

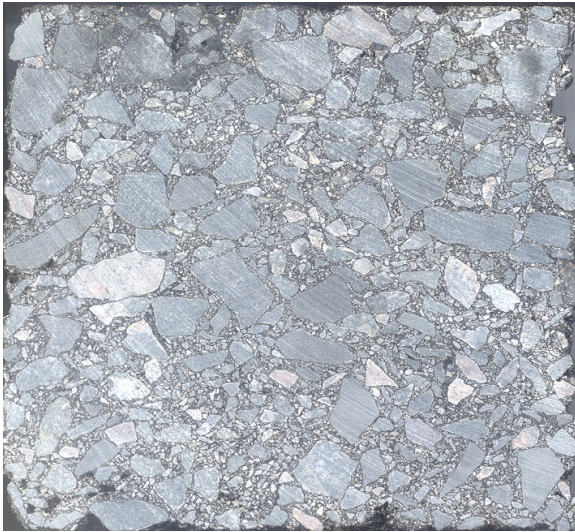
Image Analysis of HMA to Characterize the Aggregate Distribution

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Zhanping You

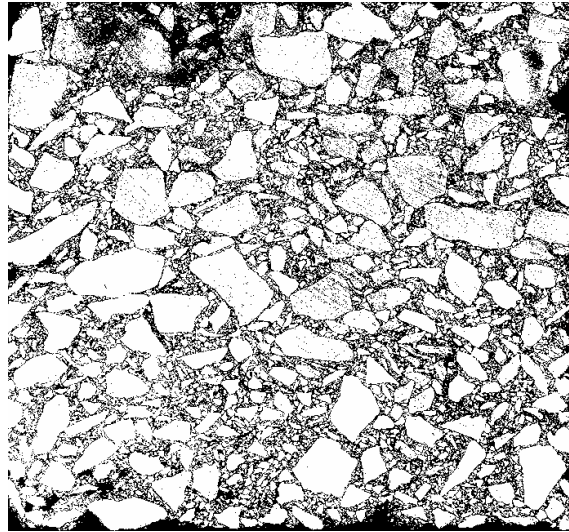
Analysis of Image

- Aggregate Gradation
- Aggregate Orientation

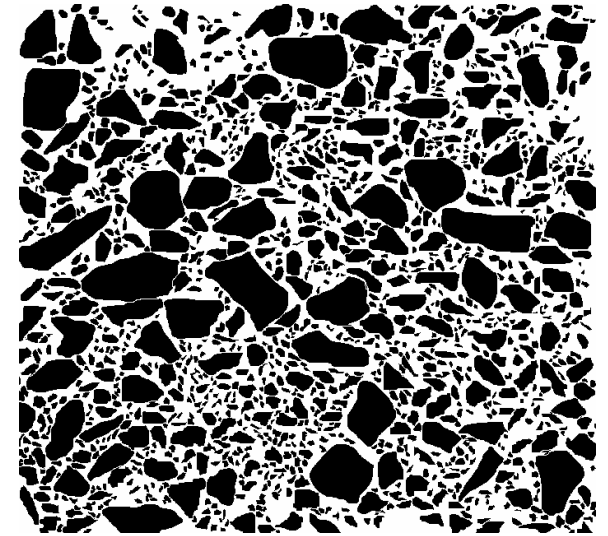
Image Processing



Raw Image



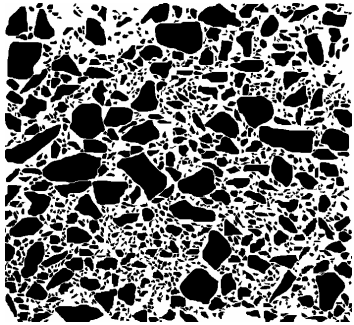
Processed with density index
Mastic: ≤ 164
Aggregate: > 164



