1 GENERAL

1.1 INTRODUCTION

1.1.1 Scope

1 This Section includes the requirements for concrete work for pipelines, roadworks, runways, structures, water retaining structures, foundations and bases for structures and equipment.

2 The purpose of QCS is to provide as a general technical guide for acceptable construction work practices in the State of Qatar, considering this; any addition for technology, material, specification, standard that are not mentioned in this section or their modification, shall be subject to approval as stated in the introduction of QCS (00-02).

3 This Part includes relevant standards, definitions, abbreviations, and requirements for testing facilities, rejected materials, and record keeping.

4 Related Sections are as follows:

This Section: ...
Part 2, ... Aggregates
Part 3, ... Cementitious Materials
Part 4, ... Water
Part 5, ... Admixtures
Part 6, ... Property Requirements
Part 7, ... Concrete Plants
Part 8, ... Transportation and Placing of Concrete
Part 9, ... Formwork
Part 10, ... Curing
Part 11, ... Reinforcement
Part 12, ... Construction Joints
Part 13, ... Inspection and Testing of Hardened Concrete
Part 14, ... Protective Coatings to Concrete
Part 15, ... Hot Weather Concrete
Part 16, ... Miscellaneous
Part 17, ... Precast Concrete
Part 18,..... Prestressed Concrete
Part 19, ... Water Retaining Structures

Section 1, General
Section 2, Quality Assurance and Quality Control
Section 4, Foundations and Retaining Structures
Section 6, Roadworks
Section 8, Drainage Works
Section 9, Mechanical and Electrical Equipment

1.1.2 References

1 The following standards are referred to in this Part:

ASTM C31/C31M .....Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C39/C39M .....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C143/C143M ...Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C1064/C1064M Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

BS 6100 .....Building and civil engineering. Vocabulary

EN 932-1 .....Tests for general properties of aggregates - Part 1: Methods for sampling

EN 932-2 .....Tests for general properties of aggregates - Part 2: Methods for reducing laboratory samples

EN 12350-1 .....Testing fresh concrete - Part 1: Sampling and common apparatus

EN 12350-2 .....Testing fresh concrete - Part 2: Slump test

EN 12390-1 .....Testing hardened concrete - Part 1: Shape, dimensions and other requirements for specimens and moulds

EN 12390-2 .....Testing hardened concrete - Part 2: Making and curing specimens for strength tests

ISO 1920-1 .....Testing of concrete —Part 1: Sampling of fresh concrete

ISO 1920-2 .....Testing of concrete – Part 2: Properties of fresh concrete

ISO 1920-3 .....Testing of concrete – Part 3: Making and curing test specimens

1.1.3 Definitions

1 Definitions used in this Section.

The following are terms and abbreviations used:

°C	degree Celsius
cal	calorie
cm	centimetre
d	day
$f_{ck,cyl}$	Characteristic compressive strength of concrete determined by testing cylinders
$f_{c,cyl}$	Compressive strength of concrete determined by testing cylinders
$f_{ck,cube}$	Characteristic compressive strength of concrete determined by testing cubes
$f_{c,cube}$	Compressive strength of concrete determined by testing cubes
f_{cm}	Mean compressive strength of concrete
$f_{cm,j}$	Mean compressive strength of concrete at the age of (j) days
GGBS	ground granulated blast furnace slag
GUTS	guaranteed ultimate tensile strength
h	hour
kg	kilogram
kJ	kilojoule
kN	kilonewton
l	litre
m	metre
m^2	square metre
m^3	cubic metre
mg	milligram
min	minute
mm	millimetre
mm^2	square millimetre
months	months
MPa	mega Pascal
kPa	kilo Pascal

MSRPC	moderate sulphate resisting Portland cement
OPC	ordinary Portland cement
PFA	pulverised fuel ash
PVC	polyvinylchloride
s	second
SF	silica fume
SRPC	sulphate resisting Portland cement
ton	1000 kg
ppm	part per million
micron	10^{-6}
µm	10^{-6} meter

