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CAUTION
HOT SURFACE →

APPENDIX F AIRCRAFT MANUFACTURERS

Manufacturers of aircraft must meet specific minimum criteria when it comes to certifying aircraft for use by the aircraft operators. It is recognised by the manufacturers that the information for certification does not cover all aspects of the aeroplane operations and as such they provide additional documents and information such as Flight Crew Operating Manuals, Flight Crew Training Manuals, Flight Crew Information Bulletins, Flight Operation Technical Bulletins, and material during symposiums, conferences, performance engineer training classes, flight crew training.

Many of these publications contain procedures and information that address issues that have been identified as causal factors in runway excursions. However not all manufacturers provide the same amount or type of information. Below are recommendations for what manufacturers should provide to help address issues associated with runway excursions. It is recognised that much of the information in the list below has been supplied by many but not necessarily all the manufacturers of the aeroplanes.

Takeoff and Landing Performance Presentation

Recommendation 3.5.1 Aircraft manufacturers should present takeoff and landing performance information in similar (common and shared) terminology and to agreed standards.

Significant progress and agreement as to terminology and standards was accomplished during the work of the United States FAA Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC) activity that occurred in 2008 and 2009. In this activity six of the major manufacturers worked with the FAA, aircraft operators, business jet operators, airport operators, and other industry interest groups to recommend a standard terminology for reporting and evaluating runways conditions when the runway is not dry and criteria for manufacturers to use when computing the aeroplanes performance information.

The current status of the recommendations from this activity is that the TALPA ARC recommendations have been issued by the FAA using advisory material. Some aircraft manufacturers have implemented the recommendations and so they are in use by some aircraft operators. Airbus has changed the way it provides data in

their operating documents for the bulk of the fleet to use terminology and standards consistent with the TALPA ARC recommendations. Boeing has used the recommendations in creating the certification and operational data for their new aeroplane programs (787 and 747-8) and provides aircraft operators on an as requested basis the information necessary to adjust their landing performance information to meet the recommendations.

It is recommended that other certification agencies consider the work done during the FAA TALPA ARC if/when they change reporting terminology and methods or change standards for computing the performance information.

Runway Conditions and Aeroplane Performance

Recommendation 3.5.2 Training material promulgated by aircraft manufacturers should emphasize the necessity of making best use of runway length available when conditions are uncertain or when runways are wet or contaminated by applying full braking devices, including reverse thrust, until a safe stop is assured.

This type of information is often included in the manufacturer's FCOM or FCTM with supplemental information possibly in bulletins or magazine articles.

An example of a manufacturer's guidance on operating on wet or contaminated runways is provided later in this appendix.

Real Time Performance Monitoring and Warning Systems

Recommendation 3.5.3 On-board real time performance monitoring and warning systems that will assist the flight crew with the land/go-around decision and warn when more deceleration force is needed should be made widely available.

Part of the tools for excursion prevention is improved technology to help the pilot with the following decisions: to proceed to destination or divert, to land or go-around, or to apply all deceleration devices to their maximum

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utilisation. Different systems are currently available or in development by some manufacturers and 3rd party vendors to use existing technology to provide the flight crew information to assist with these decisions.

Landing Distance Calculations

Recommendation 3.5.4 The aviation industry should develop systems and flight crew manuals to help flight crews calculate landing distances reliably.

The aviation industry has changed greatly in the past decade as to how the calculation of performance in general and landing distances in particular is done. In the late 90s ACARS systems and laptops started showing up in the cockpit. The information the flight crew obtains from these systems is computed based on crew input information such as airport/runway, weather conditions, wind, runway conditions, approach type etc.

These systems replace the need for crew to do multiple hand calculations, flipping through paper charts and adding/subtracting/interpolating in cumbersome tables and charts. Often because of the number of computations required flight crew relied on quick checks of the numbers or didn't do the appropriate performance checks at all.

With the aforementioned ACARS systems and on-board performance programs it is much easier for the flight crew to get an appropriate answer with less exposure to error. It is also easier for the crew to look at multiple scenarios so they can have a plan in the event they obtain additional information late in the approach that the runway has deteriorated.

