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Waste Concrete with Recycled Coarse Aggregate at a Site with Environmental Concerns

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Commentary

When concrete debris is recycled as aggregate, it is usually transported to a factory, where the recycled aggregate is made. However, when the concrete waste is transported to the plant, it consumes a substantial amount of energy and produces a significant amount of CO_2. As a result, it is necessary to consider the environment when researching concrete debris recycling on the job site. In this study, appropriate mix proportions for recycled coarse aggregate, properties of fresh concrete, pump ability, and properties of hardened concrete are investigated in the case of recycling of concrete waste on site, and when the mortar is brought to the site and the recycled coarse aggregate is used in the dry state, the recycled coarse aggregate is put into the mortar in which the amount of water corresponding to the recycled coarse aggregate's water absorption rate is used [1].

The compressive strength and tensile strength, the static elastic modulus, and the chloride ion penetration depth were about the same when the mortar was brought into the site and the recycled coarse aggregate in an air-dried state was put in the site, if the amount of water corresponding to the effective water absorption rate of the regenerated coarse aggregate was corrected at the mortar manufacturing stage [2]. Furthermore, it is assumed that even after pumping, the recycled coarse aggregate will have the same degree of fluidity as when it is employed in the surface dry form.

It is typical to transport waste concrete to an intermediate treatment plant, manufacture recycled aggregate, and use it as recycled aggregate concrete at a new site when waste concrete is used as an aggregate for concrete. However, this process necessitates the repeated transportation of waste concrete material, which incurs transportation costs and energy consumption [3]. When waste concrete is reused on-site, however, a large-scale concrete manufacturing factory can be built, and recycled aggregate concrete can be created on-site. However, the use is limited because constructing a concrete manufacturing factory on site is expensive, and it is expected that the facility cannot be built in mountainous terrain.

As a result, it's possible that only recycled aggregate is produced from deconstructed concrete, mortar is delivered from a ready-mixed concrete plant, and the recycled aggregate is mixed on site. In that situation, it's preferable to absorb enough water from the recycled aggregate in order to maintain workability, such as the recycled aggregate concrete's pumping properties. Heavy metals may elute, however, due to environmental concerns, if a considerable volume of water is utilised to treat the recycled aggregate [4]. Furthermore, 40 environmentally friendly researches on compounding and building methods for on-site recycling of waste concrete necessitate a significant investment in water treatment, and recovered aggregate must be employed in some circumstances.

The use of recycled aggregates in concrete reduces not only the extraction of natural resources, but also the dumping of building and demolition debris in landfills. As a result, environmental costs and impacts are decreased, encouraging the use of recycled materials and the circular economy. However, the effects of transportation vary depending on the distance between sites, and recycled aggregates may be more expensive and have a greater environmental impact than natural aggregates over longer distances. This paper analyses the problem, provides an overview of the application of life cycle assessment technique on natural and recycled aggregates for concrete, and uses the methodology in a real-world scenario involving coarse aggregate procurement for ready-mix concrete plants [5].

Multiple scenarios for the supply of natural and recycled aggregates are investigated, with hypotheses for the installation (construction and demolition waste plant or quarry) processing construction and demolition waste into recycled aggregates included in the scenarios for recycled aggregates procurement. Except when the quarry is assumed to be licenced and equipped for receiving unsorted construction and demolition waste and processing it into recycled aggregates, it was discovered that the supply of recycled aggregates produced at the construction and demolition waste plant has a lower environmental impact and cost than all other scenarios, including the provision of natural aggregates, for this case study and both regions.

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