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सत्यमेव जयते

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

CONCRETE ADMIXTURES

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Centre
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TECHnology

उच्च अनुरक्षण प्रौद्योगिकी केन्द्र

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CONCRETE ADMIXTURES

Foreword

In recent times, there has been a lot of development in the field of "Admixtures" and they are also used in different construction sites of Indian Railways.

Civil Engineering department of CAMTECH has made an attempt to provide information regarding "Concrete Admixture", manufacturers and their various products.

Information provided in this book shall help the Railway officials and supervisor of civil engineering branch of Indian Railways in selection and use of concrete admixtures.

I hope that this book will be very useful and informative for field staff.

CAMTECH/Gwalior
Date :18/10/2007

Pramod Kumar
Executive Director

Preface

Indian Railway having a lot of stations, buildings, offices and residential accommodations, bridges, flyovers are vast network spread all over India. Admixtures may also use in different construction sites of Railways.

Objective of this book is to provide information about various concrete admixtures, their effects on concrete, manufacturers and suppliers.

Every effort has been made to make this handbook useful to civil engineering personnel.

This handbook does not supercede any existing information from Railway Board, IRWM, RDSO etc. *This handbook is not statutory & contents are for the purpose of guidance only.* Most of the data and information mentioned herein are available in some form or the other in various books or printed matter.

We welcome valuable suggestions from our readers for further improvements.

CAMTECH/Gwalior
Date :11/10/2007

A. K.Dadarya
Director/Civil

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ISSUE OF CORRECTION SLIPS

The correction slips to be issued in future for this handbook will be numbered as follows:

CAMTECH/2007/C/ADMIXTURES/1.0/CS. # XX date …….....

Where "XX" is the serial number of the concerned correction slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

Sr. No. of C. Slip	Date of issue	Page no. & Item no. modified	Remarks

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Introduction

There are essentially four ingredients in concrete, i.e. the coarse aggregate, fine aggregate, cement and water. However, in order to improve certain properties of the concrete both in plastic and hardened state, it is necessary to add the fifth ingredients in the concrete mix, either it can be a mineral or chemical admixture.

If concrete mix is properly designed, most concrete do not need any admixtures. There may be a need to produce concrete with a particular result and using admixture may be the most convenient way. It is very important to note that any type of admixtures should be used only when there is a valid reason to use it.

1.0 What is Admixture?

A material other than water, aggregate, and hydraulic cement, used as an ingredient of concrete or mortar and added to the batch immediately before or during its mixing, to modify one or more of the properties of concrete in the plastic or hardened state, is termed as Admixture.

2.0 Uses of Admixtures

Use of admixture may be encouraged in following situations:

i) In specialised job like pre-stressed concrete bridges, precast concrete elements requiring high early strength and retention of workability at elevated temperature. Early gain of strength enables earlier release from precast mould, thus speeding up production.

ii) In the circumstances where increased workability of concrete is required without reducing the compressive strength or without changing of water- cement ratio, especially when the concrete pores are restricted, due to congested reinforcement or due to complicated formwork.

iii) In ready mix concrete where retarding action with high workability is required for long distance transportation before placing.

iv) Where reduction in permeability in concrete is required e.g. in hydraulic structures, marine structures, damp proof courses, retaining walls, swimming pools, basements and kitchen garden terraces etc.

v) Where high performance concrete is required, use of one or more admixtures can influence the strength at a later stage and improve resistance to chemical attack.

vi) In the circumstances where concrete is exposed to corrosion attack from external media in severe exposure conditions, a very high level of chloride is anticipated.

vii) Admixtures enhancing bonding properties can be used to bond old concrete with new and also for patching operations.

In view of the increasing importance of the use of admixture in concrete, it is essential to ensure that persons engaged in the production/handling of concrete should have a sound understanding of the material being utilised.

Before selection of the admixture to be used in concrete, the purpose of use of admixture should be clearly known.

Admixtures, which have been elaborated in the following Paras, are used to modify the properties of concrete.

2.1 Effects of Admixtures on the properties of fresh concrete

(i) To increase workability without increasing the water cement ratio.
(ii) To retard or accelerate time of initial or final setting.
(iii) To modify the rate of bleeding.
(iv) To retard segregation or increase cohesion.
(v) To improve pump ability.
(vi) To reduce the rate of loss of workability.

2.2 Effects of Admixtures on the properties of hardened concrete

(i) To accelerate the rate of strength development especially at early stage.
(ii) To increase the strength.
(iii) To increase the durability.
(iv) To decrease the permeability.
(v) To control expansion by alkali-aggregate reaction.
(vi) To improve bond with reinforcement.
(vii) To improve bond with old/new concrete.
(viii) To improve impact or abrasion resistance.
(ix) To inhibit corrosion of embedded reinforcement.

3.0 Types of Admixtures

As per IS: 9103, admixtures are of the following types:

(a) Accelerating admixtures
(b) Retarding admixtures
(c) Super plasticising admixtures
(d) Water reducing admixtures and
(e) Air entraining admixtures

Following Paras describe above admixtures in brief about their effects, dosages and advantages etc.

