

**WEST VIRGINIA DIVISION OF HIGHWAYS**  
**WORKSHEET FOR CALCULATING**  
**BULK SPECIFIC GRAVITIES OF AGGREGATE ( $G_{sb}$ ),**  
**APPARENT SPECIFIC GRAVITIES OF AGGREGATE ( $G_{sa}$ )**  
**AND PERCENT VMA IN COMPACTED PAVING MIXTURE**

The bulk ( $G_{sb}$ ) and apparent ( $G_{sa}$ ) specific gravities of the total aggregate are calculated as follows:

$$G_{sb} = \frac{A_p}{\frac{P_1}{G_1} + \frac{P_2}{G_2} + \dots + \frac{P_n}{G_n}}$$

$G_{sb}$  = bulk specific gravity for the total aggregate

$A_p$  = total aggregate = 100 percent

$P_1, P_2, P_n$  = percentage of total aggregate

$G_1, G_2, G_n$  = bulk specific gravities of aggregates

*Note: When using mineral filler use the apparent specific gravity*

Component Aggregate Type	Percent of Total Aggregate	Bulk Specific Gravity	Apparent Specific Gravity	$G_{sb}$	$G_{sa}$
				100 / [ $P_1/G_1 + P_2/G_2 + \dots + P_n/G_n$ ]	

$$VMA = 100 - [(G_{mb} \times P_s) / G_{sb}]$$

(VMA) voids in mineral aggregate (percent of bulk volume)

( $G_{sb}$ ) bulk specific gravity of aggregate

( $G_{mb}$ ) bulk specific gravity of compacted mixture (AASHTO T-245)

( $P_s$ ) aggregate, percent by total weight of mixture

$G_{mb}$	$P_s$	$G_{sb}$	VMA 100 - [( $G_{mb} \times P_s$ ) / $G_{sb}$ ]

*Note: Report the following values to the nearest thousandth (0.001):*  
 *$G_{sb}, G_{sa}, G_{mb}$ , bulk and apparent gravities of the aggregates*  
*Report VMA to the nearest tenth (0.1)*