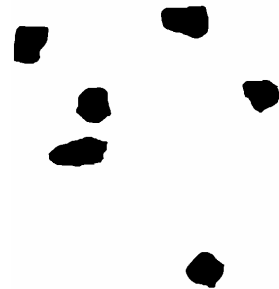
Fine Image Processing

Using Image-Pro software

Sieving of Aggregates



All aggregates



12.5mm-10mm



10mm-8mm



8mm-6.3mm



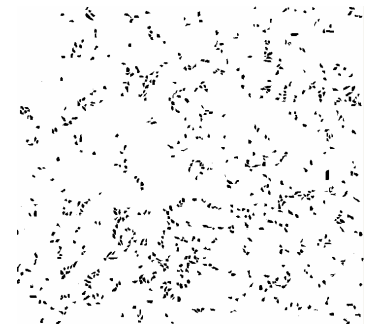
6.3mm-4mm



4mm-2mm



2mm-1mm



<1mm

Aggregates Gradation from Images

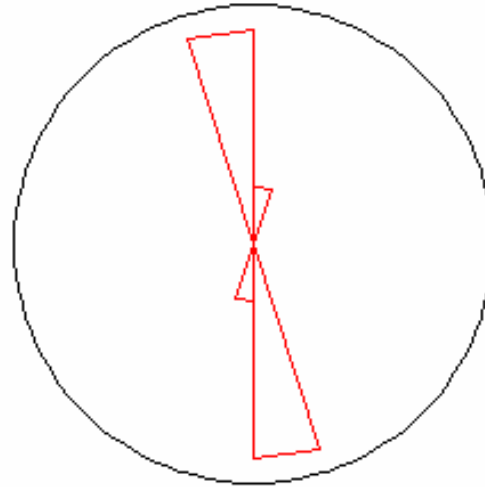
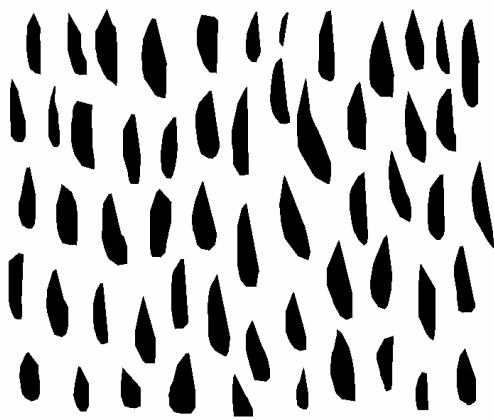
	Total	12.5-10mm	10-8mm	8-6.3mm	6.3-4mm	4-2mm	2-1mm	<1mm
Area	7197.984	744.3232	743.7165	1080.748	1349.627	1685.156	955.7116	636.7655
% Area		10.34072	10.33229	15.0146	18.75009	23.41152	13.2775	8.846447

Sieve size (mm)	From Image		Actual Gradation
	Retain (%)	Passing sieve (%)	
20	0	100	100
14	0	100	97.2
12.5	0	100	92.7
10	10.34072	89.65928	79.6
8	10.33229	79.32698	68.5
6.3	15.0146	64.31239	58.6
4	18.75009	45.5623	46.8
2	23.41152	22.15078	36.4
1	13.2775	8.873285	28.6
0.315	8.846447	0	15.8
0.08		0	7.6

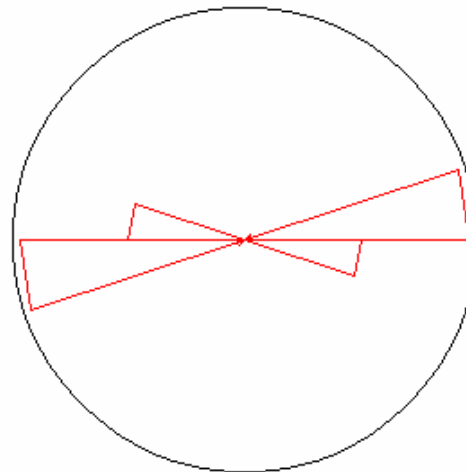
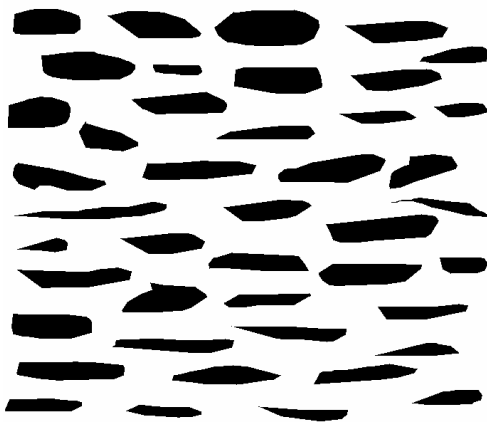
It is difficult to capture aggregate less than 1 mm

