

Annex B (normative)

Method of manufacturing recycled aggregate for concrete-class L

B.1 General

This Annex specifies the method of manufacturing recycled aggregate concrete L.

B.2 Facilities of manufacture

B.2.1 Storage facilities for materials

The storage facilities for materials shall be as follows.

- a) The storage facilities for cement shall be classified according to the manufacturer or classification and be stored in such a way as to prevent weathering.
- b) The storage facilities for aggregates shall be separated by a partition for each division according to classification, division of grain size or alkali-silica reactivity to prevent separation of sizes.

The watering function facility shall be provided for the prewetting aggregates.

The floor of storage facilities shall be made by concrete with providing waste water treating and preventing impurity incorporation.

Moreover the storage facilities shall be stored the aggregates of which amount is more than the maximum quantity of shipment for concrete per one day.

- c) The transportation facility at the storage of aggregates or the way from storage to plant shall be provided consistent quality of aggregates in such a way as to prevent segregation.
- d) The storage facility for admixture shall be classified according to classification, division and designation in such a way as to prevent quality change of admixture.

B.2.2 Plant

The plant shall be as follows.

- a) At the plant, the storage bin shall be stocked for each material.
- b) The measuring device shall measure each material precisely within errors in accordance with B.4.2. Moreover the device shall have an indicator to measure value by precision above.
- c) All indicators shall be watched by operator and the measuring device shall be easy to control by them.
- d) The measuring device shall measure in succession each materials using for concrete of different mix proportion.

- e) The measuring device shall provide the equipment which is easy to correct measuring value for surface water ratio of aggregates. However for coarse aggregate, the correction of error of measuring value for surface water ratio may be supplied by calculation.

B.2.3 Mixer

The mixer shall be as follows.

- a) The mixer shall be batch type fixed mixer, continuous fixed mixer or truck-mixer.
- b) The batch type fixed mixer or truck-mixer shall conform to the requirements in clause 6 of JIS A 8603-2 (Evaluation of test results).
- c) The continuous fixed mixer shall conform to performance testing method for measuring apparatus and supply apparatus given in Annex E and the requirement of mixture performance testing method given in Annex F,
- d) When mixing concrete of specified slump according to the amount designated in B.5 b), the mixers shall mix sufficiently and discharging homogeneously.
- e) When the mixer mix specified amount for specified hours and the testing value in accordance with JIS A 1119 shall not exceed the following value, the mixer shall be judged to have the capability of mixing concrete homogeneously.

Difference of density for mortar in concrete 0.8 %

Difference of unit amount of coarse aggregate in concrete 5 %

- f) For the batch type fixed mixer or truck-mixer, concrete specimen shall be sampled in accordance with Clause 4. of JIS A 1119 (Specimen).

For continuous fixed mixer, the specimen shall be sampled twice in accordance with F.2. When the tested value is unconformity, adjust the mixing amount per hour, gradient of mixer or the angle of mixing blade.

- g) After mixing the amount of concrete which can be loaded on a carrier, the continuous fixed mixer shall not remain concrete in the mixer.

B.2.4 Transportation vehicle

For transportation of recycled aggregate concrete L, truck-agitator or truck-mixer with following performances shall be used.

- a) The truck-agitator or truck-mixer shall maintain mixing concrete homogeneously and discharge easily and completely in such a way as to prevent segregation of materials.
- b) The specimen for slump test shall be taken from 1/4 and 3/4 part of concrete flow when the truck-agitator or truck-mixer discharge ready-mixed concrete on site and the difference of both slumps shall be less than 3 cm. In this case, the slump of sampling concrete shall be 8 to 18 cm.

B.3 Adjustment of aggregates

The aggregates shall be finished prewetting by previous day for using, drained redundant water and at the time of using, the surface water ratio shall be in stable condition.

B.4 Measuring of materials

B.4.1 Measuring method

The measuring method for materials shall be as follows.

- a) The cement, aggregates, water and admixture shall be measured by each own measuring device. However the water may accumulate with chemical admixture measuring beforehand.
- b) The cement, aggregates and admixture shall be measured according to mass. The admixture may be calculated by number of bags with approval of the purchaser.
However in the case of using amount of which less than one bag, it shall be measured by mass.
- c) The water and chemical admixture shall be measured according to mass or volume.

B.4.2 Tolerance of measurement

The tolerance of measurement shall be as follows.