2 Reference to a technical society, institution, association or governmental authority is made in accordance with the following abbreviations.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BS	British Standard
BSCP	British Standard Code of Practice
BSI	British Standards Institution
C & CA	Cement and Concrete Association
CIRIA	Construction Industry Research and Information Association
CRSI	Concrete Reinforcing Steel Institute
CS	Concrete Society
DIN	Deutsches Institut fur Normung e.V.
EN	Euro Norm
FHWA	Federal Highway Authority
GSO	GCC Standardization Organization
ICE	Institution of Civil Engineers
ISO	International Organization for Standardization
PCI	Prestressed Concrete Institute
QCS	Qatar Construction Specifications
QS	Qatar Standards
UK DfT	United Kingdom Department for Transport

1.1.4 Approved Products

1 The contract specific documentation may identify approved products and approved or prequalified manufacturers and suppliers of products used in concrete work.

1.2 IMPLEMENTATION

1.2.1 Approved Installers

1 The contract specific documentation may identify approved or prequalified providers of concrete construction services.

1.2.2 Field Quality Control

1 The Contractor shall carry out the test procedures required by this Section and any other tests and test procedures as directed by the Engineer from time to time. The test procedures shall be carried out using the facilities of an approved accredited independent testing laboratory.

2 Supply, storage, sampling and testing of all materials shall be the responsibility of the Contractor, unless the Contract specifies otherwise.

3 The Engineer may also require the Contractor to take samples of materials and deliver them to the Central Materials Laboratory for additional tests to be carried out by the Employer. Sampling procedures shall be in accordance with EN 932 or relevant ASTM Standards, and sample sizes shall conform to the requirements shown in Table 1.1.

4 The minimum equipment required for testing on Site is given in Table 1.2. This equipment shall be maintained on Site at all times during concreting operations together with the necessary scoops, buckets, sample containers, and other items required for sampling. The cube curing tank shall be located in an air-conditioned area as stated in part 06.

1.2.3 Rejected materials

1 Any material rejected by the Engineer, in particular cement which has deteriorated or aggregates which have segregated or become contaminated, shall be immediately removed from the Site.

1.2.4 Records

1 The Contractor shall maintain on the Site full records of all work carried out accurately related to the location of the work on site, which shall include:

(a) the time and date when all concrete was poured, formwork removed and when formwork props were fully removed

(b) all cubes and other tests

(c) daily maximum and minimum temperatures.

2 One copy of all test results shall be sent to the Engineer immediately upon completion of the tests

Table 1.1
Sampling Procedure and
Minimum Sample Sizes for Central Materials Laboratory

Material	Test	Min. Sample
Cement	Full range of tests	Composite sample of 7 kg taken from at least 12 bags
Aggregate	Full range of tests	200 kg
	Sieve analysis Chemical analysis Soundness test Water absorption Particle density Flakiness index Fines content LA Abrasion value	50 kg
Reinforcement	Tensile test	500 mm
	Bend test	300 mm
Water	Full range of tests	5 litres

Table 1.2
Minimum Testing Equipment for Each Site*

Test	Equipment to be Provided	Minimum Number Required
Slump test EN 12350-2 or ISO 1920-2 or ASTM C143/C143M	Slump cone with base plate	1
	Compacting rod, circular cross-section and round ends	1
	Remixing container, 300 mm ruler, moist cloth	1
	Scoop and shovel	1
	Timer	1
Cube making EN 12390-1 and EN 12350-1 or ISO 1920-1 and ISO 1920-3 or ASTM C31/C31M and C39/C39M	100 or 150 mm cubical or cylindrical moulds[1]	6
	Compacting rod or bar Set of tools for assembling and stripping moulds	1
	Remixing container	1
	Trowel, Scoop, Shovel and Mallet	1
	Mould release agent in closed container with brush	
Cube curing EN 12390-2 or ISO 1920-3 or ASTM C39/C39M	Hessian or sacking, impervious sheet	lot
	Maximum/minimum thermometer	1
	Waterproof marking crayon/paint or equivalent	1
	Curing tank (in air conditioned room)	1
	Supply of packing materials for sending cubes to commercial laboratory	Lot
ASTM C1064/C1064M	Concrete thermometer	1

1 - The use of 100 mm cube and cylinder moulds are permitted when the nominal maximum aggregate size is not greater than 20mm

END OF PART