Manufacturers of these devices and methods are continually searching for better ways to do this and in this very competitive business there is no doubt that continuous improvement will continue.

The availability of such interactive systems however does not discharge aircraft manufacturers and operators from presenting the performance information in an intuitive format that is foolproof to use. This becomes even more important when the performance tables are only used very occasionally as a backup means to an electronic system.

Data Checks

Recommendation 3.5.5 Electronic Flight Bag manufacturers and providers (class 1/2/3) should enable the flight crew to perform independent determination of takeoff data and to implement where possible an automatic crosscheck to ensure correct insertion of the takeoff data in the avionics. Standard Operating procedures should be developed to support this crosscheck.

Manufacturers of EFBs are encouraged to investigate to what degree they can create simple crosschecks between various data sources to ensure the correct information is being used in the calculation of the takeoff data. A typical error that has caused safety problems in the past has been the use of incorrect weights in computing takeoff speeds.

Any means of minimising the sources of such error has to consider human factors aspects of the concerned interfaces and how they integrate into the specific cockpit environment in which they are meant to be used. An example for a human factor driven solution is to require ZFW only as the input to the FMC instead of giving the option of inputting either ZFW or TOW. Another example is removing the weight used in the previous calculation, which requires the flight crew to input the weight for the current flight each time.

Another approach to reducing mistakes are gross-error checks, which must rely on totally independent data sources to validate consistency. An example of a gross-error check is the comparison of the maneuvering speeds calculated independently and from different sources by an EFB and the FMC.

Example guidance material may be found in the FAA AC 120-76A, "Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices" and EASA AMC 20-25, "Approval of Electronic Flight Bags".

Flight Crew Procedures

Recommendation 3.5.6 Manufacturers should have clear flight crew procedures required to attain the published takeoff and landing performance.

The manufacturer's performance presented to flight crew should clearly include the basis for the calculations. This would include items like the following:

- what level of reverse thrust was assumed,
- what is the assumption of the wheel braking,
- is the data factored or not,
- what is the air distance allowance in the data.

FCOM procedures and flight crew training manual recommendations should also be consistent with the assumptions in the data. If the data assumes prompt initiation of reverse thrust, then the procedures should require this, etc.

Maximum Crosswind

Recommendation 3.5.7 Maximum crosswind data published by aircraft manufacturers should be based upon one consistent and declared method of calculation.

The maximum acceptable crosswind depends on the aircraft capabilities and the runway conditions, but also in the personal limits of the flight crew depending on their experience. A consistently determined maximum crosswind recommendation by aircraft manufacturers would be a good basis for a pilot to determine his personal limit from.

At this time however, manufacturers supply recommended crosswind maximums based on the assumptions they consider appropriate. The assumptions include things like:

- modeling for different runway conditions,
- consideration of engine failure or not,
- assumed centre of gravity position,
- flight technique (crab, sideslip), etc.

This is because current methods for determining recommended or limitations on crosswind are not part of the certification basis for the aeroplanes, and only a demonstrated value on a dry runway is required in the AFM.

It is doubtful that manufacturers will come to a consensus on this item without regulatory guidance as in many cases there are fundamental differences in philosophy between manufacturers. A starting point for harmonisation would be for manufacturers to agree on using the description of the runway and braking action such as was accomplished for performance computations for the TALPA ARC.

The development of regulatory guidance in this field should include manufacturer consultation to ensure technical and economical feasibility.

Lessons Learned

Recommendation 3.5.8 Manufacturers should monitor and analyse all (worldwide) runway excursions involving the aeroplanes they support and share the lessons learned.

The reporting and investigation of aircraft accidents and incidents is regulated by ICAO Annex 13. The results of such investigations are sometimes shared publicly. However, due to their much higher rate of occurrence much more can be learned from precursor events if they are identified as such and acted upon.

