

## DEVELOPMENT OF ISO STANDARD SAND FROM LOCAL SILICA SAND DEPOSITS FOR CEMENT TESTING

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ISO standard sand is a siliceous natural sand used in the testing of cement for the SLSI certification process, material approval in construction projects, and material clearance in importing cement. Testing laboratories in government institutes and cement manufacturers import standard sand as it is not produced in Sri Lanka. According to the market survey carried out among the cement manufacturers and testing agencies, standard sand is imported mainly from China, France and Germany. Under the current economic situation in Sri Lanka, the government has imposed restrictions on importing standard sand required for the testing of cement. Hence, this research is mainly focused on developing ISO standard sand using locally available materials. There are several requirements for standard sand specified in SLS ISO 679 – Methods of testing cements – Determination of Strength, such as particle size distribution, and moisture content, and it must be verified with reference sand. The main mineral phase in standard sand and reference sand is Quartz. Hence, locally available vein quartz and silica sand were selected for this study due to their high silica content. Silica sand was obtained from the Marawila area in the Puttalam district, and Quartz powder from Naula in the Matale district. The sieve analysis was conducted for both washed silica sand and Quartz powder using the relevant sieves to separate each size fraction. It was observed that the percentage of particles less than 150 microns in silica sand from Marawila was very small. Therefore, Quartz powder was used to meet the particle size fraction less than 150 microns requirement. Standard sand was prepared by combining both silica sources to satisfy the requirements specified in SLS ISO 679.

The compressive strength of cement mortar samples prepared with imported ISO standard sand and standard sand prepared with local sand were determined as per the procedure given in SLS ISO 679 standard. It was observed that the particle size distribution of ISO Standard sand has a considerable effect on the compressive strength of cement mortar, even when it is within the recommended band limits as specified in SLS ISO 679. It was also observed that, even with the same particle size distribution, there was a variation of strength between different sand sources. These results indicate the importance of controlling not only particle size distribution but also characteristics of sand particles, such as particle shape and surface texture, when developing standard sand in order to obtain consistent results when testing cement for strength. Inter-laboratory test results of different cement types with the developed local standard sand indicate that the repeatability and reproducibility of the compressive strength test results are at a satisfactory level.

**Keywords: ISO standards sand, Silica sand, Cement testing, Compressive strength**

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# Development of ISO Standard Sand from Local Silica sand Deposits for Cement Testing

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ISO standard sand is a naturally occurring siliceous sand used to test cement. In Sri Lanka, standard sand is imported from countries like China, Germany, and France. Due to the ongoing economic crisis and stringent regulations on the importation of essential items, accredited laboratories and cement manufacturers are facing difficulties in obtaining the standard sand for testing cement. In response to a request from the Sri Lanka Standards Institute (SLSI), the National Building Research Organization (NBRO) investigated the possibility of producing standard sand from suitable local sources to meet the demand for standard sand in the Sri Lankan construction industry.

The SLS ISO 679 standard specifies the requirements for standard sand and the procedures for testing it. The standard sand must meet several requirements, including a specific particle size distribution and moisture content. It must also be verified with reference sand.

## Methodology

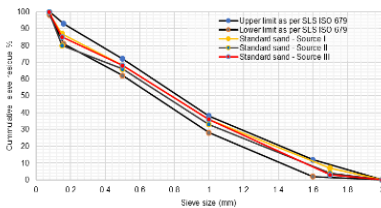
Preliminary Study

Investigation Local Source

Local Standard Sand Preparation

### Test results on standard sand

Particle size distribution-



Silica sand

From Marawila area



Quartz silica powder



(0.150mm ≤ Particle size < 2.0mm)      0.080mm ≤ Particle size < 0.150mm

Silica sand

Quartz silica powder



	Relative Density	Uncompacted Void Content (%)
Source I	2.57	38.72
Source II	2.61	37.25
Source III	2.57	39.13

Quartz percentage is more than 94 % in both sources

## Conclusion

- Particle size distribution of ISO Standard sand has considerable impact on the compressive strength of cement mortar even though the particle size distribution is within the recommended band limits as specified in SLS ISO 679.
- Even with the same particle size distribution, there was a variation of strength between different standard sand sources.
- These results indicate the importance of controlling not only particle size distribution but also characteristics of sand particles such as particle shape and surface texture when developing standard sand in order to obtain consistent results when testing cement for strength.

## Test results

