Annex A (normative)

Identification of original aggregate

A.1 General

This Annex specifies the methods for identifying the original aggregate of the recycled aggregate H for concrete.

A.2 Method for identification

The original aggregate shall be identified for each construction as stated below.

a) **Where the record on the original aggregate is accessible** If the class and place of production or name of product of the original aggregate can be identified by such as the work record of the demolished construction, the mix proportion report of the original concrete, the test result certificate of the original aggregate, etc., the original aggregate is regarded as identified.

b) **Where no record on the original aggregate is accessible** If the class and place of production or name of product of the original aggregate cannot be identified by such as the work record of the demolished construction, the mix proportion report of the original concrete, the test result certificate of the original aggregate, etc., a portion of the original concrete shall be taken according to A.3 on which observation shall be made for the color, shape and size of the original aggregate. If, as a result of this observation, the class and number of the original aggregates are successfully identified, the all the original aggregates contained in the original concrete are regarded as identified, although with unknown place of production and name of product.

A.3 Sampling method of original concrete

The sampling of the original concrete shall be in accordance with either of the followings.

a) **Where sampling from constructions**

1) Using a core drill for concrete or a cutter for concrete, a portion of the original concrete shall be taken in such a size that the identification of the color, shape and size of the original aggregate is possible.

2) The original concrete shall be sampled at at least one position of each floor and of a wall or pillar on each floor in the case of a building, and at at least one position of each placing division in the case of civil engineering construction. If the amount of concrete at the sampling division exceeds 1,000 m^3, sampling shall be made at at least one position in each 1,000 m^3.

b) **Where sampling from concrete lumps**

1) At the timing of receiving concrete lumps, a portion of the original concrete shall be taken in such a size that the identification of the color, shape and size of the original aggregate is possible.
2) The sampling shall be taken more than one time per each 10t of concrete lumps.

Annex B (normative)

Test method for impurities of recycled aggregate H by means of boundary sample

B.1 General

This Annex specifies the test of impurities of the recycled aggregate H for concrete.

B.2 Specimen

B.2.1 Sampling of specimen

The recycled aggregate H shall be sampled so as to represent the lot being tested. The sample then shall be reduced approximately to a specified amount in accordance with JIS A 1158.

B.2.2 Size of specimen

The minimum mass of the specimen shall be 10 kg in the case of recycled coarse aggregate H and 500g in the case of recycled fine aggregate H.

B.3 Test method

The specimen which spread wide enough for impurities to be clearly identified by visual observation over a saucer or the like shall be visually compared with the boundary samples specified in B.4 indicating the upper limit of the amount of each impurity, and the amount of each impurity shall be estimated[1)]. In estimation of amount of metal pieces other than aluminium or zinc pieces, if distinguishing them from the aluminium or zinc pieces is difficult, the estimation may include the amount of aluminium and zinc pieces. If visual determination of impurities is difficult by reason of dryness, bring the specimen into a wet state by, for example, spraying water. The total of the estimated amounts of all the impurities shall be taken as the total amount of impurities.

Note[1)] The amount of each impurity may be determined from mass measurement of the impurity.

B.4 Method for preparation of boundary samples

Samples containing respective impurities given in Table 4 shall be prepared by adding each of the impurities to impurity-free recycled coarse aggregate H or recycled fine aggregate H of which amount shall be as given in B.2.2, up to their respective upper limit. The size and shape of the impurities shall simulate such size and shape as contained in the recycled coarse aggregate H and recycled fine aggregate H after manufacture. If any impurity considered to be in nonconformity with the classification in Table 4 is expected to be contained, another boundary

sample shall be prepared separately. For comparison, the photograph of the prepared boundary sample which spread as same size of B.3 may be used.

NOTE : In addition to the boundary samples containing the upper limit amount of impurities, those containing half the upper limit amount of impurities may be prepared for convenience in judgement.

Note[2] : When identification is difficult by a photograph, the impurities in the boundary sample or in the photograph should be colored as necessary.

Annex C (normative)

Testing method of judgement for harmful amount of aluminium pieces and zinc pieces contained in recycled aggregate for concrete-class H

C.1 General

This Annex specifies the testing method of judgement for harmful amount of aluminium pieces and zinc pieces contained in recycled aggregate-class H.

C.2 Testing instrument

C.2.1 Erlenmeyer flask

An Erlenmeyer flask as specified in JIS R 3503, 1,000ml in capacity and not less than 25mm in inside diameter at the neck part.

C.2.2 Pipette

A pipette as specified in JIS R 3505, not less than 20ml in capacity and graduated in 0.1ml.

C.2.3 Perforated rubber stopper

A perforated rubber stopper provided with a hole through which a pipette can be inserted without any clearance.

C.2.4 Calcium hydroxide

The calcium hydroxide as specified in JIS K 8575.

C.3 Specimen

C.3.1 Sampling of specimen

The recycled aggregate H shall be sampled so as to represent the lot being tested, and that which has passed through a sieve of nominal size of 20mm shall be supplied as the specimen.

C.3.2 Reduction of specimen

The specimen shall be reduced approximately to the specified amount given in accordance with JIS A 1158.

