

TERMS OF REFERENCE FOR R&D PROJECT

1. Project Title

Study on physical and uniformity test requirements of chemical admixtures used in making cement concrete.

2. Background

- a) Chemical admixtures are those materials added to cement concrete before or during mixing of the concrete making materials, with a view to modifying one or more of the properties of the resulting concrete in its plastic or hardened state.
- b) BIS has an Indian Standard on IS 9103: 1999 'Concrete Admixtures - Specification (*first revision*)' which was amended twice (in 2003 and 2007). This Indian Standard (as well the amendments) can be accessed and downloaded from <https://standardsbis.bsbedge.com/>
- c) The Indian Standard specifies various physical requirements of the 05 types of admixtures (namely accelerating, retarding, water-reducing, air-entraining, and superplasticizing) that can be used in concrete to alter/add value in the fresh concrete and/or its hardened state. It also specifies the uniformity tests requirements of the admixtures for ascertaining their uniform and homogenous composition.
- d) New varieties of admixtures are available in the market that claim to alter not just one but two or more properties of concrete; whose credibility needs to be ascertained in the interest of the construction industry.
- e) Considering the latest technological developments in the industry, understanding gathered in the past two decades and concerns raised by the manufacturers, it was felt that a detailed study on physical and uniformity test requirements of various types of concrete admixtures is required to address the challenges being faced by the existing standard.

3. Objective – To collect data/information and evidence from primary and secondary sources in regard to physical and uniformity test requirements of concrete admixtures.

4. Scope

- a) Undertake study and comparative analysis of the available literature on the subject which includes international and other national standards and journals, research papers published on the subject, guidelines/regulations issued by the concerned Ministry/Government agency and any other study conducted by other industry/organization.
- b) Collect import and export data of the admixtures. In case, concrete admixtures are either imported or exported, information regarding relevant standards/technical regulations of concerned countries related to the product shall be reviewed.
- c) Carry out factory visit to the manufacturers of concrete admixtures which include large/medium/small/micro industry, identify/collect the information regarding the manufacturing base of the admixtures and the available testing facilities available in the country. During the visit, the researcher need to observe the following activities:
 - 1) Variety of the products manufactured
 - 2) Manufacturing process

- 3) In process quality and safety checks
 - 4) Marking and labelling
 - 5) Packaging requirements
 - 6) Testing facilities and equipment used at the factory location
 - 7) Sustainability practices adopted by the manufacturer such as energy consumption, use of renewable energy resources, waste management and disposal mechanisms and reduction of carbon footprint.
- d) Visit BIS recognised lab/NABL accredited testing laboratories of the concrete admixtures (one government and one private) to identify the testing infrastructure available in the country.
- e) Collect samples of admixtures from the manufacturers in order to obtain data on various requirements of concrete made using the admixtures, such as:

1) Physical requirements

- i) Water content
- ii) Slump
- iii) Initial and Final setting time
- iv) Compressive strength for 1, 3, 7, 28 days and 6 months
- v) Flexural strength at 3, 7 and 28 days
- vi) Change in length after 28 days and 6 months
- vii) Bleeding
- viii) Loss of workability
- ix) Air content
- x) Requirements for high workability test mix

2) Uniformity tests and requirements of admixtures

- i) Dry materials content
- ii) Ash content
- iii) Relative density
- iv) Chloride ion content
- v) pH
- vi) Emission Spectroscopy

The above requirements shall be checked for any new variety of admixture as well.

- f) Analyse and prepare an analytical report covering the above details.

5. Sampling Plan – For collecting the samples of admixtures for testing and examination, BIS expects the following:

- a) Two manufacturers from large and MSME each shall be visited as part of the project, and
- b) Samples of each type of admixture including, but not limited to accelerating, retarding, water reducing, air entraining and super-plasticizing admixtures to be collected for testing the performance parameters as mentioned in the scope from any BIS recognized lab/NABL accredited lab.

6. Methodology – In respect of the areas covered in the scope, the following should be adhered:

- a) Review the available literature.
- b) Collect feedback from the importers/exporters/manufacturers/laboratories by circulating structured questionnaire.
- c) Collect feedback from the users of concrete admixtures, even at the level of the site supervisor involved in construction.
- d) *Visit to the manufacturer* - During the visit, the following tasks shall be done:
 - 1) Witness/observe the manufacturing processes and types of admixtures produced.
 - 2) Hold group discussions with their Quality Control(QC)/Quality Assurance(QA) in-charge with respect to performance and testing requirements of the admixtures.
 - 3) Based on (1) and (2), carry out comparative analysis of the physical and uniformity test requirements recommended by the QC/QA personnel of different industries.
 - 4) Collect samples for testing.
- e) During the lab visit, the following tasks shall be done:
 - 1) Observe the testing of the product
 - 2) List out the testing equipment used.
- f) Collected samples from the manufacturers shall be tested in any of the BIS recognised lab/NABL accredited lab/ In-house lab of BIS MoU Partner Institutes.
- g) Analyse all the findings as mentioned above.

7. Deliverables

- a) An analytical report covering all the aspects as mentioned above.
- b) In addition to the above report, the following documents shall be suitably appended:
 - 1) Group discussions held with the QC/QA in charge.
 - 2) Responses received to the questionnaire held with the manufacturers.
 - 3) Details of the factory/laboratory visited during the project time duration.

8. Timeframe

- a) The timeline for completing the study and submission of the final report is **6 months** from the date of award of the project.
- b) Collection of information from manufacturers/users – 1 month
- c) Interim report on literature review – 20 days.
- d) Collection and testing of samples – 3 months
- e) Project report* shall be submitted by the end of 6 months in both hard and digital format.

NOTE: The proposer may forward the draft report to BIS without waiting for the test report in case of a long duration test of 6 months, which shall however be submitted, immediately on completion of the test.

9. Support from BIS –

BIS will provide access to latest available editions of Indian standards and/ or international standards relevant to the project, on request.

10. Nodal Officer Details

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