Runway FAA Strength Rating Conversions

Purpose of Rating Conversions

A number of airlines and airports have requested Boeing guidance concerning the use of FAA and U.S. military pavement strength rating systems with Boeing airplanes. The FAA and the U.S. military are shifting to use of the Pavement Classification Number (PCN) for each runway supporting operations by aircraft weighing greater than 12,500 lb (5,700 kg), but this transition has been slow, with a completion date set by AC 150/5335-5B for 3 to 5 years from August 2011. The FAA recommends the guidelines and specifications for reporting airport pavement strength in terms of PCN at this location:

http://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentNumber/150_5335-5

The FAA ratings, which are published in places such as the Airport Facility Directory (AFD) or the Airport Master Record (FAA Form 5010), are believed to be based on the following standard aircraft:

- S or SW – Single Wheel (DC-3)
- D or DW – Dual Wheel (727-200)
- DT or DTW – Dual Tandem Wheel (DC8-63)
- DDT or DDTW – Double Dual Tandem (747)

Figure 1 shows the pavement strength rating for a typical airport using the current FAA system, as published in the Airport Master Record (FAA Form 5010). Although both rating systems are shown, the PCN has precedence over the FAA pavement ratings. Note that this figure is an older format and is used for illustrative purposes only:

RUNWAY DATA

RUNWAY IDENT:	09/27	
LENGTH:	9,401	
WIDTH:	200	
SURF TYPE-COND:	ASP-CONC-G	
SURF TREATMENT:	GRVD	
GROSS WT:	SW	100
(IN THSDS)	DW	150
	DTW	250
	DDTW	720
PCN:	78 F/B/W/T	

Figure 1. FAA Pavement Strength Rating System

The U.S. Military has a similar naming convention, but additional gear types such as ST (C130), TRT (C-17), and TDT (C-5) are included. A complete list of FAA wheel naming conventions may be found in the FAA Order 5300.7, including the nomenclature that it replaces:

http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/14484

As an example of use, a rating of DTW250 or TT250 means that an aircraft like the DC8-63 is limited to a gross weight of 250,000 lb on that runway. Similar aircraft like the 767 or the 787 are

also limited to 250,000 lb, even though they both have much better pavement loading characteristics than does the DC8 due to the differences in landing gear arrangement. This anomaly occurs primarily in wide body aircraft. Another problem with the FAA rating system is that it is not possible to determine the pavement loading capability for aircraft such as the 777, the C17, or the C5A.

Boeing Interim Rating Conversions

Conversions were developed by Boeing's Airport Compatibility organization to provide an interim process until the airports fully establish the PCN for their pavements and to address the penalty that was assessed for wide body aircraft. This process may be used until complete conversion to the PCN is accomplished.

The method allows the conversion of standard FAA rating types (D, DT, DDT) into allowable airplane weights for other gear types. In the past it was quite simple, since most aircraft had landing gear arrangements somewhat close to the FAA standard mentioned previously. However, the current models are mostly large wide body or larger military aircraft with superior landing gear arrangements that do not conform to the standard FAA types. This has made it difficult to know how these aircraft would fit into an airport that had only FAA pavement ratings.

Since there is a lengthy list of aircraft that do not fit the FAA rating pattern and with each having a unique aircraft classification number (ACN), a method was devised to relate between the two by converting the ACN into the appropriate equivalent FAA rating. The Boeing solution is based on comparative calculations to determine equivalency. The DC8-63 is the standard reference airplane for dual-tandem gear sets, while the 727-200 is used for dual gear. No standard conversion is required for the 747 DDT gear since it is unique unto itself.

Table 1 provides the conversion factors that have been developed for Boeing and some military aircraft. These factors show the relationship of the aircraft in question to the standard FAA D, DT, or DDT published ratings. It was assembled by ratioing their average ACN at the eight subgrade codes to the average ACN of the FAA standard aircraft.

To use this table there are several caveats to keep in mind:

- When using narrow body (NB) aircraft, the gear factor for the matching FAA rating is generally 1.00. It was determined that the differences in the gear configurations between the various NB aircraft models were not great enough to warrant using factors that were significantly different.
    - The gear factors for the 717, 727, 737, DC9, P8, and MD80 series are 1.00 for the D conversion.
    - The gear factors for the 707, 720, 757, DC8, and KC-135 are 1.00 for the DT conversion.
    - The gear factors for all 747 aircraft are 1.00 for the DDT conversion.
    - Gear factors for wide body (WB) and most military (MIL) are significantly different enough to require new factors.
- Try to match the gear configuration to that of the rating. For example, 767-300ER conversions should be based on the DT factor:
    - For an FAA rating of DT300, the allowable gross weight is 300 x 1.17 = 351K.
    - To operate on a pavement at 350K, the FAA rating required for a 767-300ER is 350 ÷ 1.17 = DT299.
- If a published rating is not available that matches the gear configuration of the aircraft, then use the nearest similar rating:
    - For a pavement that has only a D200 or a DT350 rating, the allowable gross weight of a 777-300ER is 350 x 1.75 = 613K, based on the DT rating.

