Other Airfield Capacities

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Capacity of Taxiways

The capacity of the taxiway system is rarely, if ever, the capacity bottleneck of major airports. However, some specific parts of the taxiway system may consistently act as “hot spots” (points of congestion), especially at older, limited-area airports. Local geometry and traffic flows determine the location of these hot spots. The blocking of groups of stands by a single lane passage is one of the most common examples of such taxiway hot spots.

Single lane vs. dual lane access to stands
Capacity of Aprons

- Often a tough problem!
- Different stands can accommodate different sizes of aircraft
- Remote vs. contact stands
- Shared use vs. exclusive use (airlines, handlers)
- Dependence among neighboring stands
- Static capacity: No. of aircraft that can be parked simultaneously at the stands. (Easy!)
- Dynamic capacity: No. of aircraft that can be accommodated per hour. (Can be difficult to compute.)

Stand Blocking Time (SBT)

- Scheduled occupancy time (SOT) [20 minutes to 4 hours, except for overnight stays]
- Positioning time (PT) [3 – 10 mins]
- Buffer time (BT) [up to 1+ hour at some locations]

\[ SBT = SOT + PT + BT \]

A Simple Case

- Assume \( n \) stands; all can accommodate all aircraft sizes
- Subdivide aircraft into \( K \) relatively homogeneous classes w.r.t. \( SBT \)

\[ E[SBT] = \sum_{i=1}^{K} p_i \cdot SBT_i \]

- Dynamic capacity = \( n / E[SBT] \)

Annual Airside Capacity

- The number of aircraft movements that can be handled at a reasonable level of service in one year
- Vaguely defined, but very important for planning purposes
- Runway system is typically the limiting element
- Estimation of annual capacity must consider:
  - Typical hourly (saturation) capacity
  - Pattern of airport use during a day
  - Reasonable level of delays during busy hours of day
  - Seasonal and day-of-the-week peaking patterns of demand

Reference: Chapter 11, Section 11-4
Annual Airside Capacity: Boston Example

1. Typical hourly runway capacity (based on CCC) = 115. Compute: $A = 115 \times 24 \times 365 = 1,007,400$
2. Equivalent of ~16-17 hours of strong activity per day. Compute: $1,007,400 \times (16/24) = 671,600$
3. ~85% utilization in busy hours for (barely) tolerable delays Compute: $671,600 \times 0.85 = 570,860$
4. Summer season days have about 15% more movements than winter season days 
\[(570,860 / 2) + (570,860 / 2) \times (1 / 1.15) \approx 534,000\]
This is a rough estimate of the ultimate capacity of Logan airport, without expansion of capacity

Peaking Characteristics of 80 Airports in ACI Survey (1998)

<table>
<thead>
<tr>
<th>Total annual pax (million)</th>
<th>Sample size</th>
<th>Average monthly peaking ratio$^*$</th>
<th>Range of monthly peaking ratios</th>
<th>Monthly peaking ratios greater than 1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;20</td>
<td>23</td>
<td>1.18</td>
<td>1.09 – 1.43</td>
<td>6 of 23 (26%)</td>
</tr>
<tr>
<td>10 – 20</td>
<td>13</td>
<td>1.25</td>
<td>1.08 – 1.55</td>
<td>9 of 13 (69%)</td>
</tr>
<tr>
<td>1 – 10</td>
<td>44</td>
<td>1.35</td>
<td>1.11 – 1.89</td>
<td>34 of 44 (77%)</td>
</tr>
</tbody>
</table>

$^*$ Monthly peaking ratio = (average number of passengers per day during peak month) / (average number of passengers per day during entire year)

Annual Capacity Coverage Chart: Boston/Logan

Estimating Annual Capacity: Generalization

Let $C$ be the typical saturation capacity per hour of airport X and let $A = C \times 24 \times 365 = C \times 8760$
Then the annual capacity of $X$ will be in the range of 50%- 60% of $A$, the percentage depending on local conditions of use and peaking patterns.

Note: If instead of saturation capacity, $C$ is the declared capacity, then the annual capacity will be in the range of 60%- 70% of $A$, since the declared capacity is usually set to approximately 85%- 90% of saturation capacity.