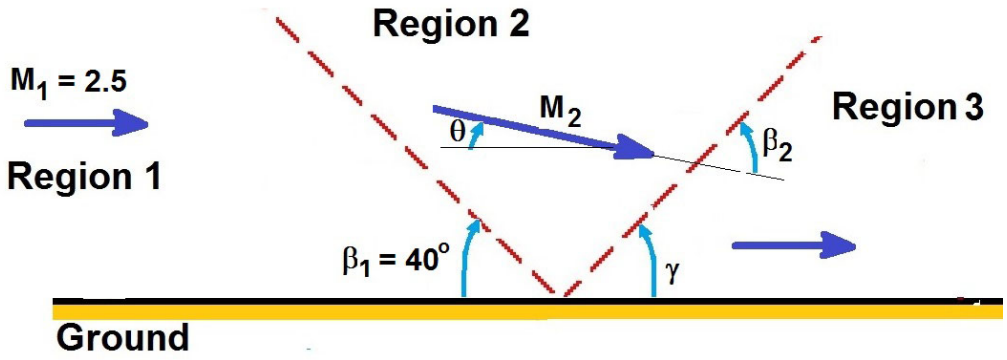
Solution to Problem 354D:

An oblique shock wave at an angle $\beta_1 = 40°$ to a supersonic flow of Mach number 2.5 reflects from a flat wall as shown below:



First analyze the incident shock wave whose upstream Mach number $M_1 = 2.5$ and whose inclination to the incoming flow is $\beta_1 = 40°$. From the oblique shock graph the flow deflection angle, $\theta = 17.7°$. Also since $M_1 \sin\beta_1 = 1.607$ from the shock wave table we find that $M_2 \sin(\beta_1 - \theta) = 0.666$ and therefore $M_2 = 1.755$.

Shifting attention to the reflected shock whose incoming Mach number is $M_2 = 1.755$ and whose flow deflection must turn the flow back to be parallel with the wall so the deflection angle must be $\theta = 17.7°$. The oblique shock graph yields the angle $\beta_2 = 61°$ and therefore the inclination of this downstream flow to the wall must be $\gamma = \beta_2 - \theta = 43.3°$. Notice that the reflection angle of 43.3° is larger than the incident angle of 40°. Moreover, since $M_2 \sin\beta_2 = 1.535$ it follows from the shock wave table that $M_3 \sin(\beta_2 - \theta) = 0.697$ and therefore $M_3 = 1.02$.