Asphalt Mix Volumetrics: Air Voids, VMA, VFB and Effective Binder

Air voids, voids in mineral aggregate, voids filled with binder, effective aggregate specific gravity and absorbed and effective binder of a compacted asphalt mix.

Method: Asphalt mix volumetric relations

Input parameters

Unit system: SI

Parameter	Value	Unit
Bulk specific gravity of compacted mix	2.3500	
Maximum specific gravity of mix	2.4500	
Bulk specific gravity of aggregate	2.6500	
Binder specific gravity	1.0200	
Binder content (by total mix)	5.0000	%

Calculated results

Parameter	Value	Unit
Air voids	4.0816	%
Voids in mineral aggregate	15.755	%
Voids filled with binder	74.093	%
Effective specific gravity of aggregate	2.6452	
Absorbed binder (by aggregate)	-0.070121	%
Effective binder (by mix)	5.0666	%

Notes for this case

• V_a = (G_mm − G_mb)/G_mm; VMA = 1 − G_mbP_s/G_sb; VFB = (VMA − V_a)/VMA; G_se = P_s/(1/G_mm − P_b/G_b); P_ba = G_b(G_se − G_sb)/(G_sbG_se); P_be = P_b − P_baP_s. Typical design targets are about 4 % air voids with VMA and VFB inside the user's specification band for the aggregate size.

Formula and method

$$V_a = \frac{G_{mm} - G_{mb}}{G_{mm}}, \quad VMA = 1 - \frac{G_{mb} P_s}{G_{sb}}, \quad VFB = \frac{VMA - V_a}{VMA}$$

Variables

G_{mb}	Bulk specific gravity of compacted mix	-
G_{mm}	Maximum specific gravity of mix	-
G_{sb}	Bulk specific gravity of aggregate	-
G_b	Binder specific gravity	-
P_b	Binder content (by total mix)	-
V_a	Air voids	-
VMA	Voids in mineral aggregate	-
VFB	Voids filled with binder	-
G_{se}	Effective specific gravity of aggregate	-
P_{ba}	Absorbed binder (by aggregate)	-
P_{be}	Effective binder (by mix)	-

Method and standards

Mix volumetrics.

Assumptions and limits

- Consistent specific gravities from standard tests.

References

Asphalt mix volumetric relations

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/roads/marshall-mix-volumetrics

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Reopens the calculator with the inputs of this report.