Concept: Aggregate Orientation

--Angle histogram using polar plot

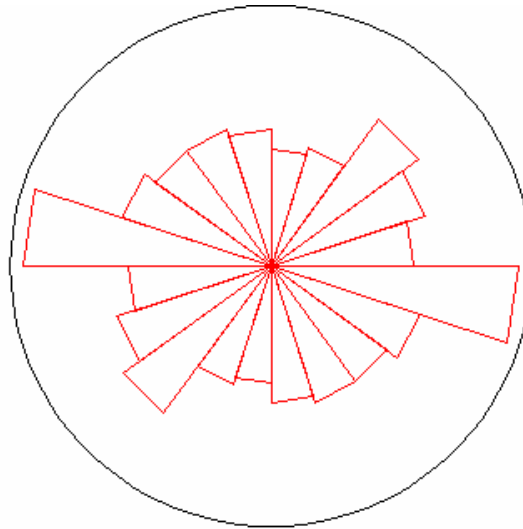
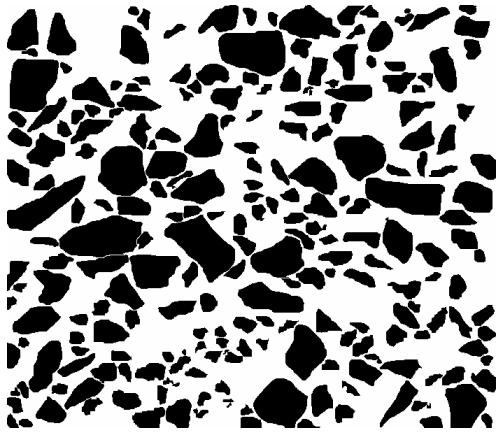


Vertical

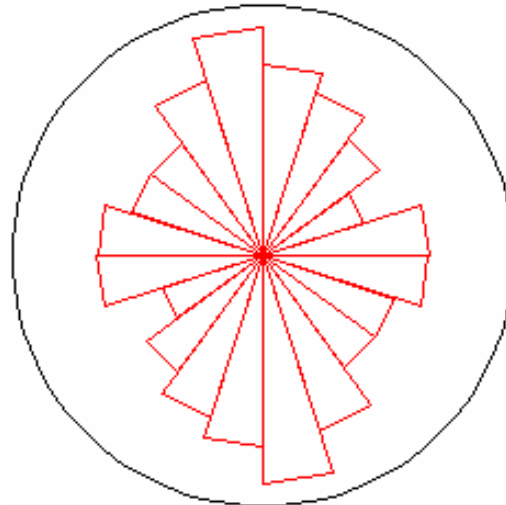
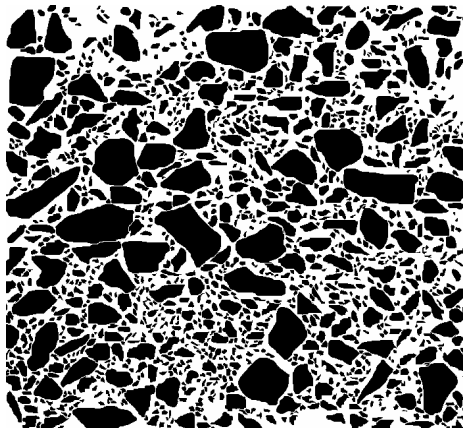


Horizontal

Aggregate orientation of HMA image

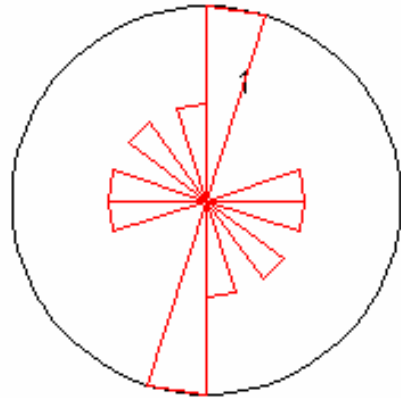
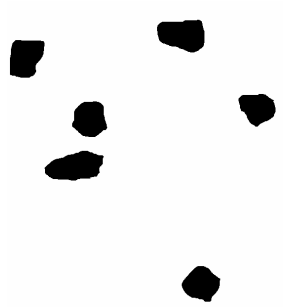


