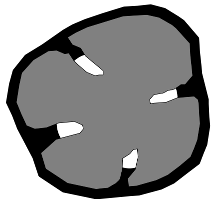
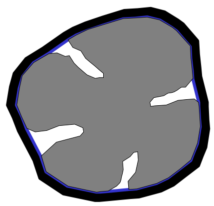
Calculating Effective Specific Gravity

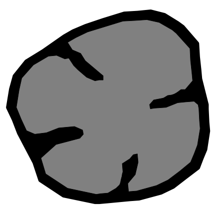
In asphalt concrete, the binder is only partially absorbed into the pervious pores:



If you use the bulk specific gravity to determine the volume occupied by the aggregate particles in an asphalt mix, you'll get an answer that is too high because you are implicitly assuming that none of the binder enters the aggregate pores:



If you use the apparent specific gravity, you'll get an answer that is too low because you are implicitly assuming that the binder completely fills the aggregate pores:



What we need is a specific gravity that only includes that portion of the pervious pores that the binder can't reach. We call this the effective specific gravity (which we will denote by G_{se}).

We can't measure the effective specific gravity directly, but we can calculate it using the formula for the specific gravity of a blend of two materials (in this case, aggregate and asphalt binder). If the air void content of the blend is zero, then its specific gravity is just the theoretical maximum (air-free) specific gravity, G_{mm}. The inverse of this value is equal to the mass-weighted average of the inverses of the effective specific gravity of the aggregate, G_{se}, and the specific gravity of the binder, G_b. The fraction of the blend contributed by the binder is just the asphalt content, P_b, so the specific gravity of the blend can be calculated as:

$$\frac{1}{G_{mm}} = \frac{1-P_b}{G_{se}} + \frac{P_b}{G_b}$$

Rearranging this equation to get G_{se} on the left side of the equal sign:

$$G_{se} = \frac{1-P_b}{\dfrac{1}{G_{mm}} - \dfrac{P_b}{G_b}}$$