Resource Circulation-Driven Port Construction: turning waste into resources
Busan Port is actively recycling waste concrete and asphalt concrete generated from construction sites, to enable resource circulation.

**Resource circulation-driven port construction means the 100% recycling of construction wastes for the first time in the port sector.**
A need for the recycling of construction waste

Construction is the largest source of waste, accounting for 44.2% of the total in the world. ※ Industrial waste 41.3%, municipal solid waste 11.5%

Use of massive amounts of aggregate within the port construction project

In building Busan New Port, a port construction site amounting 13 million m² needs to be prepared (the area of 1,800 soccer fields)

It is not possible to continue to mine natural aggregates

Natural aggregate is produced only from EEZ offshore dredging material or quarrying, inevitably causing environmental issues

Challenges in using recycled aggregates in port construction

1. Recycled aggregates have never been used when building main structures in Korea’s port sector (simple paving, subsoil and temporary structure not included)

2. There is no relevant regulation governing the use of recycled aggregates in the port sector
Various efforts made by Busan Port Authority for the active use of recycled aggregate

01 VOC monitoring alongside local businesses regarding the use of recycled aggregates
Identifying opportunities for cooperation with waste management association representing Busan and Gyeongnam area
Including waste management companies located near by Busan New Port

02 MOU signing with the Korean Recycled Construction Resources Association and the Construction Guarantee Cooperative to build Korea’s first resource circulation-driven port
• Broad cooperation on the increase use of recycled aggregate
• Sharing of future demand for construction resources and reduction of public budget
• Technical cooperation for ensuring quality management
• Exploration of ESG tasks for promoting the recycling of construction waste and development of innovative strategy

03 Quality management and monitoring of recycled aggregates
Verification of quality assurance tests, core sampling after construction, regular quality inspections, and measurement management after completion.

04 First public corporation to establish guidelines for the use of recycled aggregates
Introduction of internal guidelines to promote the use of recycled aggregate and recycled aggregate products (May 2022)

Guidelines
• Establishing regulations for promoting the use of recycled aggregate within construction projects commissioned by Busan Port Authority.
• Creating the basis guidelines for the use of recycled aggregate, including usage records and plans, quality standards and management requirements, education on the use of recycled aggregate
Construction project using recycled aggregate and recycled aggregate products spans six Busan Port construction sites, including the New Port container terminal(1), port industrial park(2), and the North Port redevelopment(3).
A total of 174,892 m³ (279,827 tons) of recycled aggregates and recycled asphalt concrete (RAC) used

**Recycled aggregates (159,347 m³)**
1. Upper part of West Container Terminal of the New Port (Phase 2-5)  
   **[Purpose]** Foundation for concrete paving and backfilling around the drainage where the use of recycled aggregate is found to be available among yards to be used at automated terminals  
   **[Usage]** recycled aggregate of 65,645 m³ and recycled sand of 73,150 m³
2. South Container Terminal Industrial Park (Site 2)  
   **[Purpose]** Foundation for temporary roads for construction (heat-treated)  
   **[Usage]** 2,250 m³
3. South Container Terminal Industrial Park (Site 3)  
   **[Purpose]** Foundation for temporary roads for construction (heat-treated)  
   **[Usage]** 2,250 m³
4. Infrastructure for Phase 1-2 of the North Port redevelopment project  
   **[Purpose]** For backfill for equipment entry  
   **[Usage]** 10,357 m³
5. Marina for the North Port redevelopment project  
   **[Purpose]** Post construction for driving safety  
   **[Usage]** 10,195 m³
6. Construction of pedestrian deck for the North Port redevelopment project  
   **[Purpose]** Asphalt concrete surface layer and foundation (heat-treated)  
   **[Usage]** 447.6 m³

