



Using reclaimed concrete in road construction

HHO, Power Group & Iselula Crushing

N2 Borchard's Quarry,
Cape Town

By designing reclaimed concrete and asphalt into a highway, landfill airspace with a value of R3.1 million was saved.

CaseStudy

Opportunity

The concrete N2 highway near Borchard's Quarry in Cape Town, was upgraded in 2017 to three lanes with the existing two lanes in both directions being rehabilitated. The concrete base layers were milled out, along with the asphalt top layer, creating 13 000 m³ of concrete and 5 000 m³ of asphalt 'waste'. The project team considered the quality of the material available and designed the reclaimed aggregate back into the highway.

Solution

13 000 m³ of concrete was removed from the road, and all of it was re-applied on-site.

5 000 m³ of asphalt millings was removed and returned in the crushed aggregate mix.

Savings

The value of City of Cape Town airspace saved by this solution was R3.1 million.¹ This excludes the savings on operational costs that would have been incurred during the landfilling process.

If crushing had been done on site as originally envisaged, the project would have realised a 36% cost saving relative to the virgin material.

However, due to the unexpected change of crusher site from the road reserve to Philippi, the cost per cubic metre of incorporating recycled material was 20% more expensive than if virgin commercial sources had been used. A further complication in this project, was the difficulty in accessing the lanes furthest away from the crushing site, which added significantly to haulage.

Lessons Learned

Crusher site

Ideally crushing should be done on the site where material was recovered. In this case, the proximity of the airport meant that crushing couldn't be done in the road reserve. Power Group's Philippi site was used as an alternative.

Haulage

Haulage will make or break a business case, and the distance travelled needs to be accurately assessed to ensure that the costing is accurate.

Materials

- Crushing to 37 mm for the G5 material is recommended, as the 53 mm made testing of the material more difficult, with higher variability in the results. Due to less control required in the testing of G6 and lower grading, materials specialists recommended 53 mm as a maximum in this case.

¹ Calculated as the cost of constructing 18 000 m³ of landfill airspace in the City of Cape Town



- Achieving a grading modulus of 2.2-2.3 is recommended. The grading modulus of recovered aggregate was 2.6 on this project – with a secondary crushing stage and blending, the recommended modulus of 2.2-2.3 will be easily achieved. This will also result in improved CBR values, from 28-30 up to 70-80%. The higher grading modulus resulted in the material being more difficult to work with and test.
- Stockpile management and strict quality processes are critical, with the crushing contractor, pavement contractor and the engineering / materials team agreeing on the process and communicating regularly from project initiation to completion.

Materials testing

- Compliance with SANS 3001 is the more conservative approach. TMH1 generally gives better results on recovered aggregate. For example, the material tested as a G4

according to TMH and a G5 according to SANS. Therefore, for all applications of reclaimed aggregate, SANS 3001 testing is recommended.

Application

- Reclaimed concrete aggregates will have a higher optimum moisture content (OMC) than most gravels, but recovered aggregate is often more easily compactable than most virgin aggregate at lower moisture contents. Contractors report that the material compacted well at 50% of OMC.
- Contractors do not tend to use asphalt mixes due to the lack of cohesion between asphalt particles and the remainder of the mix. This mix will result in a sharp decline in CBRs at lower compactions. The asphalt was included as it was spoilt material on site, which would have incurred high haulage costs. This project demonstrates that the required material performance can still be achieved, even when asphalt is included in the mix.

Guidelines for the application of recovered aggregate in roads are currently being developed by the RecMat committee, which was instituted through a resolution at the Road Pavement Forum. The committee comprises representatives from SANRAL, University of Stellenbosch Pavement Engineering, The Concrete Institute, the City of Cape Town Transport and Development Authority, and the private sector in road construction and pavement engineering.

Key Players

Consulting engineers – HHO
Road contractors – Power Group
Crushing contractors – Iselula Crushing
Laboratory services – SGS
Client – Department of Transport and Public Works, Western Cape

For access to our expert network in applying recovered aggregate...

For further information on this case study or market insights regarding builders' rubble, please contact **Kirsten Barnes, Waste Economy Analyst at GreenCape (kirsten@greencape.co.za) or (021) 811 0250.**



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