

This digest is one of a series produced by the Aggregates Advisory Service to provide information on aggregates efficiency issues.

The aim of this service, funded by the Department of the Environment, Transport and the Regions, is to assist the Government to achieve its objective of reducing the construction industry's dependence on landwon primary aggregates and increasing the contribution from secondary and recycled materials.

Further information on aggregates efficiency issues, whether relating to primary, secondary or recycled materials, can be obtained from the Aggregates Advisory Service on Freephone no. 0800 374 279 or visit the website at <http://www.planning.detr.gov.uk/aas/index.htm>.



CHINA CLAY BY-PRODUCTS AS AGGREGATES

This digest briefly describes the potential for the wider use of china clay production by-products in road construction.

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CHINA CLAY

China clay (kaolin) is formed by the hydrothermal alteration and decomposition of the feldspars within the parent granite. The material insitu takes the form of a weakened rock structure consisting predominantly of kaolin, quartz sand and mica. The 'rock' is broken out by high pressure water jetting and the kaolin is separated from the resultant slurry.

The by-products resulting from the process are:

- Stent: Largely unaltered rock material often appearing as overburden or in isolated locations within the rock mass. This material can range in size from <100 mm to over 2 m in diameter.
- Sand: Material consisting predominantly of quartz having a particle size grading from fine sand to coarse gravel.
- Mica: Sub-sand sized material.

China clay is largely produced in the southwest of England and in particular in Cornwall. Approximately nine tonnes of by-product results for every one tonne of kaolin produced. At present, there are approximately 450 million tonnes of stockpiled by-product material in Cornwall, largely in the St Austell area.

USES OF CHINA CLAY WASTES

The crushed and graded stent has been used as a substitute for primary aggregate in highways construction. Using crushing and grading techniques it is possible to meet the majority of the Department of Transport Specifications. These include drainage filter media, pipe bedding and Type 1 sub-base. It is also possible to use the material as specialist fill and as an aggregate for concrete in accordance with BS 882. Adjustments are necessary in some specifications, particularly for structural fill due to the wide range of 10% fines values.

The sand is used widely as an aggregate in concrete block manufacture in the south west of England. The coarse nature of the material coupled with the mica content requires high water cement ratios and the material is normally blended with materials from alternative sources.

The sand is also used as a bulk fill for embankment construction and is compliant with the requirements of a Class 1 General Granular Fill within the Department of Transport `Specification for Highway Works.` In some circumstances, the small residual clay content in the material can leach out and this may result in colouration of drainage waters. This risk can be managed by selection of low clay content material for use in sensitive locations.

Approximately 30 - 40% of Cornwall County Council's total aggregate requirements are met by these materials.

EXAMPLE PROJECT

Crushed stent was used as Type 1 sub-base in the A30/A39 Indian Queens and Fraddon Bypass. This was a major trunk road scheme comprising of 7 km of new dual carriageway which was constructed in 1993/4.



A30/A39 Indian Queens and Fraddon Bypass during construction

Approximately 150 thousand tonnes of crushed stent was provided from the Indian Queens Quarry. This material was tested both by the contractor and Cornwall County Council and was found to be generally compliant to the specification with only occasional oversized material being present.

China clay sand was also used as the fine aggregate in concrete for the by-pass this was supplied by CAMAS Aggregates from the Blackpool Pit. Testing again demonstrated high compliance rates with occasional instances of a marginally high silt content. The concrete mixes incorporated both OPC and ground granulated blast furnace slag with a plasticiser admixture.



Embankment constructed using china clay waste

FUTURE

China Clay by-products have properties similar to primary aggregates. In particular the better quality stent has properties not dissimilar to crushed granite.

These materials are abundant in the south west of England and are available for exploitation. High road transport costs coupled with limitations in the existing rail link renders their transport to other parts of the UK uneconomic at present.

However future changes in the market structure possibly coupled with changes in Government policy may tip the balance of the market place in favour of these intrinsically suitable materials.