**VLOF**: Lift off speed  
- Short runways **higher flaps** to take-off faster **lower VLOF** but lowers **climb performance**  
- Distant obstacles **lower flaps** higher **VLOF**, higher **ground roll distance**  
- **Higher with increased mass**

**V_{MCG}**:  
- Min control speed on the ground  
- **No nose-wheel steering & no crosswind** used for determination  
- Determined by engine thrust & rudder deflection  
- Determined by primary aerodynamic control only  
- \( V_{MCG} < V_{EF} < V_{1} \)

**V_1**:  
- Pilot decides to **abort take-off AT V_1** (At the last resort)  
- Limited by \( V_{MCG}, V_{R} \) & \( V_{MBE} \)  
- Min value \( V_{MCG} \), max value \( V_{R} \)  
- Must not be exceeded by \( V_{MBE} \)  
  - Can be **higher** than \( V_{MU} \)  
  - Value exceeds correct \( V_1 \) value = ASD will exceed the ASDA  
  - \( V_1 \) increase but \( V_R \) the same = Increased ASD  
- Higher value used with constant mass: TODR decrease & ASDR increase  
- Reduced by **inoperative anti-skid** (Because you are braking manually you need a lower decision speed)  
- OEI obstacle clearance reduces because of **contaminated runway**, but **climb performance remains constant**  
- **Increased with mass** (Because higher mass requires more lift = more speed)  
- **Down slope decreases** \( V_1 \)

**V_R**:  
- Speed at which pilot should start to rotate the aeroplane  
- If aircraft rotates earlier: Stabilizer trim setting miscalculated, centre of gravity too far aft (If calculated \( V_R \) does not cause early rotation, it is just a calculated value)  
- Speed to which rotation to the lift off angle is initiated  
- Must not be less than 1.05\( V_{MCA} \) or \( V_1 \)

**V_{EF}**: 2 seconds are for recognition

**V_{MBE}** (Max brake energy):  
- Must not be exceeded by \( V_{EF} \)  
- If TOM is \( V_{MBE} \) limited, an uphill requires less brake energy thus allows an **increased mass** (A good thing)

**V_2**:  
- Take-off safety speed/take off climb speed or speed at 35ft  
- May not be less than 1.13 \( V_{SR} \) for turbojets  
- May not be less than 1.08 \( V_{SR} \) for turboprops  
- May not be less than 1.10 \( V_{MCA} \)  
- **Limited by \( V_{MCA} \)**: Large flap angles, high air pressure & low aircraft weight (What is good for thrust also increases adverse yaw OEI)  
- **Decreases with higher flaps**  
- **Increased \( V_2 \)** procedure(Improved take-off climb/climb performance procedure):  
  - Only possible when an **excess field length** is available (ASD is not limiting)  
  - Further screen height along runway  
  - Increases **TODR & climb gradient** for a given TOM  
  - \( V_{2MIN} \):  
    - Decrease with higher flaps if not limited by \( V_{MCA} \)  
    - Uses \( V_{SR} \) & \( V_{MCA} \)

**V speeds affected by:**  
- Mass: Lower mass, lower speeds  
- Density altitude: Density altitude increase, thrust decrease, lower \( V_{MCA} \) to counteract yaw OEI  
- Low field elevation = lower speeds  
- Flap settings: Higher flaps = decreased stall speed