Some manufacturers review yearly or bi-yearly the significant accidents and incidents as well as the causal factors and issues highlighted by these events. This can be done at meetings and conferences attended by operators, and in manufacturer publications like bulletins, changes in procedures or other information.

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Information on the TALPA ARC

The TALPA ARC was tasked with an exhaustive review of safety issues of operations on contaminated runways and recommending modified FAA regulations, which would be retroactively applicable to all existing aircraft.

The proposals for regulatory changes concerning transport category aircraft put forward to the FAA by the ARC were oriented along three main axes:

- Standards for runway condition reporting (FAR139)
- Definition of operational landing performance computation (FAR25/26)
- Operational Rules (FAR121)

The committee also covered FAR23/91/91K/135 operations, which are not further addressed here.

The following aspects were outside of the scope of the FAA TALPA ARC mandate:

- Assessment of landing with in-flight failures,
- Overweight landing without failures,
- Automatic landing distances,
- Dispatch landing distances.

The exclusion of dispatch was made to minimise the economical impact of the proposed changes. Furthermore, the introduction of a more operationally representative assessment of landing distances to be used for dispatch is not considered to constitute a significant improvement in safety levels, while accurate in-flight landing distance assessments are accepted as being the major means to reduce exposure to runway excursions at landing. Even so, for the long term, the need to review dispatch landing distances for consistency with the time of arrival requirements was acknowledged by TALPA ARC in its submission to the FAA.

The concepts detailed in the following are those proposed for aircraft that will be certified under the FAA TALPA ARC rules. The TALPA ARC rules also mandate that landing distances in line with the spirit of the proposal are published for all existing aircraft still supported by the manufacturer, albeit with less stringent requirements and with an increased grace period. For non-supported aircraft a set of fixed and conservative factors to be applied to the AFM dispatch data are provided by the regulator.

The TALPA ARC submitted its proposals to the FAA in May 2009, who will translate them into a Notice of Proposed Rulemaking (NPRM). In parallel, a field trial was launched with selected airports and operators to further validate the Runway Condition Assessment Matrix. It is not expected that the NPRM will be published before 2013 to 2015, to be followed by a mandatory comment period of at least 6 months. The proposals included a grace period for compliance of existing aircraft of two years. However, several manufacturers and countries have taken on board significant elements of the TALPA ARC work for their publications and reporting respectively.

Operational Rules Challenges

Today, most operational regulations make a very generic statement regarding the need to assess landing performance in flight ("the commander must satisfy himself/herself that, according to the information available to him/her, the weather at the aerodrome and the condition of the runway intended to be used should not prevent a safe approach [and] landing"), which does not detail the criteria and factors to be taken into account for the determination of a safe landing distance.

The lack of clear direction has led to aircraft operator operations departments filling the regulatory deficit with a variety of policies of their own initiative (or sometimes under requirement from their national Operational Authorities). Such variety of aircraft operator policies was observed by the FAA in the aftermath of the Chicago-Midway accident, and subsequently led to the publication of SAFO and AC. These documents made recommendations applicable to US operators to perform in flight landing performance assessment, including the manner in which the Operational Landing Distance should be derived, and instigated the additional 15% margin, except in emergency situations.

Proposals

■ Dispatch landing distance assessment

The FAA TALPA ARC has recognised that the current dispatch landing distance, in particular on a wet smooth runway, might, in some cases, like hot & high elevation airports or descending runway slope, deliver unsatisfactory margins. This is why an in-flight landing performance assessment will be required to be made systematically as part of the approach preparation.

■ **In-flight landing distance assessment**

The proposed FAR 121 operational rules will mandate a systematic in-flight landing distance assessment based on a Factored Operational Landing Distance (FOLD) equal to 115% of the OLD published for the prevailing conditions (100% if emergency or in-flight failure):



This 15% FOLD increment serves to provide a margin to cover variations in parameters entering in the OLD calculation, like for example:

- The variability of runway friction due to evaluation and reporting of surface contamination, changing runway condition due to weather and in the case of wet runway surface issues such as texture loss and precipitation rate
- The variability in the flare execution or deceleration means application by the pilot
- The variability in touchdown speed due to turbulence or the impact of cross-wind

■ **Use of Autobrake**

The proposal of operational rules includes an exemption regarding the application of the 15% margin when using autobrake:

- If the FOLD for manual landing is less than the Landing Distance Available (LDA)
- And if the OLD for automatic braking is less than the LDA
- Then the FOLD for automatic braking may be longer than the LDA

The rationale for this exemption is that the pilot can always override autobrake when required.

