5.3.2 Stall Speed

Use Raymer Fig. 5.3, or annotation to Section 5.3.3 (Fig. 5.3.3.1), to estimate $C_{L_{max}}$ for your airplane.

The difficult question to answer is what kind of flap system to use. For given takeoff and landing field length requirements a simple flap system may result in a wing that is larger than optimum for the cruise condition, resulting in increased weight and drag. A complicated flap system may permit the wing to be smaller, but will result in increased design cost, weight and maintenance.

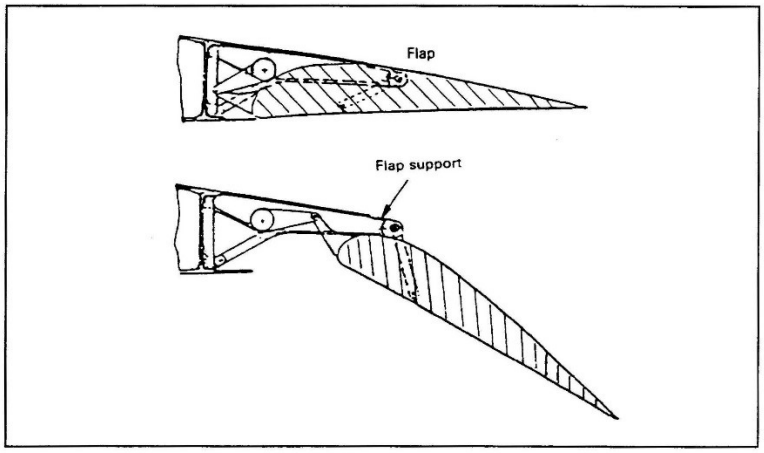

Figure 5.3.2.1 Boeing 747SP Single-slotted Flap System

An interesting example of optimizing the flap system for the mission is for a derivative where the wing was already designed (so the wing area was fixed), but the existing flap system was more complex than necessary for the new mission requirements. The Boeing 747-100 had a triple-slotted flap system. A derivative of the Boeing 747 was the 747SP (Special Performance), which was designed for long, thin (i.e. low traffic) routes. This derivative was purchased by Pan Am (and these airplanes were later flown by United Airlines after they took over Pan Am's routes) and CAAC for transpacific routes such as San Francisco - Hong Kong, and San Francisco - Beijing. The reduction in the number of seats available resulted in a fuselage that was shortened by 48 ft, so that more fuel could be added for the longer range. This resulted in a lower landing weight, so that the complex flap system was no longer required. The designers decided to replace the triple-slotted flaps with single-slotted flaps, which were lighter, offered less drag (the mechanism for the triple-slotted flaps was housed in underwing fairings called canoes, and these could be removed), and lower maintenance.