

## Case studies of Advanced Construction and Demolition waste(CDW) Recycling initiatives and technologies In JAPAN

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|------------------------------|---|---|
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| Title                        | <b>New quality management codes for low quality recycled aggregate named "Tokyo brand 'Cool eco-Stone'", extending applicability for several soil/ground materials.</b>   |   |
| Theme classification         | <input type="checkbox"/>  | Prevention  |
|                              | <input type="checkbox"/>  | Re-use  |
|                              | <input type="radio"/>   | Recycle   |
|                              | <input type="checkbox"/>  | Reduce Co2  |
|                              | <input type="checkbox"/>  | Legacy  |
|                              | <input type="checkbox"/>  | Business to overseas                              |
|                              | <input type="checkbox"/>  | Etc.  |
| Technology development stage | <input type="radio"/>   | Practical use                                     |
|                              | <input type="checkbox"/>  | Scheduled to be put into practical use by 2020    |
|                              | <input type="checkbox"/>  | Scheduled to be put into practical use after 2020 |
| Specific content             | <p>-This code is a quality standard of recycled aggregate established by the cooperative committee among industries, local governments and academia for branding recycled aggregates which have much attached mortar.</p> <p>This quality standard aims to be widely used not only for roadbed materials but also general geomaterials(ground materials).</p> <p>.</p> <p>-The characteristics of this code is to design the grades of concrete wastes for applying embankment, pervious foundations, and drainage systems as well as conventional road base/subbase. As a result, the quality of concrete wastes become improved and connect into manufacturing high quality recycled materials applied to several soil structure.</p> |   |
| Appeal point                 | <p>-this quality standard designed comprehensively for recycled geomaterials(ground materials) made from concrete waste is unprecedented worldwide.</p> <p>-Tokyo Metropolitan Government has also publicly certified this private quality standard, and its recognition as a brand is increasing.</p> <p>-Through creating a quality standard for recycled materials and establishing the goal of setting up as a brand, we are proud that many people have involved to improve the image of recycled materials and the comprehensive framework has been created to contribute to promoting recycling.</p>   |   |

## **New quality management codes for low quality recycled aggregate named "Tokyo brand 'Cool eco-Stone'", extending applicability for several soil/ground materials.**

### **1. Quality Management process for low quality recycled aggregate extending applicability to several soil/ground materials.**

Tokyo brand "Cool eco-Stone", new codes for low quality recycled aggregate is assumed to be designed for extending applicability to several types of geomaterials as well as recycled crusher-run for road base/subbase. Specifically, Tokyo brand "Cool eco-stone" is considered to satisfy the following two requirements:

- ① Sufficient mechanical performances required for geomaterial, such as embankment, pervious foundations, and drainage systems
- ② Extreme low concentration of any harmful components such as chromium hexavalent, which may cause critical adverse environmental changes in the ground.

In order to satisfy these requirements of "Tokyo brand 'Cool eco-stone'", the special committee consisting of all stakeholders, such as related industries, local governments and academia, established the codes for quality management system in close cooperation.

According to these codes, the comprehensive quality management system covering from concrete wastes generated in demolition sites to recycled aggregate applied in construction sites are standardized accurately. These codes include the rating system of quality of concrete wastes qualifying into A, B, and C. In consequence, the rating system succeeds the improvement of the quality of recycle aggregate, because the cost for controlling quality of recycled aggregates would be decreased and the quality consistency in manufacturing recycled aggregate would be improved with low cost. It is a simple but an innovative system to progress recycling concrete wastes.

### **2. Performance of recycled aggregate applying as ground materials**

Table 1 shows the standard (draft) for recycled aggregate named Tokyo brand "Cool eco-stone". This standard (draft) requires that recycled aggregate applying in ground proves environmental safety in compliance with the standard value of "Soil Contamination Countermeasures Act" based on the result of leaching test (JIS K 0058-1) in the "as-is" use form and the results of contents test (JIS K 00580-2) , so as that surrounding soil and groundwater might sustain environmental safety for a long time.

Additionally, the codes require to disclose several values for contributing to awareness of the quality and recasting public images of recycled aggregates.