- If the pavement also has a DDT800 rating, then the allowable gross weight for the 777-300ER is 800 x 0.80 = 640K. Choose between the DT and the previous DDT conversions.
- For another pavement with a rating of DT350, the allowable gross weight of a 747-8 is 350 x 2.27 = 795K.
- For a pavement with only a rating of D200, the allowable 757-300 gross weight is 200 x 1.70 = 340K. The allowable 777-300ER gross weight is 200 x 3.03 = 606K, and the allowable 747-400ER gross weight is 200 x 3.93 = 786K.
- The required rating for a 777-300ER at 750K gross weight on a pavement is
  - 750 ÷ 3.03 = D248
  - 750 ÷ 1.75 = DT429
  - 750 ÷ 0.80 = DDT938

Table 1 - Boeing Gear Conversion Factors

Aircraft	Gear Type	Body Type	D	DT	DDT
707-320C	DT (2D)	NB	1.85	1.00	0.46
717-200	D	NB	1.00	0.53	0.23
720B	DT (2D)	NB	1.74	1.00	0.43
727-100	D	NB	1.00	0.58	0.25
727-200	D	NB	1.00	0.59	0.25
737-200	D	NB	1.00	0.57	0.25
737-300	D	NB	1.00	0.57	0.25
737-400	D	NB	1.00	0.55	0.24
737-500	D	NB	1.00	0.56	0.24
737-600	D	NB	1.00	0.58	0.25
737-700	D	NB	1.00	0.58	0.25
737-700ER	D	NB	1.00	0.59	0.29
737-800	D	NB	1.00	0.57	0.25
737-900ER	D	NB	1.00	0.56	0.24
737BBJ	D	NB	1.00	0.58	0.25
737BBJ-2	D	NB	1.00	0.57	0.25
737BBJ-3	D	NB	1.00	0.56	0.24
747-200	DDT (2D/2D2)	WB	4.14	2.39	1.00
747-400	DDT (2D/2D2)	WB	4.02	2.35	1.00
747-400F	DDT (2D/2D2)	WB	4.01	2.31	1.00
747-400ER	DDT (2D/2D2)	WB	3.93	2.27	1.00
747-400ERF	DDT (2D/2D2)	WB	3.93	2.27	1.00
747-8F	DDT (2D/2D2)	WB	4.07	2.34	1.00
747-8	DDT (2D/2D2)	WB	3.93	2.27	1.00
747SP	DDT (2D/2D2)	WB	4.12	2.38	1.00
757-200	DT (2D)	NB	1.73	1.00	0.43
757-300	DT (2D)	NB	1.70	1.00	0.42
767-200	DT (2D)	WB	2.02	1.17	0.54
767-200ER	DT (2D)	WB	2.02	1.17	0.54
767-300	DT (2D)	WB	2.02	1.17	0.54
767-300ER	DT (2D)	WB	2.03	1.17	0.54
767-400ER	DT (2D)	WB	1.95	1.13	0.52

Aircraft	Gear Type	Body Type	D	DT	DDT
777-200	3D	WB	3.07	1.77	0.82
777-200ER	3D	WB	3.07	1.77	0.82
777-200LR	3D	WB	3.06	1.76	0.81
777-300	3D	WB	2.95	1.70	0.78
777-300ER	3D	WB	3.03	1.75	0.80
777F	3D	WB	3.06	1.76	0.81
787-8	DT (2D)	WB	2.11	1.22	0.56
787-9	DT (2D)	WB	2.20	1.27	0.58
787-10 Preliminary	DT (2D)	WB	2.18	1.26	0.58
DC/MD10-10	DT (2D)	WB	2.22	1.28	0.59
DC/MD10-30/40	DT (2D/D1)	WB	2.80	1.62	0.74
MD-11ER	DT (2D/D1)	WB	2.59	1.50	0.70
DC8-63/73	DT (2D)	NB	1.73	1.00	0.43
DC9-32	D	NB	1.00	0.54	0.23
DC9-51	D	NB	1.00	0.53	0.23
MD-83	D	NB	1.00	0.53	0.23
MD-87	D	NB	1.00	0.53	0.23
MD-90-30	D	NB	1.00	0.52	0.23
C17A	2T	MIL	3.11	1.80	0.82
KC-10A	DT (2D/D1)	MIL	2.72	1.57	0.72
KC-135E	DT (2D)	MIL	1.81	1.00	0.45
KC-135R	DT (2D)	MIL	1.83	1.00	0.46

Notes: Gear Types shown in parentheses reflect the revised FAA nomenclature of FAA Order 5300.7
NB = Narrow Body Aircraft
WB = Wide Body Aircraft
MIL = Military Aircraft

Additional questions concerning this issue can be directed to Boeing's Airport Compatibility group as follows:

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