■ **Exemption from In-Flight Assessment**

It will be permitted to omit the in-flight assessment for landing on the runway planned at dispatch only if:

- Dispatch was performed for DRY (or worse), and if at time of approach preparation a DRY runway and no worse conditions than the standard ones considered for dispatch are reported (e.g. no tailwind when zero wind considered for dispatch, no higher VAPP than usual)
- Dispatch performed for WET, and if at time of approach preparation a WET runway and no worse conditions than the ones considered for dispatch are reported and the runway is maintained to the standards defining grooved or PFC runways in AC 150-5320.

Runway Condition Reporting Challenges

There is not currently a single worldwide standard for runway condition reporting.

Most frequently, the type of contaminant (and its depth when available) is reported, although the means for measurement, the threshold for reporting in terms of runway coverage, as well as the format, terminology and resolution of the reported information vary with local ATC practices.

Where runway friction measurements by dedicated vehicles are available, such friction values are sometimes reported to flight crew, although manufacturers do not provide any correlation of runway friction measured with a vehicle or a trailer with aircraft performance capabilities on the same surface. Some aircraft operators and local regulators have developed their own guidance.

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In North America, after landing, pilots usually report to ATC their assessment of braking action on a scale from GOOD to POOR to ATC, and thus to following aircraft. This may occur spontaneously when braking action is found to be lower than expected for the reported runway condition, or on request by the tower.

Proposals

The centrepiece of the regulatory proposals is what became known in the work group as the “runway condition matrix”. Its structure adheres to the existing ICAO runway codes and shows seven runway condition levels associated to codes from 0 (for nil braking action) to 6 (for dry), where each runway condition code (except 0) is matched with a corresponding aircraft performance level.

Different criteria of runway condition reporting can be used as entry points for the determination of the applicable aircraft performance level. These reporting criteria are:

- Contaminant type and depth,
- Pilot braking action report (PIREP), and
- Runway friction measurement (μ).

The latter two types of report should be used only for downgrading of a runway from a friction category basically identified via contaminant type and depth. Pilots will be informed of contamination on the runway as soon as in excess of 10% of the runway surface is contaminated, while runway condition codes will be reported for each third of the runway when more than 25% of the entire runway surface is contaminated. If a friction measurement or reports from preceding aircraft’s pilots (PiReps) indicate that the friction levels have dropped below those expected for the type of contaminant on the runway, the airport should report a lower condition code in line with the observed friction or braking action.

The information to be transmitted to the flight crew includes:

- The runway condition code for each third of the runway
- The type and depth of the contaminant and percentage of coverage in 25% increments (to avoid currently used terms such as “thin” and “patchy”)
- The PIREPs when available.

AIRPORT RUNWAY CONDITION ASSESSMENT				
ASSESSMENT CRITERIA			DOWNGRADE ASSESSMENT CRITERIA	
CODE	RUNWAY CONDITION DESCRIPTION	MU (μ)	DECELERATION AND DIRECTIONAL CONTROL OBSERVATION	PIREP
6	<ul style="list-style-type: none"> ■ Dry 	40 or Higher	-	-
5	<ul style="list-style-type: none"> ■ Wet (includes water 1/8" or Frost 1/8" or less depth of: <ul style="list-style-type: none"> ■ Slush ■ Dry Snow ■ Wet Snow 		Braking deceleration is normal for the wheel braking effort applied. Directional control is normal	Good
4	<p>15°C and Colder outside air temperature:</p> <ul style="list-style-type: none"> ■ Compacted Snow 	39 to 30	Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	<ul style="list-style-type: none"> ■ Wet ("Slippery when wet runway") ■ Dry Snow or Wet Snow (Any Depth) over Compacted Snow Greater than 3 mm (1/8") depth of: <ul style="list-style-type: none"> ■ Dry Snow ■ Wet Snow Warmer than -15°C outside air temperature: <ul style="list-style-type: none"> ■ Compacted Snow 		Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be noticeably reduced.	Medium
2	<p>Greater than 1/8" depth of:</p> <ul style="list-style-type: none"> ■ Water ■ Slush 		29 to 21	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.
1	<ul style="list-style-type: none"> ■ Ice 	20 or lower	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	<ul style="list-style-type: none"> ■ Wet ice ■ Water on top of Compact Snow² ■ Dry Snow or Wet Snow over Ice² 		Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil

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The TALPA ARC recommended that friction values should no longer be transmitted to pilots, but restricted to use by the airport authorities in consolidating the runway condition assessment, mainly to downgrade a runway condition assessment from descriptive characteristics. The Runway Condition Assessment Table as presented hereafter, and in particular the area shown in grey, is therefore meant for airport use only.

It is notable that this matrix provides a recommendation for the performance-wise classification of runways that are reported as Slippery When Wet (Code 3) due to rubber contamination or otherwise degraded runway friction. The concept of reporting runways as Slippery When Wet when the measured friction drops below the maintenance threshold was previously recommended for enforcement by the national authorities in ICAO Annex 14, but no associated aircraft performance was so far available to allow the flight crew to take this information into account in their landing performance assessment.

Actual in-service experience has been already acquired with the "matrix" in Alaska and some airports in other northern US states, and has been extensively tested in real conditions during winters 2008-2009 and 2009-2010. The runway condition classification made in the matrix will also be the basis of the digital NOTAM system currently being developed in the US.

The lack in standardisation of today's runway condition reporting has been identified as a contributing factor to overrun accidents at landing. There are encouraging indications from other international workgroups that these proposals developed in the frame of the TALPA ARC will find their way into various international rules and regulations.

Operational Landing Distance

The TALPA proposal defines aircraft performance only for in-flight landing distance determination to reflect actual aircraft maximum performance as it can be expected to be achieved by a line pilot, realistic but without margin. This distance is called Operational Landing Distance (OLD), made up of the components described here below.

Air Distance

The length of the airborne distance is the distance covered in 7 seconds at the ground speed corresponding to the approach speed (including temperature effect and 150% of the tailwind or 50% of the headwind). The touchdown

speed is 96% of the approach speed, which more accurately represents modern jet aircraft than the definition in EASA AMC 25.1591.

Activation of Deceleration Means

Deceleration means are taken into consideration in line with their intended use as prescribed in the Standard Operating Procedures (SOP): ground spoiler deployment and maximum pedal braking at or near main gear touchdown, maximum reversers if their use is intended, at or near main gear touchdown. There is no allowance for delayed pilot actions.

Ground Roll

In line with the runway condition matrix above, the proposal identifies and defines aircraft performance levels matching the 6 runway friction codes, which are equally valid whatever the origin of the runway condition classification: contaminant type, measured runway friction or pilot reports on braking action.

Each of the 6 levels is associated to a runway code between 6 – Dry and 1 - Poor, and is approximately consistent with the friction coefficients described for the appropriate runway contaminant in the latest issue of EASA AMC 25.1591:

- 6 – Dry
- 5 – Good Wet
- 4 – Good to Medium Compact Snow
- 3 – Medium Loose Snow
- 2 – Medium to Poor Standing Water, Slush
- 1 – Poor Ice

No performance level is provided for Nil, since operations in these conditions are prohibited.

Provisions of performance credit for WET Grooved or Porous Friction Course (PFC) runways have been made. However no specific runway code was assigned to such runways:

- A grooved or PFC runway is considered as an enhanced safety, that would be dissipated if performance credit was given systematically,
- Maintenance and minimum friction thresholds set in Annex 14 for a runway to be declared slippery when wet with associated aircraft performance level are under review by ICAO, which put them outside the time frame of TALPA ARC.

