7 Calculation of Traffic Load

Careful flight planning ensures that sufficient fuel is carried for a particular flight. This fuel load, together with the aircraft limitations listed below, will determine the revenue-earning portion of the Traffic Load. Traffic Load is the total mass of passengers, baggage and cargo, including any non-revenue load.

After the fuel required has been decided for a particular flight the Traffic Load may be calculated, taking into account the following aircraft structural limitations:

Dry Operating Mass (DOM)

Dry Operating Mass is the total mass of the aeroplane ready for a specific type of operation excluding all usable fuel and traffic load. This mass includes:

- Crew and baggage
- Catering and removable passenger service equipment
- Potable (drinking) water and lavatory chemicals

Maximum Zero Fuel Mass (MZFM)

Maximum Zero Fuel Mass is the maximum permissible mass of an aeroplane with no usable fuel. The MZFM is a structural limit based on the bending moments of the wing root.

Maximum Structural Take-Off Mass (MSTOM)

Maximum Structural Take-Off Mass is the maximum permissible total aeroplane mass at the start of the take-off run.

Maximum Structural Landing Mass (MLSM)

Maximum Structural Landing Mass is the maximum permissible total aeroplane mass upon landing under normal circumstances.

The DOM will vary as the role of the aircraft varies. For instance, the DOM for a freight task is considerably less than that for the same airframe fitted out to carry a maximum passenger load.

All extra weight above the MZFM must comprise fuel only. The added fuel, which is invariably carried in the wing increases its stiffness and reduces its bending and torsion (twisting). Therefore the MZFM can, in many instances, determine the overall Traffic Load, particularly on sectors that require a small fuel uplift; the reduced fuel requirement cannot automatically be substituted with extra traffic load. Thus:

MAXIMUM STRUCTURAL
TRAFFIC LOAD = MZFM - DOM

Regulated Take-off Mass (RTOM)

This is defined as the TOM which is regulated by accelerated stop distance, take off climb requirements, obstacle clearance requirements, enroute obstacle and landing mass requirements.

Regulated Landing Mass (RLAM)

This is defined as the Landing mass regulated by limitaitons of runway in use and landing and climb requirements.

Maximum Take-off Mass (MTOM) and Minimum Landing Mass (MLM)

MTOM and MLM are obvious limitations on the Traffic Load and under normal operating conditions they must not be exceeded.

MTOM comprises the DOM, route fuel at start of the take-off run and Traffic Load.

The MLM comprises the DOM, the fuel remaining at touchdown and the Traffic Load.

The three limitations, MZFM, MTOM and MLM must be considered separately in order to determine the maximum Traffic Load.

Example 1

Calculate the maximum Traffic Load given:

MTOM	195 000 kg
MLM	142 000 kg
DOM	115 000 kg
MZFM	137 000 kg
Fuel at Take-Off	51 444 kg
Estimated landing fuel	6200 kg

Answer

At **MTOM** the traffic load available will be:

MTOM - DOM - Total fuel
= 195 000 - 115 000 - 51 444
= **28 556 kg**

At **MLM** the traffic load available will be:

MLM - DOM - Landing fuel
= 142 000 - 115 000 - 6200
= **20 800 kg**

At **MZFM** the traffic load available will be:

MZFM - DOM
=137 000 - 115 000
= **22 000 kg**

The **limiting traffic load** is the **lowest** of the three figures i.e. **20 800 kg.**

The above calculations can be tabulated as shown in *table MB 7.1.*

MTOM limited traffic load	MLM limited traffic load	MZFM limited traffic load
MTOM 195000 kg	MLM 142000 kg	MZFM 137000 kg
DOM 115000 kg	DOM 115000 kg	DOM 115000 kg
Trip fuel 45244 kg		
Landing fuel 6200 kg	Landing fuel 6200 kg	
Traffic load 28556 kg	Traffic load 20800 kg	Traffic load 22000 kg

Table MB 7.1 Traffic load calculations - example 1

Example 2

A flight is to be made from Manchester to Hanover and return. No fuel is available at Hanover. Given the following information calculate the maximum Traffic Load for each leg and the Take-Off Mass at Manchester.

