

Alan Buckley
Manager Infrastructure & Services
Norfolk Island Airport

Dear Alan,

Norfolk Island Airport Pavement Rehabilitation – On-Island rock supply

Council requested that I review the risk to NIRC associated with underwriting the quantity, quality and timely accessibility to on-island rock supplies for the production of aggregate for asphalt and concrete manufacture associated with the Norfolk Island Airport pavement rehabilitation project, scheduled for 2019 and 2020.

In preparing this report, I have referred to and relied upon:

- Preliminary Design Report, APES Pty Ltd, dated 24 August 2018.
- Geotechnical Investigation Report, Douglas Partners, dated 25 October 2018.
- Cascade Quarry Development Options & Alternative Quarry Rock Options, BCA Consulting, dated 21 November 2018.
- Advice provided by NIRC Planning Section, during a meeting of 19 November 2018.

Rock material demand

The preliminary design report indicated the combined designed in-place volume of asphalt and concrete is approximately 14,000 m³. Typically, after accounting for natural sand, lime, bitumen and cement, around 85% of this volume is comprised of crushed quarry aggregate. Based on a typical aggregate particle density of 2.5 t/m³, that is around 30,000 tonnes of crushed material. Allowing for scalps, unbalanced aggregate production, waste and other losses, around 40,000-50,000 t of actual in-quarry material extraction is expected to be required to meet the demand of the airport project.

Cascade quarry rock quantity

From the Cascade quarry development and options report, it is likely that:

- Only the second (14 m high) of the four flows are likely to be suitable for high quality aggregate production.
- The residential properties in the vicinity of quarry present a challenge for its operation.
- The historical development of the quarry has left 5-7 m wide benches and quarry faces, battered at angles between 1V:1H and 1.5V:1H. These appear to have been constructed to maintain geotechnical stability and to minimise the risk of boulders in the overlying flows being loosened by erosion and falling to the car park area below. Maintaining the existing RL 38 m quarry bench to catch boulders loosened from the top flow restricts the area available for quarrying to approximately 500m², at the eastern end of the second flow.
- Both explosive and non-explosive extraction methods are technically viable, but non-explosive extraction is unlikely to be efficient for the volume of material required to be worked, while explosive extraction presents some (albeit manageable) risk to nearby residential properties and existing batter stability.

The report concludes that the quantity of safely workable material is less than half that required for the airport project. Further investigation, environmental impact assessment and significant quarry

re-development is possible, but as described below this is likely to take significantly longer than the period available to be useful to the airport project.

Cascade quarry rock quality

The Cascade quarry development and options report focussed on the one flow likely to produce aggregate of suitable quality for airport asphalt resurfacing and concrete production. This is important because the currently variable and (in isolated areas) poor condition of the current airport pavement surface is likely to reflect (at least in part) the quality of the aggregate used during the 2007 resurfacing works, which used Cascade quarry rock.

The geotechnical investigation report was focussed on the existing pavement thickness and composition at the airport, but the opportunity was taken to also sample and evaluate residual stockpiles of the aggregate used during the 2007 resurfacing work. Various aggregate fractions still stockpiled at the airport were sampled and tested for the properties that would normally be specified for airport asphalt aggregate production. The results are compared to the typical airport specification limits in the following table.

Test Property	Result	Typical Airport Limit
Particle Density Coarse Aggregate	2860 kg/m ³	Not less than 2300 kg/m ³
Water Absorption	2.7%	Not more than 2.0%
Material Finer than 0.075 mm in Aggregates (by washing)	0.4%	Not more than 2.0%
Flakiness index	Not tested	Not more than 25%
Soundness (using Sodium Sulphate)	Up to 3.1% Average 1.0%	Not more than 3%
Wet Strength	139 kN	Not less than 150 kN
Wet/Dry Strength Variation	54%	Not more than 30%
Los Angeles Value	20%	Not more than 25% loss
Secondary Mineral Content	Not tested	Not more than 20%
Friable Particles	0.1%	Not more than 0.2%

The samples recovered from the 2007 residual stockpiles exhibited high water absorption, which likely has a significant detrimental impact on the wet strength and, by association, the wet-dry strength variation. The samples tested would not normally be considered suitable for airport asphalt resurfacing.

