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Crushed aggregate potential in Newcastle, KZN Province, South Africa

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In the National Development Plan of South Africa, the Durban-Free State-Gauteng Corridor has been identified in the freight logistics strategy by government as one of its five massive infrastructural projects planned to boost the economy. The effective implementation of such ambitious programme will require a massive amount of aggregate whose quality is a critical component in determining the use and life of infrastructure.

It is therefore essential that a detailed investigation of the aggregate quality be conducted in order for the decision makers to be aware of the position and spatial extent of potential construction and building materials during land-use planning.

The overall aim of the study is to compile a pilot crushed aggregate quality map for the area around Newcastle based on geological descriptions, chemical and physical property measurements of rock, radio elements values of airborne radiometric data, geochemistry, geotechnical testing and ground geophysics measurements.

The analysis of material supply situation shows incomplete statistical data although a qualified guess is that the construction aggregates used each year in South Africa is more than 80 million tons. This means that the consumption per capita is close to 2 tons per capita per year. The demand of aggregates is suspected to increase in South Africa as more infrastructural and housing project starts. To manage this future demand of aggregates more quarries will have to be started, especially hard rock quarries.

Results from geophysical surveys indicate that the gamma radiation is generally low for all sampled bedrock type in the area; dolerite, sandstone and shale. The dolerites show activity index between 0 and 0.2, the shale show activity index between 0.7 and 0.9 and the sandstones show activity index between 0.4 and 0.7.

Geophysical surveys have also indicated that the magnetic susceptibility is very low for sandstone and shale with values around 0.06 to 0.075 (x 10-3 SI) except for the quartzitic sandstone that shows a slightly higher magnetic susceptibility (mean value 0.5 x 10-3 SI). The magnetic susceptibility for the dolerites varies between 4 and 12 (x 10-3 SI) and can therefore be clearly distinguished from sandstone and shale due to their magnetic properties.

Analysis of regional magnetics data confirms the network of dykes, sills and sheets and the presence of sediments as low magnetic bodies. Ground magnetic and electromagnetic profiles identified a number of anomalies coinciding with known dolerite outcrops as well as anomalies possibly due to dolerite that have not been mapped. Resistivity surveys on selected dolerite sites suggested that the majority of the dolerites are high resistivity bodies of horizontal extent (sills and sheets) with varying degrees of weathering. Areas of low resistivity and high electromagnetic conductivity were attributed to shales, weathered sandstones and weathered dolerite.

The results of the aggregate mapping for crushed rock resources indicate potential for several near surface resources of high-quality bedrock lithologies. The potential of these areas are classified as high, moderate, low, and limited based on the integration of all sources of information.

Since this is a reconnaissance-level study, additional site-specific information is required to determine the suitability for economic development of a crushed stone quarry site.