A320 MAX LANDING WEIGHT CALCULATION TO REMAIN WITHIN LDA

Last Updated 15th Nov 2020

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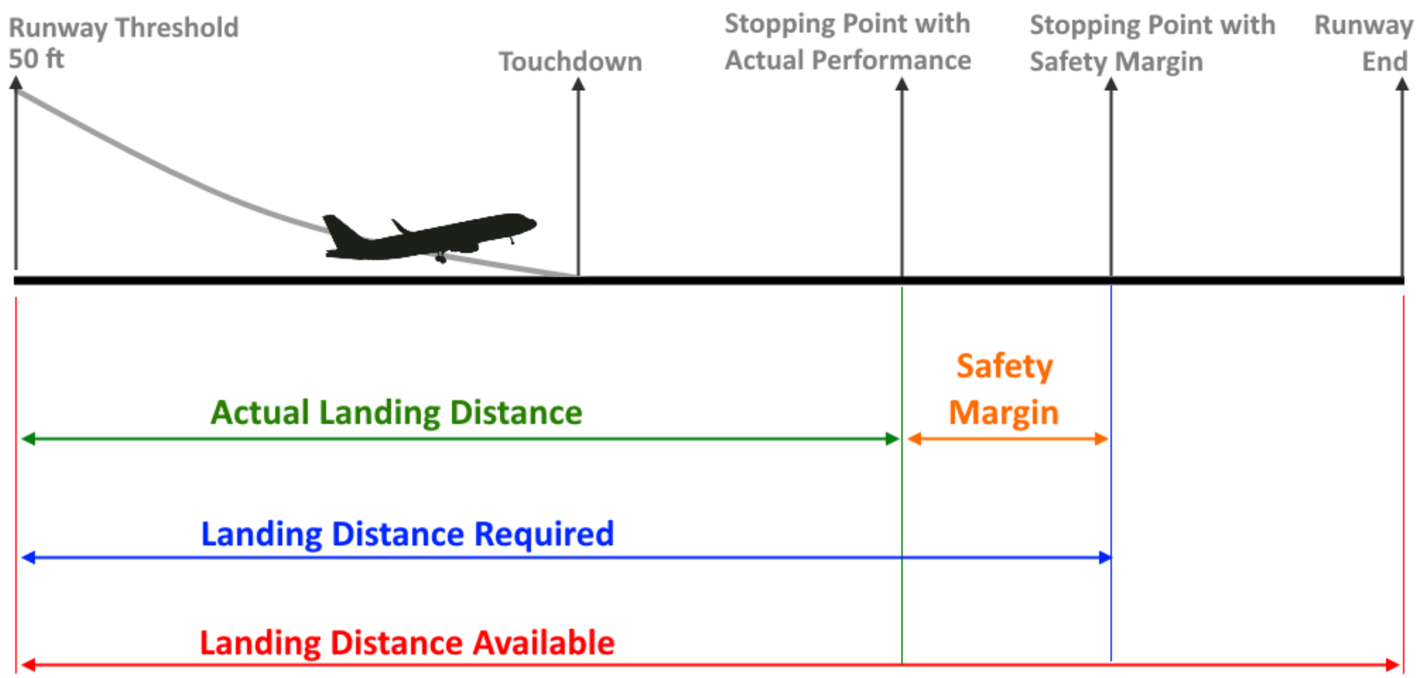
This article refers to inflight determination of maximum landing weight in order to remain within the available landing distance (LDA) without compromising the landing safety margins.



1) Check your LDA from Charts / Bulletins / NOTMAS etc. and call it A.

2) Divide LDA by 1.15 to keep the 15% recommended safety margin or by any other factor that is defined by your operator and call this value B i.e. A / 1.15 = B. Under exceptional circumstances you may disregard this margin.

3) Ref to QRH > Inflight Performance > Landing Distance Without Failure and from the given table determine the items that will be applicable for your landing like correction for speed, elevation, wind, ISA deviation, slope, reverser and overweight landing if expected. Add up all these values and call it C.

4) LDA will now be B minus C. Call it D.

5) Compare available distance D with the actual reference distance of 66 tons given in the table to find out the maximum landing weight that would keep us within this factored LDA.

LANDING DISTANCE WITHOUT FAILURE

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing[(1)], VAPP=VLS without APPR COR.

6 - DRY										
Corrections on Landing Distance (m)			**WGT[(2)]**	**SPD**	**ALT**	**WIND**	**TEMP**	**SLOPE**	**REV**	**OVW**
Braking Mode	**LDG CONF**	**REF DIST (m) for 66T**	**Per 1T above 66T**	**Per 5kt**	**Per 1000ft above SL**	**Per 5kt TW**	**Per 10°C above ISA**	**Per 1% Down Slope**	**Per Thrust Reverser Operative**	**If OVW PROC applied**
Maximum MANUAL	FULL	**1 090**	+ 50	+ 70	+ 40	+ 120	+ 30	+ 20	- 10	+ 780
	3	**1 170**	+ 50	+ 80	+ 40	+ 130	+ 40	+ 20	- 10	+ 940
AUTOBRAKE MED	FULL	**1 370**	+ 30	+ 90	+ 50	+ 130	+ 50	+ 10	0	+ 230
	3	**1 450**	+ 40	+ 100	+ 50	+ 140	+ 50	+ 10	0	+ 250
AUTOBRAKE LOW	FULL	**1 950**	+ 40	+ 140	+ 70	+ 200	+ 70	+ 30	- 10	+ 260
	3	**2 090**	+ 50	+ 140	+ 80	+ 210	+ 70	+ 20	- 10	+ 290

(1) Automatic Landing correction: if CONF FULL, add 280m. If CONF 3, add 300m.
(2) Weight correction: subtract 10m per 1T below 66T.

