
Test Procedure for

**OPTIMIZED AGGREGATE GRADATION FOR
HYDRAULIC CEMENT CONCRETE MIX DESIGNS**



TxDOT Designation: Tex-470-A

Effective Date: April 2016

1. SCOPE

- 1.1 This method outlines the procedure for analyzing combined aggregate gradations for optimized **aggregate gradation (OAG)** in concrete mix designs.
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2. UNITS OF MEASUREMENT

- 2.1 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
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3. APPARATUS

- 3.1 The apparatus required for sampling aggregates and performing sieve analysis will be as stated in:
- Tex-400-A and
 - Tex-401-A.
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4. PROCEDURE

- 4.1 Perform sieve analysis in accordance with Tex-401-A to determine the percent passing for each proposed aggregate stockpile, except use all standard sieves starting with the nominal maximum aggregate size of the proposed coarse aggregate to the No. 200 sieve. **Note 1** —Consider intermediate size aggregates as either coarse or fine aggregate in this test method.
- 4.2 Determine the cumulative combined percent passing, the cumulative combined percent retained, and the combined percent retained **using the equations in Section 5.**
- 4.3 Complete the Sieve Analysis Table, based on the example shown in Table 1, with the percent passing and the percent of each aggregate used in the proposed mix design.
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- 4.4 Generate the combined Percent Retained Chart described in Section 6. The combined percent retained gradations must meet the following criteria.
- The combined percent retained for each sieve must be within the upper and lower boundaries shown in Figure 1.
 - The sum of the percent retained on the No. 8 sieve to the No. 30 must not be less than 15%.
 - The sum of the percent retained on the No. 30 sieve to the No. 200 sieve must be between 24% and 34%.
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5. CALCULATIONS

- 5.1 Calculate the cumulative combined percent passing each sieve.

$$\text{Cumulative Combined \% Passing} = \sum \{(A)(B)\}$$

Where:

A = % passing and

B = % of aggregate used in proposed mix design.

- 5.2 Calculate the cumulative combined percent retained on each sieve.

$$\text{Cumulative Combined \% Retained} = 100\% - C$$

Where:

C = Cumulative Combined % Passing.

- 5.3 Calculate the combined percent retained on each sieve.

$$\text{Combined \% Retained} = D - E$$

Where:

D = Cumulative Combined % Retained and

E = Cumulative Combined % Retained of next larger size.

Table 1—Example Sieve Analysis Table

Sieve Size	Coarse Aggregate			Fine Aggregate		Cumulative Combined		Combined
	Agg. 1, % Passing	Agg. 2, % Passing	Agg. 3, % Passing	Agg. 1, % Passing	Agg. 2, % Passing	% Passing	% Retained	% Retained
2 in.	100	100	-	100	-	100	0	0
1-1/2 in.	100	100	-	100	-	100	0	0
1 in.	95	100	-	100	-	98	2	2
3/4 in.	62	100	-	100	-	81	19	17
1/2 in.	35	100	-	100	-	67	33	14
3/8 in.	20	95	-	100	-	59	41	8
No. 4	1	65	-	100	-	46	54	13
No. 8	-	1	-	96	-	36	64	10
No. 16	-	-	-	79	-	29	71	7
No. 30	-	-	-	45	-	17	83	12
No. 50	-	-	-	17	-	6	94	11
No. 100	-	-	-	7	-	3	97	3
No. 200	-	-	-	2	-	1	99	3
Pan	-	-	-	0	-	0	100	1
% of Aggregate	50%	13%	0%	37%	0%	-	-	-

6. CHARTS

- 6.1 *Percent Retained Chart*—Create the Percent Retained Chart (Figure 1) by plotting the combined percent-retained (y-axis) vs. the sieve sizes (x-axis).

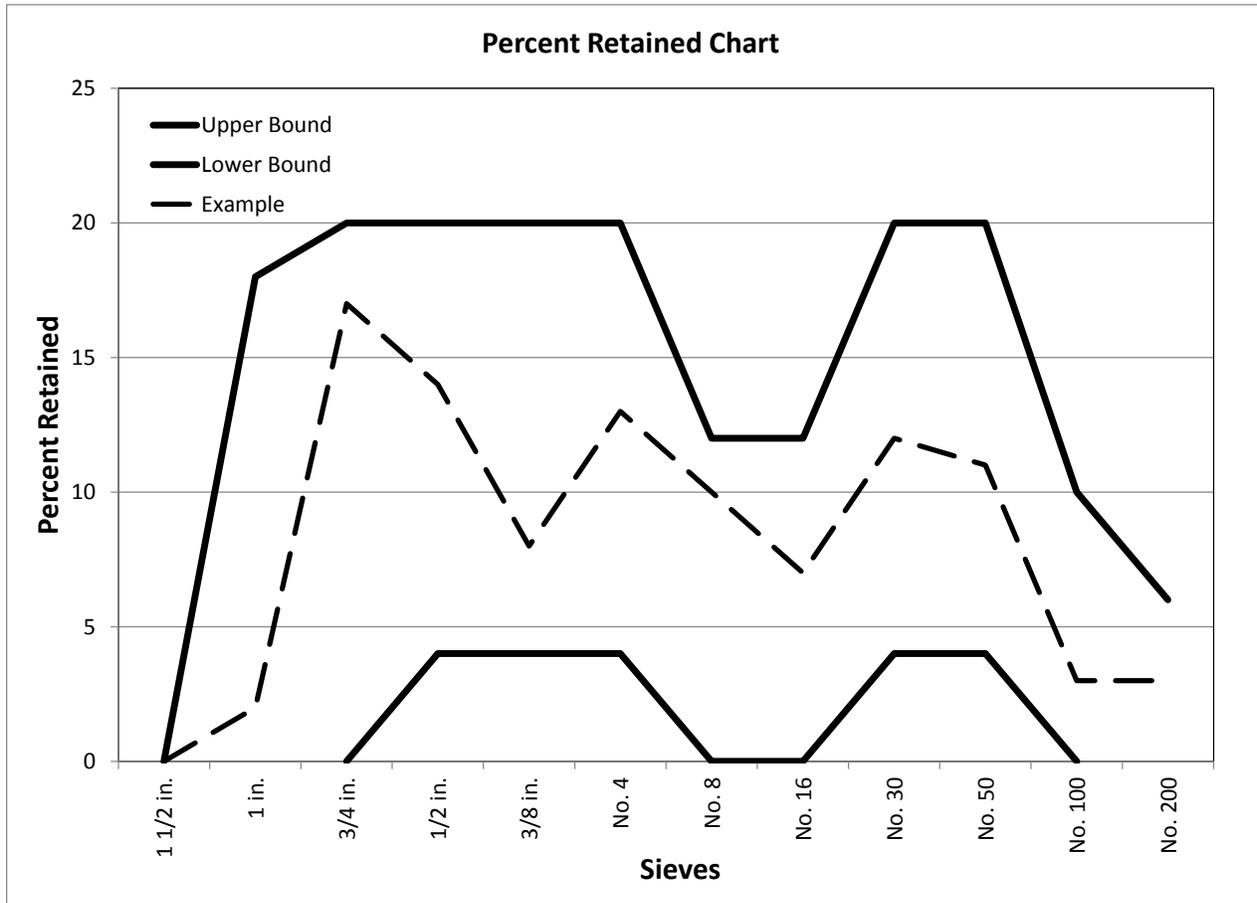


Figure 1—Combined Percent Retained Chart

7. ARCHIVED VERSIONS

7.1 Archived versions are available.