MTOM Manchester	136 000 kg
MTOM Hanover	142 000 kg
MLM Manchester	92 000 kg
MLM Hanover	92 000 kg
DOM	56 000 kg
MZFM	89 000 kg
Sector distance	580 NM
Fuel Consumption	5500 kg/hr
TAS	420 kt
Wind component to Hanover	+35 kt
Wind component to Manchester	-43 kt
Descent fuel	1300 kg
Final Reserve and Alternate fuel	4700 kg

Answer

First work out the fuel burn for each sector:

Groundspeed outbound	455 kt
Time outbound	1.275 hrs
Sector fuel outbound	**8313 kg** (7013 +1300)
Groundspeed home	377 kt
Time home	1.538 hrs
Sector fuel home	**9759 kg** (8459 +1300)

∴ Total fuel required at departure from Manchester:

Fuel for both sectors + reserve fuel
8313 + 9759 + 4700 = **22 772 kg**

Now work out maximum Traffic Load for both sectors.

Therefore:
Maximum Traffic Load that can be carried from Manchester to Hanover is **21 541 kg**

Maximum Traffic Load that can be carried from Hanover to Manchester is **31 300 kg**

Take-off weight at Manchester = DOM + Fuel + Traffic Load = 56 000 + 22 772 + 21 541 = 100 313 kg

The above calculations can be tabulated as shown in *table MB 7.2 and table MB 7.3.*

MTOM limited traffic load	MLM limited traffic load	MZFM limited traffic load
MTOM 136000 kg	MLM 92000 kg	MZFM 89000 kg
DOM 56000 kg	DOM 56000 kg	DOM 56000 kg
Trip fuel 8313 kg		
Retn trip fuel 9759 kg	Retn trip fuel 9759 kg	
Reserve fuel 4700 kg	Reserve fuel 4700 kg	
Traffic load 57228 kg	Traffic load 21541 kg	Traffic load 33000 kg

Table MB 7.2 Traffic load calculations from Manchester

MTOM limited traffic load	MLM limited traffic load	MZFM limited traffic load
MTOM 142000 kg	MLM 92000 kg	MZFM 89000 kg
DOM 56000 kg	DOM 56000 kg	DOM 56000 kg
Trip fuel 9759 kg		
Reserve fuel 4700 kg	Reserve fuel 4700 kg	
Traffic load 71541 kg	Traffic load 31300 kg	Traffic load 33000 kg