RUNWAY CONDITION CODE	BRAKING ACTION	CONTAMINANT DESCRIPTION	OLD COMPUTATION ¹		REV CREDIT
			AIR DISTANCE	GROUND ROLL AND FRICTION	
6	-	DRY	7 sec, with 4% speed decay	Flight Tests demonstrated value reduced by 10%	Allowed
5	Good	Wet		Unchanged FAA/EASA model with wet anti-skid efficiency	
4	Good to medium	Compact Snow		Consistent in essence with EASA CS25.1591	
3	medium	Loose Snow			
2	Medium to poor	Standing Water, Slush			
1	Poor	ICE			

¹ Defined wheel braking coefficients are assuming a friction limited situation. Final performance is adjusted appropriately to account for autobrake deceleration controls.

An example of a manufacturer's guidance for operating on wet or contaminated runways.

NOTE:

The following information is an example of manufacturer's guidance for operating on wet or contaminated runways. This information is an example only and may change. It will not be kept up to date.

Slippery Runway Landing Performance

When landing on slippery runways contaminated with ice, snow, slush or standing water, the reported braking action must be considered. Advisory information for reported braking actions of good, medium and poor is contained in the PI chapter of the QRH. The performance level associated with good is representative of a wet runway. The performance level associated with poor is representative of a wet ice covered runway. Also provided in the QRH are stopping distances for the various autobrake settings and for non-normal configurations. Pilots should use extreme caution to ensure adequate runway length is available when poor braking action is reported.

Pilots should keep in mind slippery/contaminated runway advisory information is based on an assumption of uniform conditions over the entire runway. This means a uniform depth for slush/standing water for a contaminated runway or a fixed braking coefficient for a slippery runway. The data cannot cover all possible slippery/contaminated runway combinations and does not consider factors such as rubber deposits or heavily painted surfaces near the end of most runways.

One of the commonly used runway descriptors is coefficient of friction. Ground friction measuring vehicles typically measure this coefficient of friction. Much work has been done in the aviation industry to correlate the friction reading from these ground friction measuring vehicles to aeroplane performance. Use of ground friction vehicles raises the following concerns:

- the measured coefficient of friction depends on the type of ground friction measuring vehicle used. There is not a method, accepted worldwide, for correlating the friction measurements from the different friction measuring vehicles to each other, or to the aeroplane's braking capability.
- most testing to date, which compares ground friction vehicle performance to aeroplane performance, has been done at relatively low speeds (100 knots or less). The critical part of the aeroplane's deceleration characteristics is typically at higher speeds (120 to 150 knots).
- ground friction vehicles often provide unreliable readings when measurements are taken with standing water, slush or snow on the runway. Ground friction vehicles might not hydroplane (aquaplane) when taking a measurement while the aeroplane may hydroplane (aquaplane). In this case, the ground friction vehicles would provide an optimistic reading of the runway's friction capability. The other possibility is the ground friction vehicles might hydroplane (aquaplane) when the aeroplane would not, this would provide an overly pessimistic reading of the runway's friction capability. Accordingly, friction readings from the ground friction vehicles may not be representative of the aeroplane's capability in aquaplaning conditions.
- ground friction vehicles measure the friction of the runway at a specific time and location. The actual runway coefficient of friction may change with changing atmospheric conditions such as temperature variations, precipitation etc. Also, the runway condition changes as more operations are performed.

The friction readings from ground friction measuring vehicles do supply an additional piece of information for the pilot to evaluate when considering runway conditions for landing. Crews should evaluate these readings in conjunction with the PIREPS (pilot reports) and the physical description of the runway (snow, slush, ice etc.) when planning the landing. Special care should be taken in evaluating all the information available when braking action is reported as POOR or if slush/standing water is present on the runway.

Wheel Brakes

Braking force is proportional to the force of the tyres on the runway and the coefficient of friction between the tyres and the runway. The contact area normally changes little during the braking cycle. The perpendicular force comes from aeroplane weight and any downward aerodynamic force such as speedbrakes.

