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# Structure Transition and Circularity Gap of Sand and Gravel Resources in China

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Aggregates (collectively sand, gravel, and crushed stone) are the most extracted material by weight over the world, and they are important raw materials for buildings and infrastructure. Owing to its rapid development, China is the largest aggregate consumer and producer, accounting for over half of the global aggregate consumption. However, aggregates in China are now facing shortages and low resource circulation. As a long-neglected resource, it is difficult to provide sufficient support for relevant policy-making without a comprehensive quantitative basis. To bridge the knowledge gap, first, we established a systematic material flow and stock accounting framework to map the social metabolism of aggregate resources in China. Then we discussed the results in the global context for international comparison to figure out the circularity gaps of aggregates in China. Our results show during 1978–2018, the inflows of China's aggregates increased by 13 times (1.3 to 17.3 billion tons), the stocks increased by 15 times (18.3 to 285.5 billion tons), and the outflows, the main component of CDW, increased 9 times (from 445 million tons to 4.4 billion tons). On the supply side, a transition of the primary supply structure is observed. The manufactured aggregates gradually replaced the natural aggregates as the main supply source in the past decade. On the demand side, the demand for aggregates stepped to a peak of around 18.5 billion tons. The infrastructure rather than building becomes the main consumer since 2014. However, the model shows the recycling rate of outflows is less than 5%, indicating a circularity gap compared to the rate that could be as high as 70%–95% in certain advanced economies. The market acceptance, policy supports, and the structures of demolished buildings are the main reasons for the current circularity gap of aggregates. Regarding a large amount of aggregates accumulated in the material stocks, it is expected to see rapid growth of aggregate waste in the

near future. It is essential to foster a well-functioned circular system to achieve the sustainable development of the aggregate industry.