

5.16.59 FLAT AND ELONGATED PARTICLES IN COARSE MATERIAL TEST (KANSAS TEST METHOD KT-59)

**a. SCOPE**

This test method covers the determination of the percentage of flat and elongated particles in coarse aggregates. **KT-59** reflects testing procedures found in ASTM D 4791.

This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

**b. REFERENCED DOCUMENTS**

**b.1.** KT-1; Sampling Aggregates

**b.2.** KT-2; Sieve Analysis of Aggregates

**b.3.** AASHTO M 231; Balances used in the Testing of Materials

**b.4.** ASTM D 4791; Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

**c. DEFINITIONS**

**c.1.** Flat and elongated particles of aggregate—those particles of aggregate having a ratio of length to thickness greater than a specified value.

**c.2.** Failure of a particle exists when the particles small ratio (the 1 in 5:1) fails to slide the full length through the opening established by the large ratio (the 5 in 5:1). **EXAMPLE:** Checking flat and elongated particles requires comparing the length vs. thickness. After setting the large ratio to the maximum length of the particle, attempt to slide the flattest portion of the particle horizontally through the opening of the small ratio. If the particle passes clear through the opening, then the particle fails the flat and elongated test.

**d. SIGNIFICANCE AND USE**

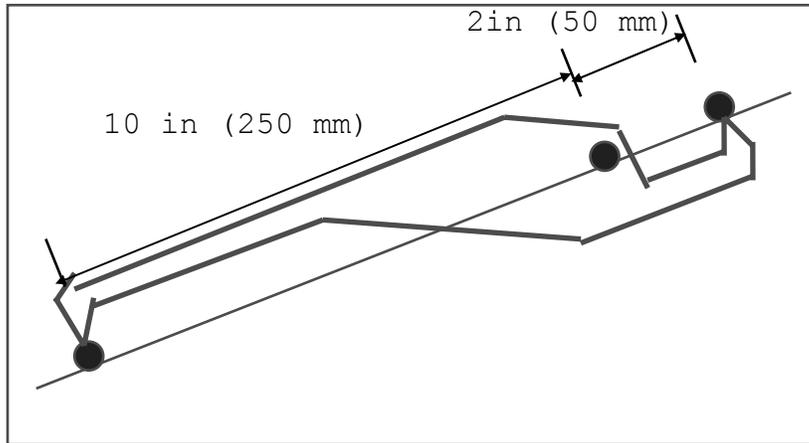
**d.1.** Flat and elongated particles of aggregates, for some construction uses, may interfere with consolidation and result in harsh, difficult to place materials.

**d.2.** This test method provides a means for checking compliance with specifications that limit such particles, or to determine the relative shape characteristics of coarse aggregates.

**e. APPARATUS**

**e.1.** Use apparatus suitable for testing aggregate particles for compliance with the definition in **c.1.**, at the dimensional ratios desired.

**e.1.a.** Proportional Caliper Device The Proportional caliper device illustrated in **Figs. 5.16.59-1** is an example of all apparatus suitable for this test method. It consists of a base plate with two fixed posts and a swinging arm mounted between them so that the openings between the arms and the posts maintain a constant ratio.



**Figure 5.16.59-1 Proportional Caliper**

The caliper and pins are to be perpendicular to the base plate and rise at least 2 in (50 mm) in height. Design the caliper to touch the length of the fixed pins simultaneously. Provide a 5:1 ratio between the two fixed pins and the center pins. Design the center pin so the caliper can be easily locked into position. Make the base plate, caliper and pins of rigid and durable materials.

Fig. 5.16.59-1 illustrates a device on which the ratio 5:1 is set.

**e.1.b.** Balance to meet the requirements of AASHTO M 231 for the class of general purpose balance required for the principal sample mass of the sample being tested.

**f. SAMPLING**

**f.1.** Sample the coarse aggregate in accordance with **KT-1**. **KT-2** provides the mass requirements from the field.

**f.2.** Thoroughly mix the test sample and reduce it to an amount suitable for testing using the applicable procedures described in **KT-1**. Provide test sample quantities at approximately the mass desired when dry and as an end result of the reduction. Reduction to an exact predetermined mass is not permitted.

Conform the mass of the test sample to the following:

Nominal Maximum Size Square Openings, in. (mm)	Minimum Mass of Test Sample, lb (kg)
# 4 (4.75).....	1 (0.5)
3/8 (9.5) .....	2 (1)
1/2(12.5) .....	4 (2)
3/4(19.0) .....	11 (5)
1(25.0) .....	22 (10)
1 1/2(37.5) .....	33 (15)

**g. PROCEDURE**

**g.1.** Oven dry the sample to constant mass at a temperature of  $230 \pm 9^{\circ}\text{F}$  ( $110 \pm 5^{\circ}\text{C}$ ).

**g.2.** Sieve the sample of coarse aggregate to be tested in accordance with **KT-2**. Reduce each size fraction larger than the # 4 (4.75 mm) sieve present in the amount of 10% or more of the original sample in accordance with **KT-1** until approximately 100 particles are obtained.

**g.3.** With the proportional device set at a **5:1 ratio**, test each of the particles in each size fraction for flat and elongated.

**g.3.a.** Use the Proportional caliper device, shown in **Figure 5.16.59-1**. Set the larger opening equal to the particle length. The particle is flat and elongated if the flattest portion of the particle can be placed through the smaller opening. Determine the proportion of the sample in each group by mass.

**h. CALCULATION**

**h.1.** Calculate the percent of flat and elongate particles to the nearest 1% for each sieve size greater than #4 (4.75 mm).

**h.2.** When a weighted average for a sample is required, assume that the sieve sizes not tested (those representing less than 10% of the sample) have the same percentage of flat and elongated particles as the next smaller or the next larger size, or use the average for the next smaller and larger sizes, if both are present.

**i. REPORT**

**i.1.** Include the following information in the report:

**i.1.a.** Identification of the coarse aggregate tested,

**i.1.b.** Grading of the aggregate sample, showing percentage retained on each sieve,

**i.1.c.** Percentages, calculated by mass for Total Flat and Elongated particles, for each sieve size tested, and the combined aggregate percent for flat and elongated particles.

**i.1.d.** When required, weighted average percentages based on the actual or assumed proportions of the various sieve sizes tested. Report the grading used for the weighted average if different from that in **i.1.b.**

**j. PRECISION AND BIAS**

**j.1.** Precision- The precision of this test method is being determined.

**j.2.** Bias- Since there is no accepted reference material suitable for determining the bias for this test method no statement on bias is being made.