It is important to understand that it has not been determined which location(s) (within the quarry) are represented by the sample tested. That is, I have not been able to determine if the results tabulated above are likely to represent the good material (in the second flow) or contamination from the overlying third and fourth flows. It is, however, understood the significant cross-flow contamination occurred during the previous quarry operation, meaning the potential for marginal/unsuitable material (from the third or fourth flows) having been included in the residual 2007 stockpiles, can not be discounted.

Alternate on-island rock sources

The Cascade quarry development and options report also considered a number of alternate rock sources on Norfolk Island, but these would likely require years to be investigated, evaluated and developed, as discussed below.

Timeliness of rock accessibility

Advice was sought from the NIRC planning section regarding current and future approvals associated with the Cascade quarry. My interpretation of that advice is summarised as:

- The normal process for a new, re-habilitated or re-opened quarry operation (or other significant development) on Norfolk Island would include:
 - NIRC evaluation of whether the proposal should be reported to the Commonwealth.
 - If yes, a Commonwealth assessment of whether the proposal was deemed to be a 'controlled action'.
 - Controllable actions are evaluated via a Commonwealth Environmental Impact Statement.
 - Non-referred and non-controllable actions are evaluated via a NIRC Environmental Assessment.
 - The NIRC assessment would likely be simpler, but still requires an environmental assessment report, public consultation and ratification by Council.
- With regard to Cascade quarry, only the NIRC owned portion at the eastern end of the existing quarry site has a current evaluation, which included the initial NIRC evaluation and determination that it did not need to be referred to the Commonwealth.
- Any proposed extension of the quarry operation to the western portion for the existing Cascade quarry faces would require a reassessment by NIRC and would likely require referral to the Commonwealth, which may (or may not) determine the proposal is a controlled action.
- The area identified in the Cascade quarry development and options report is generally consistent with the existing NIRC assessment, so quarry operations in that area would likely not require further referral to the Commonwealth and therefore would likely not be a controllable action.
- Even quarry operations within the area already evaluated by NIRC would still require an environmental assessment report, development application, public consultation and Council approval.
- Subject to the availability and completeness of the existing documentation and information, establishing a quarry operation:
 - Within the area of the current NIRC evaluation would be expected to take 6-12 months.
 - Within Cascade quarry, but outside the area within the current NIRC evaluation, would be expected to take more than 12 months.
 - At a location outside of Cascade quarry would be expected to take more than two years.
- The starting point for all NIRC evaluation is a general design and quarry operation plan, so that the impact of the specific proposal can be evaluated.

It is clear that outside of the area of the current NIRC evaluation, Cascade quarry operations are unlikely to be possible in a timeframe that supports the airport project.

Recommendation

It is my opinion that an adequate volume, of safely extractable material, of appropriate quality for airport asphalt and concrete production, is unlikely to be found within the current Cascade quarry. This is based on:

- The safely workable area of the second flow expected to produce only half the required volume.
- The limited ability to extend the operation outside of the workable area.
- The (albeit limited) aggregate property testing indicating the 2007 aggregate (from the same quarry) is marginal/unsuitable.
- Any development proposal likely requiring referral to the Commonwealth and potentially being classified as a controllable action.

Furthermore, it is unlikely that any extension or major re-development of the Cascade quarry operation is practically possible within the timeframe required by the airport pavement rehabilitation project. Consequently, I recommend that NIRC does not enter into any contract for the airport pavement rehabilitation project that implies or states that NIRC underwrites or otherwise guarantees the quality and/or quantity of the material available at Cascade quarry. This is particularly important given the performance-based nature of the asphalt specification. Furthermore, I recommend that the current tender Option 1 (on-island rock crushing) be discontinued so tenderers can focus on Option 2 (rock importation).

Aside from the airport project, it is clear that securing a long-term source of quality rock for general construction on Norfolk Island is important. This could be addressed by investigating alternate sources of rock elsewhere on the island, a major development of Cascade quarry or, in the medium term, re-establishing the Cascade quarry operation within the area already evaluated by NIRC's planning section. It is recommended that NIRC consider these options without delay, but separately from the airport pavement rehabilitation project.

Regards,



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