where the normal stop bar lights might be obscured (from a pilot's view), for example, by snow or rain, or where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft, then a pair of elevated lights should be added to each end of the stop bar.*

Location

5.3.19.5 Stop bars shall be located across the taxiway at the point where it is desired that traffic stop. Where the additional lights specified in 5.3.19.4 are provided, these lights shall be located not less than 3 m from the taxiway edge.

Characteristics

5.3.19.6 Stop bars shall consist of lights spaced at intervals of 3 m across the taxiway, showing red in the intended direction(s) of approach to the intersection or runway-holding position.

5.3.19.7 Stop bars installed at a runway-holding position shall be unidirectional and shall show red in the direction of approach to the runway.

5.3.19.8 Where the additional lights specified in 5.3.19.4 are provided, these lights shall have the same characteristics as the lights in the stop bar, but shall be visible to approaching aircraft up to the stop bar position.

5.3.19.9 Selectively switchable stop bars shall be installed in conjunction with at least three taxiway centre line lights (extending for a distance of at least 90 m from the stop bar) in the direction that it is intended for an aircraft to proceed from the stop bar.

Note.— See 5.3.16.12 for provisions concerning the spacing of taxiway centre line lights.

5.3.19.10 The intensity in red light and beam spreads of stop bar lights shall be in accordance with the specifications in Appendix 2, Figures A2-12 through A2-16, as appropriate.

5.3.19.11 **Recommendation.—** *Where stop bars are specified as components of an advanced surface movement guidance and control system and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications of Appendix 2, Figure A2-17, A2-18 or A2-19.*

Note.— High-intensity stop bars should only be used in case of an absolute necessity and following a specific study.

5.3.19.12 **Recommendation.—** *Where a wide beam fixture is required, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications of Appendix 2, Figure A2-17 or A2-19.*

5.3.19.13 The lighting circuit shall be designed so that:

a) stop bars located across entrance taxiways are selectively switchable;

b) stop bars located across taxiways intended to be used only as exit taxiways are switchable selectively or in groups;

c) when a stop bar is illuminated, any taxiway centre line lights installed beyond the stop bar shall be extinguished for a distance of at least 90 m; and

d) stop bars shall be interlocked with the taxiway centre line lights so that when the centre line lights beyond the stop bar are illuminated the stop bar is extinguished and vice versa.

Note 1.— A stop bar is switched on to indicate that traffic stop and switched off to indicate that traffic proceed.

Note 2.— Care is required in the design of the electrical system to ensure that all of the lights of a stop bar will not fail at the same time. Guidance on this issue is given in the Aerodrome Design Manual, *Part 5.*

~~5.3.20 Intermediate holding position lights~~

~~*Note.— See 5.2.11 for specifications on intermediate holding position marking.*~~