- a) The tolerance of measurement for cement, aggregates, water and admixture shall be in accordance with Table B.1. For continuous mixer, the error shall be the difference between the set value per one minute and actual measuring value. Accordingly the mixer shall be installed the device which can read the actual measuring value continuously for one minute. However in this case, the integrated value per one minute or the device which can read the difference of measuring value (integrated value) for before and after any one minute may be used for instead.

TableB.1 Tolerance of measurement for materials

(%)

Types of materials	tolerance for one butch
Cement	±2
Aggregate	±4
Water	±2
Admixture	±2
Chemical admixture	±3

- b) The measuring difference shall be calculated by the following formula and rounded-off to integer:

$$m_0 = \frac{(m_2 - m_1)}{m_1} \times 100$$

where, m : measuring difference (%)
 m : measuring amount of target for one batch
 m : effective measured value

B.5 Mixing

The mixing shall be as follows.

- a) The recycled aggregate concrete L shall be mixed homogeneously by mixer given in B.2.3.
- b) The mixing amount and mixing hours for the recycled aggregate concrete L shall be tested given in JIS A 1119 and decided by B.2.3 e).

For truck mixer, the rotation speed of drum shall be designated.

B.6 Transportation

The transportation of the recycled aggregate concrete L shall be as follows.

- a) The transportation of the recycled aggregate concrete L shall be operated by carrier conform to the requirement in B.2.4.
- b) The transportation hours¹⁾ for recycled aggregate concrete L shall be the time from the manufacturer start mixing till the carrier arrive at unloaded site and the time limit shall be within one and a half hours. However the manufacturer may consult with the purchaser to change the limit of transportation hours.

Note ¹⁾ : The transportation hours can be confirmed by the time difference between departure and arrival time of delivery shown in the delivery notice given in Table 4.

B.7 Treatment of mortar adhering in drum of truck-agitator or truck-mixer

The treatment of adhesive mortar shall be as follows.

- a) After all the mixing concrete was discharged from truck-agitator or truck-mixer, the fresh mortar which adhering to inner wall or blade of drum may be reused with adhesive mortar stabilizer given in Annex D of JIS A 5308.
- b) When reusing adhesive mortar, it shall be carried out in accordance with Annex D of JIS A 5308, and the mixing hours of concrete and the time of slurring adhesive mortar shall be recorded.

B.8 Quality management

The manufacturer shall perform quality management to guarantee the quality of concrete given in Clause 5. The manufacturer shall present the test result if requested by the purchaser.

a) Quality management for cement

According to the test result certificate issued by the manufacturer of cement, the articles given in JIS R 5210, JIS R 5211, JIS R 5213 or JIS R 5214 shall be confirmed once a month.

b) Quality management for aggregates

The routine test such as density test, water absorption test and test for content of materials finer than 75 μm sieve shall be carried out every three months, the grain size test shall be carried out once a week in-house or at public testing authority.

When recycled aggregate L is managed in division of more than two kinds of grain size, the grain size test for the aggregates of each grain size designated by company standard may be carried out once a month so as to the aggregates after mixing shall conform to grain size distribution given in Table A.6 of Annex A. The test for density, water absorption and particle quantity shall be carried out every three months for mixed aggregates.

In daily management, the water absorption shall be confirmed more than once a week whether it conform to the standard value in accordance with JIS A 1109 and JIS A 1110 at the recycled aggregate concrete L manufacturing site. However for the recycled coarse aggregate L which maximum size is less than 25 mm, the estimating method of water absorption based on Annex C may be used. For the recycled fine aggregate L, the estimating method of water absorption based on Annex D may be used.

In the case of estimating water absorption approximate within 0.5 % to the standard value, the water absorption shall be confirmed so as to conform to the standard value in accordance with JIS A 1109 and JIS A 1110.

The content of materials finer than 75 μm sieve of recycled fine aggregate L shall be confirmed more than once a week so as to conform to the standard value in accordance with JIS A 1103 at the recycled aggregate concrete L manufacturing site. However it may be judged as to conform to the standard value in case the sand equivalent is 60 % or over after tested in accordance with JIS A 1801.

c) Admixture

In accordance with the test result certificate issued by the manufacturer of admixture, the quality specified in JIS A 6201, JIS A 6202, JIS A 6205, JIS A 6206 and JIS A 6207 shall be confirmed once a month, the quantity specified in JIS A 6204 shall be confirmed every six months.