C.3.3 Amount of specimen

The specimen for test shall be 1,000g in air-dried mass.

C.3.4 Conditioning of specimen

The specimen for test shall be immersed in water for 24 h or longer before the start of test so that it absorbs sufficient water.

C.4 Test method

The test method shall be as follows.

a) The temperature of laboratory and the temperature of water shall be 20℃±3℃.

b) Put the specimen for test in an Erlenmeyer flask, pour 600 ml of water and shake the Erlenmeyer flask lightly.

c) Insert a pipette in a perforated rubber stopper, attach it to the Erlenmeyer flask and adjust so that the tip of the pipette is immersed in water to a depth of at least 1 cm.

d) Detach the rubber stopper with the inserted pipette from the Erlenmeyer flask, add 0.5 g of calcium hydroxide to the Erlenmeyer flask and shake the Erlenmeyer flask lightly.

e) Quickly attach the rubber stopper with the inserted pipette to the Erlenmeyer flask, leave it to stand for 10 min, read the graduation of the water level of the pipette to the nearest 0.1 ml and take it as the initial value.

f) In 24 h elapse after the addition of calcium hydroxide, shake the Erlenmeyer flask lightly, read the graduation of water level of pipette to the nearest 0.1 ml and take the difference from the initial value as the amount of gas generation.

C.5 Report

The report shall including the necessary from among the following.

a) The producer's name of recycled aggregate H

b) The position, date and time of sampling the recycled aggregate H

c) The amount of gas generation (ml)

d) The date of test

Annex D (normative)

Test method for alkali-silica reactivity of recycled aggregate for concrete-class H

(recycled aggregate rapid method)

D.1 General

This Annex specifies the method of rapidly measuring the alkali-silica reactivity of the recycled aggregate for concrete-class H by curing mortar bar at high temperature and high pressure and measuring the change of its characteristics.

D.2 Testing instrument

The testing instrument shall be in accordance with Clause 3 (Testing instrument) of JIS A 1804.

D.3 Specimen

The preparation of specimen shall be as follows.

a) Take about 40 kg of representative portion from the recycled coarse aggregate H and the recycled fine aggregate H.

b) Mix well the 40 kg of recycled aggregate H and reduce it to about 10 kg in accordance with JIS A 1158.

c) Wash the reduced recycled aggregate H, and after bringing it to an oven-dry condition, grind it coarsely by a sand-manufacturing machine until the whole amount has passed through a 5 mm sieve. Mix this well, and reduce to about 5 kg by quartering or by means of a sample splitter and take it as the representative specimen.

d) Grind the representative specimen by the sand-manufacturing machine successively and classify according to the grain size indicated in Table D.1.

After the specified amount of specimen is taken, the residual representative specimen shall be ground until the whole amount has passed through the remaining sieve.

e) Wash the representative specimens of each grain size with water, remove the minute particles, then bring it to an oven-dry condition.

f) Mix the representative specimens of each grain size in the oven-dry condition so as to be in accordance with the grain size distribution indicated in Table D.1, and take it as the test specimen.

g) The test specimen shall be supplied for the test in the oven-dry condition or in the air-dried condition.

Table D.1 Grain size distribution of graded test specimen

Nominal opening of sieve		Mass fraction
Passed	Remained	%
4.75mm	2.36mm	10
2.36mm	1.18mm	25
1.18mm	600μm	25
600μm	300μm	25
300μm	150μm	15

D.4 Material

The material shall be as follows.

a) **Cement** The normal portland cement specified in JIS R 5210, of which the total alkali amount Na_2Oeq is (0.50±0.05) %, and the ratio of Na_2O (%) to K_2O (%) is in the range of 1 : 1 to 1 : 2.5 shall be used.

b) **Standard sand** The standard sand specified in 11.3 of JIS R 5201 shall be used.

c) **Sodium hydroxide** The aqueous solution prepared using the reagent specified in JIS K 8576 shall be used. A.2 mol/L aqueous solution of sodium hydroxide which is available on the market may also be used.

d) **Water** The water used for mixing of mortar and that used for adjusting the concentration of the aqueous solution of sodium hydroxide shall be the city water.

D.5 Preparation and curing of specimen

D.5.1 Mix proportion number and mix proportion of mortar

The mix proportion number and mix proportion of mortar for each measuring method shall be as follows.

a) **For measurement of ultrasonic propagation velocity or dynamic modulus of elasticity**

1) **Mix proportion number of mortar** The mix proportion number of mortar shall be one and the constitution ratio of fine aggregate shall be in accordance with the constitution condition of fine aggregate 1 indicated in Table D.2.

2) **Mix proportion of mortar** The mix proportion of mortar shall be such that the mass ratio of cement, water and fine aggregate (standard sand + test specimen) is 1 : 0.5 : 2. The amount of cement, water + sodium hydroxide aqueous solution, fine aggregate (standard sand + test specimen) mixed in one time shall be as follows.

The amount of sodium hydroxide aqueous solution shall be determined by calculating so that the total alkali amount of cement becomes 2.50 % in Na_2Oeq.