The coefficient of friction depends on the tyre condition and runway surface, (e.g. concrete, asphalt, dry, wet or icy).

Automatic Brakes

Use of the autobrake system is recommended whenever the runway is limited, when using higher than normal approach speeds, landing on slippery runways, or landing in a crosswind.

For normal operation of the autobrake system select a deceleration setting. Settings include:

- MAX AUTO: Used when minimum stopping distance is required. Deceleration rate is less than that produced by full manual braking
- 3 or 4: Should be used for wet or slippery runways or when landing rollout distance is limited
- 1 or 2: These settings provide a moderate deceleration suitable for all routine operations.

Experience with various runway conditions and the related aeroplane handling characteristics provide initial guidance for the level of deceleration to be selected.

Criteria to be fulfilled by an effective runway excursion prevention system

The system should work in real time and continuously assess the position of the aircraft relative to the runway to which it performs the approach, as well as its actual energy level. The system should work in manual and automatic landing and manual and automatic braking. It should make a conservative but realistic assessment of the stopping distance required under the prevailing conditions for that energy level. It should compare the necessary distance with that available. It should alert the flight crew during the approach when a safe stop on the runway is not ensured. It should alert the flight crew during the ground roll when more deceleration is required. No runway overruns should occur with aircraft equipped with the system under conditions for which it is certified without an alert being triggered. The system should not generate alerts unnecessarily.

A system fulfilling these conditions permits the definition of clear procedures associated with the alerts (go-around, maximum braking and selection of max reverse thrust) that can, when applied, prevent runway excursions.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30
Dry Runway

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)											
	REF DIST*	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	VREF ADJ	REVERSE THRUST ADJ	PER 10 KTS ABOVE VREF30	ONE REV	NO REV	
MAX MANUAL	2940	+70-40	60	-120	440	40	-30	60	-60	230	50	100
MAX AUTO	3980	+60-40	90	-120	610	0	0	90	-100	410	0	0
AUTOBRAKE 4	4940	+80-40	130	-240	850	20	-20	130	-130	520	0	0
AUTOBRAKE 3	5970	+100-80	160	-290	1060	40	-60	160	-160	590	10	20
AUTOBRAKE 2	6670	+120-100	190	-340	1220	90	-130	180	-180	540	140	140
AUTOBRAKE 1	7070	+140-120	220	-380	1370	150	-190	200	-200	540	410	500

Good Reported Braking Action

	00	330	200	450
	90	410	210	480
	30	520	20	70
	60	590	10	20

Reference distance is for sea level, standard day, VREF 30 approach speed and 2 engine reverse thrust, adjust accordingly for actual conditions
Actual (unfactored) distances are shown
Includes distance from 50 ft. above the threshold (1000 ft. air distance)

AUTOBRAKE 4	5730	+100-100	170	-320	1260	250	-150	150	-150	510	520	1350
AUTOBRAKE 3	6280	+110-110	180	-340	1340	190	-130	170	-170	590	620	900

Poor Reported Braking Action

MAX MANUAL	7050	+150-140	230	-470	2010	680	-390	200	-190	480	1160	3110
MAX AUTO	7400	+150-140	230	-470	1990	680	-390	200	-190	490	1170	3140
AUTOBRAKE 4	7400	+150-140	230	-470	2000	680	-400	200	-190	470	1190	3180
AUTOBRAKE 3	7430	+150-140	230	-480	2020	650	-340	200	-200	590	1070	3070

Reference distance is for sea level, standard day, no wind or slope, VREF 30 approach speed and 2 engine reverse thrust.
Max Manual braking data valid for auto speedbrakes. For manual speedbrakes, increase reference landing distance by 200 ft.
Autobrake data valid for both auto and manual speedbrakes.
Actual (unfactored) distances are shown.
Includes distance from 50 ft above threshold (1000 ft of air distance).

JAR operators advisory data in QRH include 1.15 factor

Based on these notes

Example of procedures required to obtain published performance