Annex C (normative)

Testing method of the quality management of manufacturing process for recycled aggregate

Testing method of estimating value of water absorption for recycled coarse aggregate L

C.1 General

This Annex specifies the testing method which estimate the water absorption for recycled coarse aggregate L of maximum size is 25 mm or under easily for the quality management of the recycled coarse aggregate L.

C.2 Testing instrument

C.2.1 Scale

The scale shall have a scale interval of 0.2 % or under of the specimens.

C.2.2 Steel measuring container

The measuring container shall be strong steel cylindrical container of which inner diameter is 115 mm and inner height is 178 mm.

C.2.3 Steel testing container

The testing container shall be strong steel cylindrical container of which inner diameter is 154 mm, inner height is 140 mm and the bottom plate is 6 mm or over in thickness of the flat plate and the side plate is 16 mm or over in thickness.

C.2.4 Steel plunger

The steel plunger shall be 152 mm diameter, quenching its surface with removal handle.

C.2.5 Rodding rod

The rodding rod shall be 16 mm diameter, 600 mm length round steel and semispherical top.

C.2.6 Sieve

The sieve shall be wire sieve¹⁾ of which nominal size is 19mm, 4.75mm and 2.36mm given in JIS Z 8801-1.

Note¹⁾ These sieves may be called 20 mm, 5 mm and 2.5 mm sieves.

C.2.7 Loading device

The loading device shall be 100kN or over of the volume.

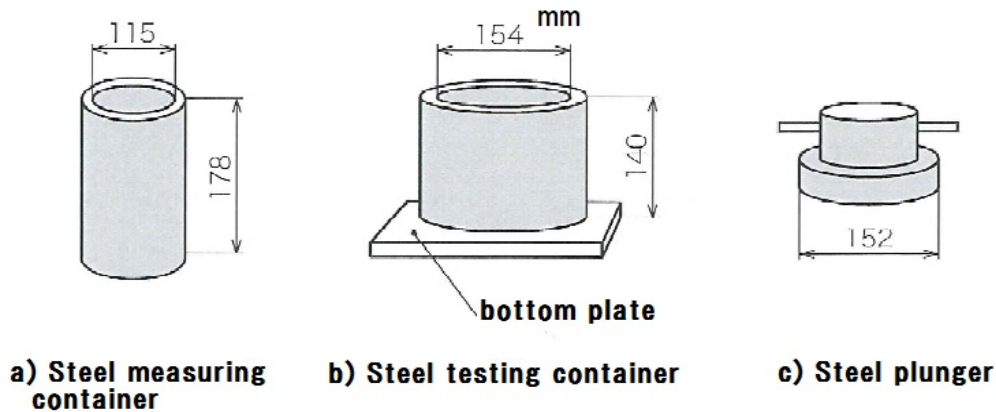


Figure C.1 Crush testing instrument

C.3 Specimen

The specimen shall be as follows.

- a) Prepare 18 to 20 kg of materials of which grain size is 20 to 5 mm from the recycled coarse aggregate L to represent the lot being tested
- b) The specimen shall be in air-dry condition.
- c) When surface water is on the specimen²⁾, wipe off them by cloth, dry four hours by 100 to 140 °C and cool it down to the room temperature.

Note²⁾ The specimens manufactured by dry system and placed in air-dry condition for more than three days may be supplied for the test. The specimens manufactured by wet system or the specimens just after manufacturing by dry system shall be dried.

C.4 Testing method

The test shall be carried out as following procedure by using crushing test instrument shown in Figure C.1.

- a) Put the specimens into measuring container divided by three layers and rod each layer 25 times by rodding rod.
- b) Level irregularity of the aggregate as same as the surface of the measuring container
- c) Move the specimens in the measuring container to shallow container and measure the mass of specimens with accuracy to 1 g.
- d) Put the specimens into measuring container divided by three layers and rod each layer 25 times by rodding rod. Level the irregularity of the surface of aggregate on the same level. The thickness of the specimens shall be around 10 cm.
- e) Put the steel plunger flat on the specimens in the testing container and remove the handle.

- f) Set the testing container which remaining plunger inside on the loading device and load 40kN per minutes evenly to the plunger.
- g) After reached 100kN, return the load to zero.
- h) Sieve the specimens in the testing container by 2.5 mm sieve and measure the mass of which has passed through the sieve with accuracy to 1g.
- i) Carry out three times of the testing procedure of a) to h).

C.5 Calculation

At every three times of the test, the 100 kN crushing value³⁾ (C_g) shall be calculated by following formula and round off to the first decimal place.

