Resource Circulation-Driven Port Construction:

turning waste into resources

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

14 LIFE BELOW WATER

15 LIFE ON LAND

BPA 부산항만공사 BUSAN PORT AUTHORITY

The World at a glance

According to a UN report,
the global population is expected to reach 9.7 billion by 2050.

If the population keeps increasing in this way, while maintaining our current lifestyles, we would need an estimated **three earths to provide enough natural resources for humans to survive.**

With the world increasingly concerned over resource availability, **93% of the world's top 250 companies are currently** reporting on sustainability, **and 108 countries have relevant national policies and plans in place.**

Busan Port, a port of sustainability

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 m^2 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

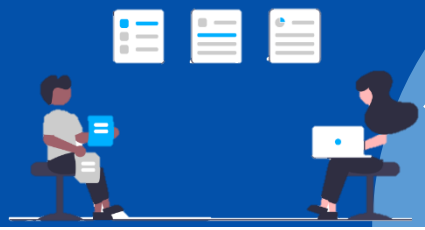
Challenges in using recycled aggregates in port construction

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

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

Monitoring

Conclusion of MOU

Various efforts made by Busan Port Authority for the active use of recycled aggregate

Guidelines

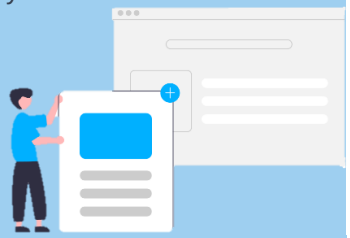
Quality Management

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



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.

Verification of quality test results

- Verifying test results according to standards in the specifications, such as recycled aggregate particle size, abrasion loss, modified CBR, and foreign substance content
- Regular quality inspections and special quality inspections conducted after construction

Core sampling and installation plan for measuring instruments

- Core sampling, density, and backfill thickness testing after completion
- Ground measurement management service after completion

6 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)

BUSAN PORT

Busan New Port ·Jinhae New Port

Gamcheon Port ·Dadae Dock

North Port

New Port development

① Construction of the New Port West Container Terminal (Phase 2-5)

②③ Development of South Container Terminal Industrial Park (site 2, site 3)

North Port redevelopment

④ Construction of connecting pedestrian deck for North Port redevelopment

⑥ Phase 1-2 infrastructure construction for North Port redevelopment

⑤ Construction of Marina for North Port redevelopment

A total of 174,892㎥ (279,827 tons) of recycled aggregates and recycled asphalt concrete (RAC) used

Recycled aggregates (159,347㎥)

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㎥ and recycled sand of 73,150㎥

⑤ Marina for the North Port redevelopment project
[Purpose] Post construction for driving safety
[Usage] 10,195㎥

⑥ Infrastructure for Phase 1-2 of the North Port redevelopment project
[Purpose] For backfill for equipment entry
[Usage] 10,357㎥

RAC (15,545㎥)

② South Container Terminal Industrial Park (Site 2)
[Purpose] Foundation for temporary roads for construction (heat-treated)
[Usage] 2,250㎥

③ South Container Terminal Industrial Park (Site 3)
[Purpose] Foundation for temporary roads for construction (heat-treated)
[Usage] 2,250㎥

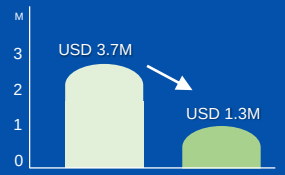
④ Connecting pedestrian deck for the North Port redevelopment project
[Purpose] Asphalt concrete surface layer and foundation (heat-treated)
[Usage] 447.6㎥

Economic effects

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

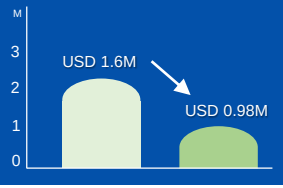
[Using recycled aggregate]

Saving of USD 2.4M



[Using RAC]

Saving of USD 0.65M



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Benefit of USD 2.7M
From the use recycled aggregates and RAC of 174,892㎥ (279,827 tons)

- 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

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3,500 Moai
(80 tons each)

OR

2,333 Stonehenge
(120 tons each)

Use of recycled aggregates results in a reduction of **6,570 tons of CO_2**

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Planting 1,048,285 trees

▶ Reduction in carbon emission attributable to the recycling of AP (crude oil extract) amounting to 30.6 kg per one ton of waste asphalt concrete

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]

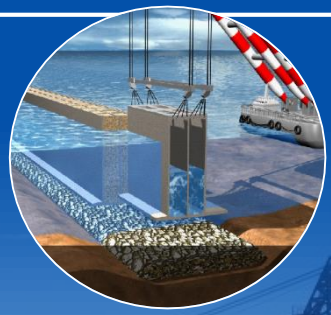
- Total project budget : USD 60 billion
- Scope: 9-berth container dock, 1.4km-long breakwater, 8.08km-long revetment, and industrial park of 674,000㎡
- Opening: three berths in 2029 and six berths in 2032

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

Type of work	Specification	Total usage (㎥)				
		Phase 1-1	Phase 1-2	Finishing Revetment	Paving and others	Total
Foundation backfilling	0.015~ 0.03㎥/ea	275,593.6	480,788.0	-	-	756,381
Levee body backfilling	0.03㎥/ea	-	-	361,467.0	-	361,467
Armor stone	0.3㎥/ea	13,816.6	24,353.0	-	-	38,169
	0.2㎥/ea	-	-	12,690.0	-	12,690.0
Backfilling stone	0.001~ 0.03㎥ level	662,418.4	1,167,572	-	-	1,829,990
Filter bac	Φ100mm or below	106,001.4	196,245.0	35,892.0	-	338,138
Caisson filling	Gravel	268,966.0	484,324.0	-	-	753,290
Reclamation	Earth and sand	4,538,492	11,711,627	-	-	16,250,119
Paving and others	Φ40mm	-	-	-	1,119,000	1,119,000
	Φ80mm	-	-	-	746,000	746,000

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!