6) If the available distance D is equal to the actual reference distance at 66 tons then the maximum landing weight that would keep you within your factored LDA will be 66 tons. If available distance D is not equal to the actual reference distance at 66 tons then you will have to calculate the weight using the weight correction given in the table e.g.

- If available distance D (i.e. the factored LDA) is above the actual reference distance let's say 1190 meters then the difference is actual 1090 – available 1190 = -100 meters. This means that the actual landing distance will be 100 meters less than the factored LDA. In this case we are able to land with a landing weight higher than 66 tons. We can use the correction in the table to calculate this. If we are doing a full-flaps landing with max manual braking then 1 ton above 66 gives a distance penalty of 50 meters. Since our actual distance was 100 meters less than LDA we can take that to our advantage and increase our landing weight i.e. 100 / 50 = 2. That means 66 +2 = 68 tons will be the maximum landing weight that would keep us within the LDA.

- If available distance D (i.e. the factored LDA) is below the actual reference distance let's say 1040 meters then the difference is actual 1090 – available 1040 = 50 meters. This means that the actual landing distance will be 50 meters more than the LDA. In this case we cannot land with a landing weight of 66 tons if we have to remain within our factored

LDA. To remain within our target, we will have to determine our maximum landing weight limit. We can use the correction in the table to calculate this. The footnotes in the table say that for every 1 ton below 66 tons, decrease the distance by 10 meters. Since our actual distance was more than the available by 50 meters, we need to reduce the weight by 5 tons i.e. 50/10 = 5. That means 66 - 5 = 61 tons will be the maximum landing weight that would keep us within the factored LDA.

Let's take some hypothetical values to understand this with an example. You are diverting to an aerodrome where:

- Declared LDA is 1850 meters.
- Runway Elevation is 5000 feet ASL.
- Temperature is ISA+10.
- Wind is 10 knots tailwind.
- Runway Slope is 2% Down
- Overweight landing is not the case but 1 thrust reverser is inoperative.

The first step is to keep a recommended safety margin for your landing so the LDA becomes 1850 / 1.15 = 1608 meters.

The second step will be to consider the effect of factors affecting the landing distance. If you see the table you will find that the maximum landing performance in terms of stopping in the shortest distance is with full flaps and maximum manual braking. You can choose whichever configuration you want for landing but we will be discussing here the performance with full flaps and maximum manual braking. With that consideration, the effect of factors applicable to our case will be:

Corrections on Landing Distance (m)			WGT	SPD	ALT	WIND	TEMP	SLOPE	REV
Braking Mode	LDG CONF	REF DIST (m) for 66T	Per 1T above 66T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C above ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	FULL	1 090	+ 50	+ 70	+ 40	+ 120	+ 30	+ 20	- 10

a) SPD Correction: This is to be considered if while determining VAPP, approach correction is greater than 1/3rd of the headwind component (Ref: QRH > Inflight Performance > VAPP Determination). In our case there is no headwind component but auto thrust will be ON for landing so approach correction will be 5 knots. That means we will apply the SPD correction. So, for 5kts the distance will be 70 meters.

b) ALT Correction: 40 meters for every 1000 feet ASL. In our case elevation was 5000 ASL so that makes it 40 x 5 = 200 meters.

c) Wind Correction: 120 meters per 5 knots of tailwind. In our case we had 10 knots of tailwind so that makes it 120 x 2 = 240 meters.

d) Temperature Correction: 30 meters per 10^{o}C above ISA. In our case the temperature was 10^{o}C above ISA so that makes it 30 meters.

e) Down Slope: 20 meters per 1% down slope. In our case down slope was 2% so that makes it 20 x 2 = 40 meters.

f) Thrust Reverser: -10 meters per thrust reverser operative. For both reversers operative the reduction in distance would have been 20 meters but since in our case one reverser was inoperative, we will only have the credit of 10 meters.

After adding up the total effect of above factors (70+200+240+30+40-10), the distance comes to 570 meters. Subtracting 570 from 1608 (which was the LDA with a 15% safety margin), the final factored LDA becomes 1038 meters.

At 66 tons, the actual reference landing distance is 1090 meters. This is more than what is available (i.e. 1038 meters as determined above) by 52 meters. Their ratio (1038/1090) shows that the factored LDA is 5% less than the actual distance. Since the LDA we calculated included a 15% margin, landing can still be done but with less than the recommended safety margin. In some exceptional circumstances if there is some sort of an urgency to land, this can be disregarded however under normal conditions the recommended safety margins should be kept. In order to keep the margins, in our example we will reduce the weight. As per the footnotes in the table, if a 10-meter reduction in distance is equivalent to 1-ton reduction below 66 tons then for 52 meters, 5.2-ton (52/10) reduction is required in landing the weight. That means a landing weight of (66 – 5.2) 60.8 tons is required to land with recommended safety margins on a runway with a declared LDA of 1850 meters after considering all the applicable factors that affect the landing distance, as mentioned above.

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