**RAC (15,545 m³)**
1. Construction of the New Port West Container Terminal (Phase 2-5)  
   **[Purpose]** Foundation for concrete paving and backfilling around the drainage where the use of recycled aggregate is found to be available among yards to be used at automated terminals  
   **[Usage]** recycled aggregate of 65,645 m³ and recycled sand of 73,150 m³
2. Construction of the New Port West Container Terminal (Phase 2-5)  
   **[Purpose]** Foundation for concrete paving and backfilling around the drainage where the use of recycled aggregate is found to be available among yards to be used at automated terminals  
   **[Usage]** recycled aggregate of 65,645 m³ and recycled sand of 73,150 m³
3. Construction of the New Port West Container Terminal (Phase 2-5)  
   **[Purpose]** Foundation for concrete paving and backfilling around the drainage where the use of recycled aggregate is found to be available among yards to be used at automated terminals  
   **[Usage]** recycled aggregate of 65,645 m³ and recycled sand of 73,150 m³

Economic effects

Use of recycled aggregates instead of natural aggregates has saved USD 3M in budget.

- Site purchase and construction costs (USD 3 /t)
- Operation & Management costs (USD 12 /t)

Environmental benefits

Preservation of natural aggregates by using 280,000 tons of recycle aggregates =

- 3,500 Moai (80 tons each)
- 2,333 Stonehenge (120 tons each)

Use of recycled aggregates results in a reduction of 6,570 tons of CO₂ =

- Planting 1,048,285 trees

Benefit of USD 2.7M

From the use recycled aggregates and RAC of 174,892 m³ (279,827 tons)
To use recycled aggregates for approx. 40% of the construction at Phase 1 of the Jinhae New Port development project

[Phase 1 of Jinhae New Port]
- Total project budget: USD 60 billion
- Scope: 9-berth container dock, 1.4km-long breakwater, 8.08km-long revetment, and industrial park of 674,000m²
- Opening: three berths in 2029 and six berths in 2032

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Specification</th>
<th>Phase 1-1</th>
<th>Phase 1-2</th>
<th>Finishing Revetment</th>
<th>Paving and others</th>
<th>Total usage (㎥)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation backfilling</td>
<td>0.015-0.03/ea</td>
<td>275,593.6</td>
<td>480,788.0</td>
<td>-</td>
<td>-</td>
<td>756,381</td>
</tr>
<tr>
<td>Levee body backfilling</td>
<td>0.03/ea</td>
<td>-</td>
<td>-</td>
<td>361,467.0</td>
<td>-</td>
<td>361,467</td>
</tr>
<tr>
<td>Armor stone</td>
<td>0.3/ea</td>
<td>13,816.6</td>
<td>24,353.0</td>
<td>-</td>
<td>-</td>
<td>38,169</td>
</tr>
<tr>
<td>Armor stone</td>
<td>0.2/ea</td>
<td>-</td>
<td>-</td>
<td>12,690.0</td>
<td>-</td>
<td>12,690.0</td>
</tr>
<tr>
<td>Backfilling stone</td>
<td>0.01-0.03/m³</td>
<td>662,418.4</td>
<td>1,167,572</td>
<td>-</td>
<td>-</td>
<td>1,829,990</td>
</tr>
<tr>
<td>Filter back</td>
<td>Φ100mm or below</td>
<td>106,001.4</td>
<td>196,245.0</td>
<td>35,892.0</td>
<td>-</td>
<td>338,138</td>
</tr>
<tr>
<td>Caisson filling</td>
<td>Gravel</td>
<td>268,966.0</td>
<td>484,324.0</td>
<td>-</td>
<td>-</td>
<td>753,290</td>
</tr>
<tr>
<td>Reclamation</td>
<td>Earth and sand</td>
<td>4,539,492</td>
<td>11,711,627</td>
<td>-</td>
<td>-</td>
<td>16,250,119</td>
</tr>
<tr>
<td>Paving and others</td>
<td>Φ40mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1,119,000</td>
<td>1,119,000</td>
</tr>
<tr>
<td>Paving and others</td>
<td>Φ80mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>746,000</td>
<td>746,000</td>
</tr>
</tbody>
</table>

Expected usage of recycled aggregate: **748,916 ㎥ (40%)**

To identify further potential construction projects which can utilize recycled aggregates within port construction and define use criteria

- To establish a criteria for construction projects within the port sector that may allow the utilization of recycled aggregates and that require a large volume, such as for site preparation and felling
- To review the quality standards and plan for quality assurance of the these construction projects and make policy suggestion
Busan Port: leading the resource circulation-driven port construction!