Table-1 standards (draft) of recycled aggregate for applying as geomaterials

| Items for quality management                      |  | <div></div> Standards of test methods for each item | Names of recycled aggregates   | Conventional recycled crusher-run   | RC-40 For roadbed    | RS-40 For infiltration trench | RC-40 For gravel compaction | RC-40 For back-filling |
|---|--|---|--|---|----------------------|-------------------------------|-----------------------------|------------------------|
|   |  |   | Construction method applying each product  | Roadbed construction  | Roadbed construction | Permeability method           | Foundation improvement work | Earthwork              |
|   |  |   | Function of recycled aggregate   | Roadbed material  | Roadbed material     | Infiltration trench material  | Gravel compaction           | Backfilling material   |
| Regulations on harmful component content          | Heavy metal elution/ content                             | JIS0058-1 or JIS0058-2                              | —  | Based on the following two test results<br>1. To satisfy the dissolution amount criteria (Type 2 Specified Hazardous Substance) of Soil Contamination Countermeasures Act by dissolution test(JISK0058-1) on appearance sample<br>2. To satisfy the content criteria (Type 2 Specified Hazardous Substance) of Soil Contamination Countermeasures Act in content test(JISK0058-2) of crushed sample |                      |                               |                             |                        |
|   | Chloride content   | JISA5023A4.7  | —  | 0.04wt%   |                      |                               |                             |                        |
|   | Ph   | JGS0211   | —  | Disclose data   |                      |                               |                             |                        |
|   | Electrical conductivity                                  | JGS0212   | —  | 200mS/m or less   |                      |                               |                             |                        |
|   | Ignition loss  | JISA1226  | —  | 10% or less   |                      |                               |                             |                        |
|   | Asbestos content   | JISA1481-1  | —  | Do not detect   |                      |                               |                             |                        |
|   | Impurity contamination rate                              | JISA5023A4.2  | To satisfy the civil engineering material specification (edited by Construction Bureau ,Tokyo Metropolitan Government) |   |                      |                               |                             |                        |
| Regulations on physical mechanics characteristics | Grain size distribution                                  | JISA1102  | —  | To satisfy the civil engineering material specification (edited by Construction Bureau ,Tokyo Metropolitan Government)  |                      |                               |                             |                        |
|   | Solid volume percentage                                  | JISA1104  | —  | Disclose data   | 65% or less          | Disclose data                 |                             |                        |
|   | Fine fraction content                                    | JISA1223 or JISA1103                                | —  | less than 10%   | 2% or less           | less than 10%                 |                             |                        |
|   | Water absorption   | JISA1110  | —  | 8.65% or less   | 7% or less           | 9.1% or less                  | 8.65% or less               |                        |
|   | Density in absolutely dry condition                      | JISA1110  | —  | 2.05g/cm3 or more   | 2.1g/cm3 or more     | 2.03g/cm3 or more             | 2.05g/cm3 Or more           |                        |
|   | Density in saturated surface-dry condition               | JISA1110  | —  | Disclose data   |                      |                               |                             |                        |
|   | Mass of unit volume                                      | JISA1104  | —  | Disclose data   |                      |                               |                             |                        |
|   | Percentage of wear                                       | JISA1121  | 40% or less  |   |                      |                               |                             |                        |
|   | Plasticity index   | JISA1205  | 6% or less   |   | -                    | 6% or less                    |                             |                        |
|   | Plastic limit  | JISA1205  | —  | Disclose data   | —                    | Disclose data                 |                             |                        |
|   | Liquid limit   | JISA1205  | —  | Disclose data   | —                    | Disclose data                 |                             |                        |
|   | Cone index   | JISA1228  | —  |   | —                    | 400KN/m3 or more              |                             |                        |
|   | Maximum dry density                                      | JISA1210  | —  | Disclose data   |                      |                               |                             |                        |
|   | Optimum moisture content                                 | JISA1210  | —  | Disclose data   |                      |                               |                             |                        |
|   | Modified CBR   | JISA1211  | 40% or more  |   | Disclose data        | 40% or more                   |                             |                        |
|   | Expansion ratio  | JISA1211  | —  | 3% or less  |                      |                               |                             |                        |
|   | Method of classification of Geomaterials for engineering | JGS0051   | —  | Disclose data   |                      |                               |                             |                        |
|   | Internal friction angle                                  | JGS0524   | —  | Disclose data   | 35degree or more     |                               |                             |                        |
|   | Cohesion   | JGS0524   | —  | Disclose data   |                      |                               |                             |                        |
|   | Slaking rate   | NEXCO testing method110                             |  | —   | Disclose data        | 1% or less                    |                             |                        |
| Hydraulic conductivity                            | JISA1218   | —   | Disclose data  | 1x10 <sup>-4</sup> m/sec  |                      |                               |                             |                        |