Note³⁾ : An indicator easily evaluate the quality of recycled coarse aggregate L obtained by this testing method.

$$C_g = \frac{m_1}{m_2} \times 100$$

where, C_g : 100 kN crushing value (%)
 m_1 : mass of the specimen which has passed through 2.5 mm sieve (g)
 m_0 : mass of whole specimens (g)

The test result shall be the mean value in three times of the test. According to the obtained 100 kN crushing value (C_g), the estimating water absorption⁴⁾ (Q) shall be calculated by following formula to 0.01 %.

Note⁴⁾ : An indicator easily evaluate the water absorption of recycled coarse aggregate L obtained by this testing method.

$$Q = 0.85 C_g + 1.50$$

where, Q : estimating water absorption of recycled coarse aggregate L (%)
 C_g : 100 kN crushing value (%)

C.6 Record

The following items shall be recorded.

- a) Method of manufacturing recycled coarse aggregate L (dry/wet type)
- b) 100 kN crushing value in three times and the mean value
- c) Estimating water absorption
- d) The date of test
- e) The name of tester

Annex D (normative)

Testing method of estimating value of water absorption for recycled fine aggregate L

D.1 General

This Annex specifies the testing method to estimate the water absorption of recycled fine aggregate L easily for the quality management of the recycled fine aggregate L.

D.2 Testing instrument

D.2.1 Scale

The scale shall have a scale interval of 0.2 % or under of the specimens.

D.2.2 Container

The container shall be used of which capacity is 1 to 2 L given in JIS A 1104.

D.2.3 Rodding rod

The rodding rod shall be 16 mm in diameter, 500 to 600 mm length round steel with semispherical top.

D.2.4 Sieve

The sieve shall be wire sieve¹⁾ of which nominal size is 4.75mm and 150 μm given in JIS Z 8801-1.

Note¹⁾ These sieves may be called 5 mm and 0.15 mm sieves.

D.3 Specimen

The specimen as to represent shall be sampled and of which rather in a wetting condition shall be reduced approximately to the specified amount in accordance with JIS A 1158. The specimen shall be used either in absolutely dried condition or of which spread out 1 cm or under the thickness, dried 90 minutes by 100 to 110 °C, passed through the 5 mm sieve and remained on the 0.15 mm sieve.

D.4 Test method

D.4.1 Measuring the bulk density

The measuring the bulk density shall be as follows.

- a) The specimen shall be stuffed by rodding rod. Put the specimen into 1/3 of the container, leveling the top by finger and rod specified times evenly by rodding rod. At that time, be careful to prevent the top of the rodding rod hit strongly to the bottom of the container. Then

put the specimen into 2/3 of the container and rod as same times as the previous time. At last, put into the specimen until overflow from the container and rod as same times as the previous time.

- b) Using rodding rod as a ruler, scrape superfluous specimens off and leveling along the top of the container.
- c) Measure the mass of the container of b).

D.4.2 The number of testing

The test shall be carried out twice for the specimen sampled at the same time.

D.5 Calculation

The calculation shall be as follows.

- a) The bulk density (T) of recycled fine aggregate L shall be calculated by the following formula and rounding off to three digits of significant figures.

$$T = \frac{m_1}{V}$$

where, T : bulk density of recycled fine aggregate L (kg/L)

V : capacity of the container (L)

m_1 : mass of the specimens in the container (kg)

When testing with specimen in air-dried condition and measured total moisture content, the following formula shall be used.

$$T = \frac{m_1}{V} \times \frac{m_0}{m_2}$$

where, m_2 : mass of the specimen before drying for measuring total moisture content (kg)

m_0 : mass of the specimen after drying for measuring total moisture content (kg)

- b) The test result shall be the mean value in twice the test. The difference from the mean value of the bulk density shall not exceed 0.02 kg/L. When this condition is not satisfied, the test shall be judged as not appropriately performed and be carried out again.
- c) Using the bulk density obtained in a), the estimating water absorption shall be calculated by the following formula and rounded off to the second decimal place.

$$Q = - 25 T + 41$$

where, Q : estimating water absorption of recycled fine aggregate L (%)

T : bulk density of recycled fine aggregate L (kg/L)

D.6 Record

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

- a) The sampling place and date of aggregate
- b) The testing value of bulk density in two times and the mean value (kg/L)
- c) Estimating water absorption (%)
- d) The date of test
- e) The name of tester