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:

\[
\text{MAXIMUM STRUCTURAL TRAFFIC LOAD} = \text{MZFM} - \text{DOM}
\]
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:

<table>
<thead>
<tr>
<th>MTOM</th>
<th>MLM</th>
<th>MZFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>195 000 kg</td>
<td>142 000 kg</td>
<td>137 000 kg</td>
</tr>
</tbody>
</table>

Answer
At MTOM the traffic load available will be:
\[
\text{MTOM} - \text{DOM} - \text{Total fuel} = 195\,000 - 115\,000 - 51\,444 = 28\,556\,kg
\]

At MLM the traffic load available will be:
\[
\text{MLM} - \text{DOM} - \text{Landing fuel} = 142\,000 - 115\,000 - 6200 = 20\,800\,kg
\]

At MZFM the traffic load available will be:
\[
\text{MZFM} - \text{DOM} = 137\,000 - 115\,000 = 22\,000\,kg
\]

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.

<table>
<thead>
<tr>
<th>MTOM limited traffic load</th>
<th>MLM limited traffic load</th>
<th>MZFM limited traffic load</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTOM 195 000 kg</td>
<td>MLM 142 000 kg</td>
<td>MZFM 137 000 kg</td>
</tr>
<tr>
<td>DOM 115 000 kg</td>
<td>DOM 115 000 kg</td>
<td>DOM 115 000 kg</td>
</tr>
<tr>
<td>Trip fuel 45 244 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landing fuel 6200 kg</td>
<td>Landing fuel 6200 kg</td>
<td></td>
</tr>
<tr>
<td>Traffic load 28 556 kg</td>
<td>Traffic load 20 800 kg</td>
<td>Traffic load 22 000 kg</td>
</tr>
</tbody>
</table>

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.*
Basic empty mass

Basic empty mass  Crew and special equipment

Dry operating mass

Basic empty mass  Crew and special equipment  Traffic load

Zero fuel mass

Basic empty mass  Crew and special equipment  Traffic load  Fuel  Start up and taxi

Ramp mass = take-off mass plus start and taxi fuel

Basic empty mass  Crew and special equipment  Traffic load  Fuel

All up mass = take-off mass

Fig. MB 7.1  Graph showing how the ramp mass is compiled
Fig. MB 7.2  Mass and load definitions