Aggregates greater than 2mm

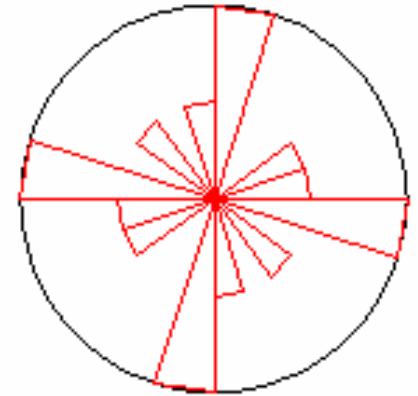


All aggregates

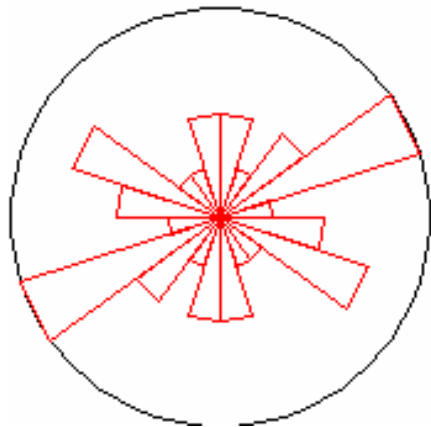
Aggregate Orientation: 1



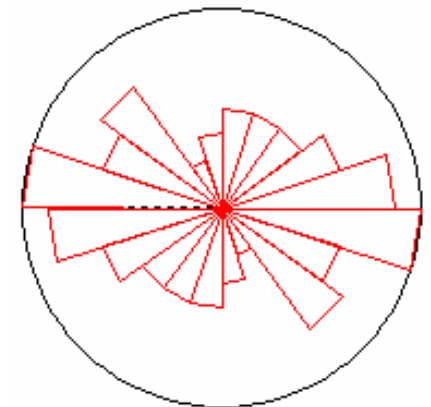
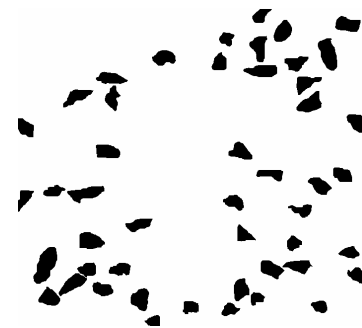
12.5mm-10mm



10mm-8mm

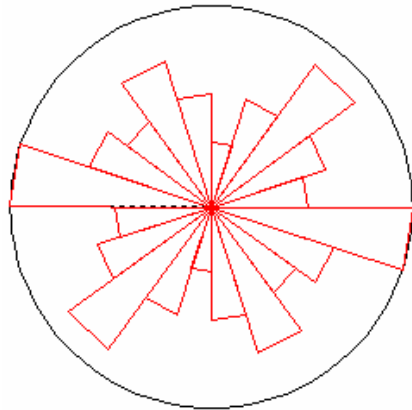


8mm-6.3mm

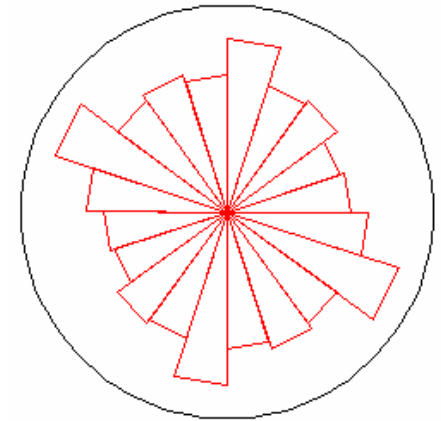


6.3mm-4mm

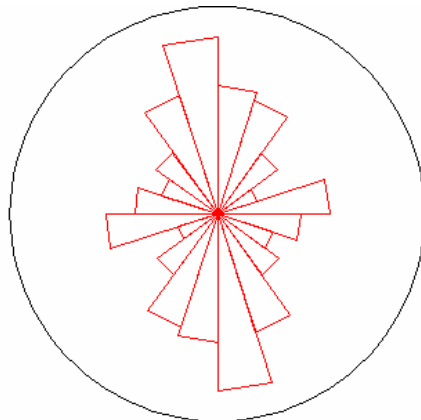
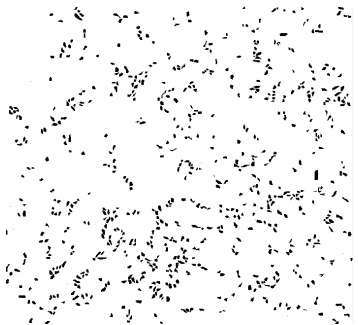
Aggregate Orientation: 2



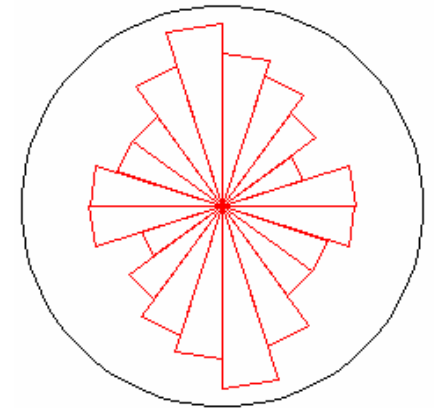
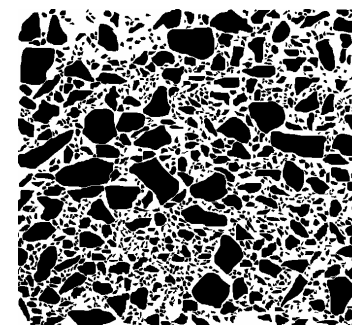
4mm-2mm



2mm-1mm



<1mm



All aggregates