Cement	: 600 g ± 1 g
Water + sodium hydroxide aqueous solution	: 300 ml ± 1ml
Fine aggregate (standard sand + test specimen)	: 1,200 g ± 1 g

b) **For measurement of change rate of length**

1) **Mix proportion number of mortar** The mix proportion number of mortar shall be four, with the constitution ratio of fine aggregate changed. The test shall be first carried out with the fine aggregate constitution condition 1 in Table D.2, and depending on the result, additional tests shall be carried out with the constitution conditions 2 to 4 as necessary.

2) **Mix proportion of mortar** The mix proportion of mortar shall be in accordance with a) 2).

Table D.2 Constitution ratio and mass of fine aggregate (standard sand, test apecimen)

Constitution condition of fine aggregate	Constitution ratio of fine aggregate (mass ratio)		Mass of fine aggregate g		
	Standard sand	Test specimen	Standard sand	Test specimen	Total
1	50	50	600	600	1,200
2	0	100	0	1,200	1,200
3	25	75	300	900	1,200
4	75	25	900	300	1,200

D.5.2 Mixing of mortar

Fix the mixing bowl and the paddle at the mixing position and put in the specified amount of cement and fine aggregate. Start the mixer and perform mixing by rotating the paddle for 30 s. Next, stop the mixer and pour the specified amount of water with the sodium hydroxide aqueous solution. Continue to operate the mixer for 30 s, then stop it for 20 s. During the stop, scrape off the mortar adhered to the mixing bowl and the paddle by a spoon. Then, stir the mortar in such a way as to scoop up from the bottom of bowl. After the stop, start the mixer again and perform mixing for 120 s.

The rotation speed of the paddle, for any case, shall be a low speed (rotation speed : 140 r.p.m ±5 r.p.m, revolution speed : 62 r.p.m ± 5 r.p.m).

D.5.3 Preparation and curing of specimen

The preparation and curing of specimen shall be as follows.

a) The mortar shall be immediately cast into the formwork in two layers. Compact the mortar to half the height of the formwork and strike 15 times each layer of every specimen by using a ram such that its tip goes into the mortar to a 5mm depth in each strike. The number of striking

shall be reduced if separation of mortar is feared. In the vicinity of the gauge plug, special attention shall be paid to spread the mortar sufficiently by performing spacing or the like. Next, place additional mortar up to a height of about 5mm above the upper end of the formwork, and strike with a ram in a similar manner to the first time. Finish the surface of this specimen within about 20 min after forming.

b) Prepare three specimens of rectangular parallelepiped of 40 mm×40 mm×160 mm (when the change of length is measured, a gauge plug may be attached). After forming, cure the specimens in a humid box at 20℃±2℃ in temperature and not less than 95 % in relative humidity for 24 h, then remove the formwork, and immediately carry out curing in water at 20℃ ±2℃ for 24 h.

D.6 Test method

The test method shall be in accordance with Clause 5 (Test method) of JIS A 1804.

D.7 Calculation

The calculation shall be in accordance with Clause 6 (Calculation) of JIS A 1804.

D.8 Precision

The precision shall be in accordance with Clause 7 (Precision) of JIS A 1804.

D.9 Judgement

The judgement shall be as follows.

a) **For measurement of ultrasonic propagation velocity or dynamic modulus of elasticity** The judgment shall be made on the rate of ultrasonic propagation velocity or the coefficient of relative dynamic modulus of elasticity which is the mean value of test results of three specimens of fine aggregate constitution condition 1 indicated in Table D.2rounded off to an integer. When the following conditions are satisfied, judgement shall be “harmless”, and when not satisfied, judgement shall be “not harmless”.

1) The rate of ultrasonic propagation velocity is not less than 95 %.
2) The coefficient of relative dynamic modulus of elasticity is not less than 85 %.

b) **For measurement of change rate of length** When the change rate of length, which is the mean value of the test results of three specimens of fine aggregate constitution condition 1 indicated in Table D.2 rounded off to two decimal places, is 0.07 % or less, judgement shall be “harmless”, and when the value is exceeding 0.07 %, judgement shall be “not harmless”. However, when the change rate of length is exceeding 0.07 % but less than 0.10 %, additional tests shall be carried out with fine aggregate constitution conditions 2 to 4 indicated in Table D.2, and if all the results of the fine aggregate constitution conditions 1 to 4 turn out to be under 0.10 %, judgement shall be “harmless”.

D.10 Report

The report shall include the necessary information from among the following.

a) The class and division of recycled aggregate H

b) The name of the manufacturer of recycled aggregate H, the name of the manufacturing plant and its location

c) The location of production of original concrete

d) The sampling place and date of recycled aggregate H

e) The total alkali of cement [potassium oxide (K_2O), sodium oxide (Na_2O), total alkali (%)]

f) The curing temperature (℃)

g) The curing time (h)

h) The date of test (period of test)

i) The measuring method and the constitution ratio of fine aggregate

j) The test results before and after boiling (%)

k) The judgement results

l) The other matters to be noted which have been discovered by observation of specimen after testing.