Table MB 7.3 Traffic load calculations from Hanover

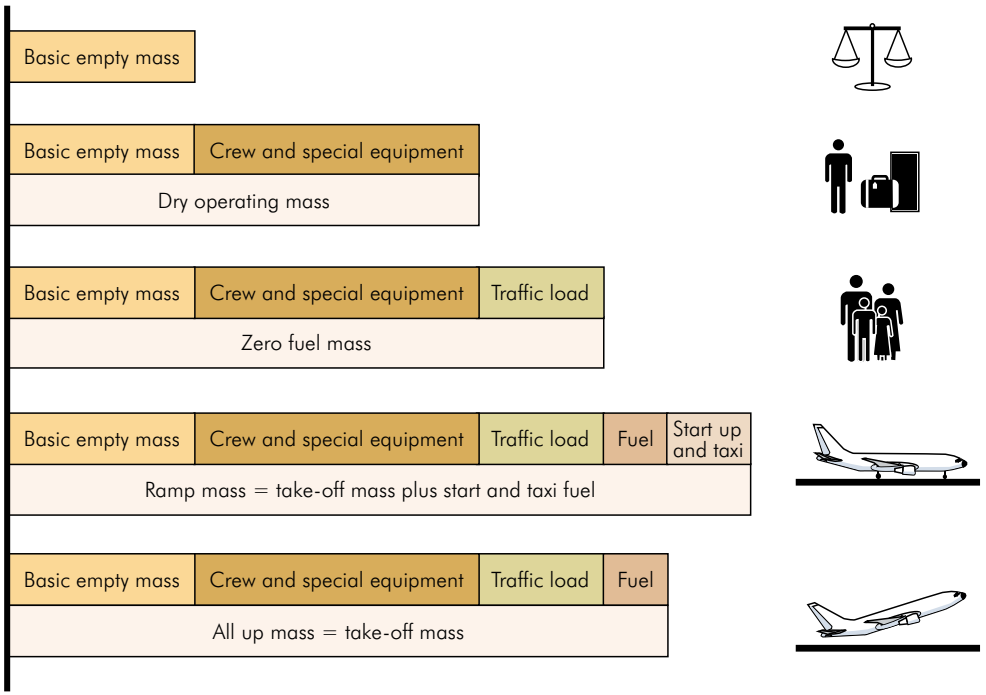

Fig. MB 7.1 Graph showing how the ramp mass is compiled

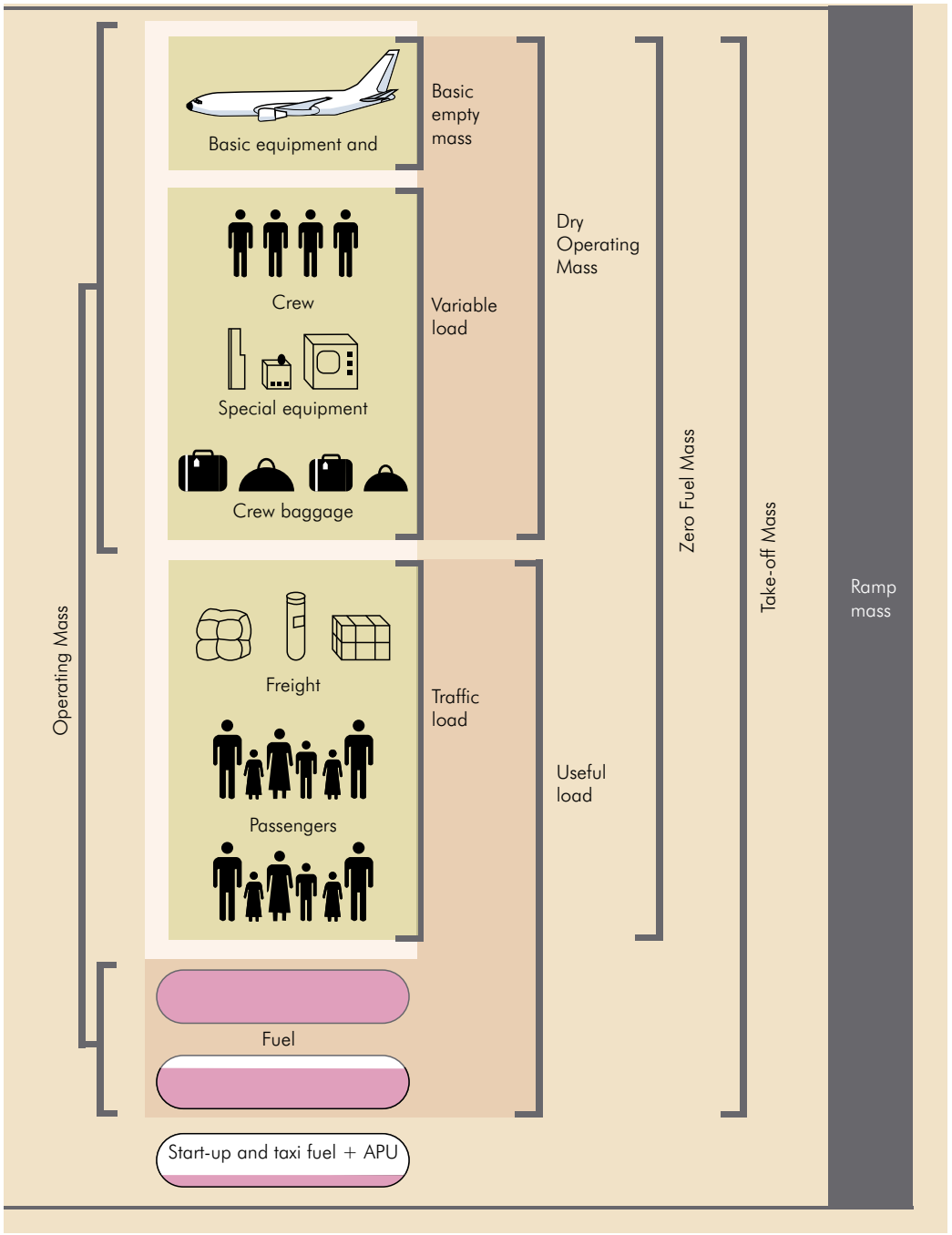

Fig. MB 7.2 Mass and load definitions