3.1 Accelerating admixtures

These admixtures when added to concrete, mortar or grout increase the rate of hydration of hydraulic cement, shorten the time of set, and accelerate the hardening or development of strength of concrete/mortar.

These admixtures function by interaction with C_3S (Tri-calcium silicate) component of the cement thus increasing the reaction between cement and water.

3.1.1 Why it is used

Accelerating Admixtures can be used

i) For shortening the setting time of cement and thereby increasing the rate of gain of strength.
ii) For speeding production from pre-cast moulds by enabling earlier release of moulds.
iii) To reduce segregation and increase density and compressive strength.
iv) To cure concrete faster and therefore uniform curing in winter and summer can be achieved.
v) For early use of concrete floors by accelerating the setting of concrete with the help of accelerating admixtures.
vi) To reduce water requirement, bleeding, shrinkage and time required for initial set.

3.1.2 Effects of use of accelerator

By the use of accelerator in concrete mix of same slump and cement contents, the increase of strength at early stage with better workability can be achieved even at reduced water cement ratio.

Dosages ranging from 0.06 to 3% by weight of cement for different products are recommended by different manufactures, but it should be fixed as per design requirement and site trials.

3.2 Retarding admixtures

An admixture which delays the setting of cement paste, and hence of mixtures, such as mortar or concrete containing cement.

This type of chemical admixtures decreases the initial rate of reaction between cement and water and thereby retards the setting of concrete. It functions by coating the surface of C_3S (tri Calcium silicate) components, thus, delaying this reaction with the water. Reaction process is slow to form as such setting and hardening of the concrete is delayed reducing early compressive strength. Since, the rate of stiffening of concrete

can be too fast in our tropical climatic conditions, sufficient time for the concrete is required for transportation and placement before setting. In such conditions retarding admixtures can be very useful. Retardation setting time up to 8 to 10 hours is possible by suitable use of retarders.

The delay in hardening caused by the retarders can be exploited to obtain an architectural finish of exposed aggregates; the retarders are applied to the interior surface of the form work so that the hardening of the adjacent cement is delayed. This cement can be brushed off after the form work has been struck so that an exposed aggregate surface is obtained.

3.2.1 Why it is used.

Retarding Admixtures can be used for

i) to Improve workability, cohesion

ii) to extend setting time,

iii) to provide protection against delays and stoppages and facilitate keeping workable concrete for extended period.

iv) good workability of the concrete throughout the placing period and prevention of cold joints is ensured by adding retarders in the concrete.

v) to minimise risk of long distance delivery in hot weather by extended setting time, improve pumpability of concrete by extended setting period and improved workability of concrete.

vi) to reduce bleeding and segregation where poor sand grading is unavoidable.

vii) to reduce adverse environmental effects of various natures on concrete and embedded steel by considerable reduction in permeability.

3.2.2 Effects of use of Retarder

Retarding admixture forms a film around the cement grain that prevents or delays the reaction with water. After some times, this film breaks and normal hydration takes place.

By the use of retarder in concrete as an admixture, due to increase in slump, the workability can be increased maintaining same water cement ratio and strength of concrete. With reduction of water cement ratio, the strength of concrete can be increased without loss of workability.

Dosages ranging from 0.05 to 1% by weight of cement for different products are recommended by different manufactures. However, it should be fixed as per design requirement and after site trials.

3.3 Plasticizer (Water reducer) admixtures

A material, which either increases workability of freshly mixed concrete without increasing water cement ratio or maintains workability with a reduced amount of water, is termed as water reducing admixture.

As the name implies, the function of water reducing admixture is to reduce the water content of the mix, usually by 5 to 10%, sometimes (in concrete of very high workability) up to 15%. Thus, the purpose of using a water reducing admixture in a concrete mix is to allow a reduction in the water cement ratio while retaining the desired workability or, alternatively, to improve its workability at a given water cement ratio. The actual reduction in water depends on dose of admixture, cement content, type of aggregate used, ratio of cement, fine and coarse aggregate etc. Therefore, the trial mixes containing an actual material to be used on the job are essential to achieve optimum properties.

3.3.1 Why it is used

i) To increase the workability of the concrete without reducing the compressive strength or without changing water cement ratio.

ii) This type of admixture is particularly useful when concrete pores are restricted either due to congested reinforcement or due to thin sections.

iii) To obtain high strength with the same cement content by reducing water cement ratio.

iv) To save the quantity of cement (approx. upto10%) can be achieved keeping the same water cement ratio and workability.

3.3.2 Effects of use of Plasticizers

i) Reduced cement content keeping same water-cement ratio and workability. This will lead to economy.

ii) Reduced water-cement ratio keeping same water content and same workability. This will lead to increase in strength.

iii) Increased workability keeping same water cement ratio and cement content. This is specially required when workability retention for pumping etc. is needed.

Dosage ranging from 0.15 to 0.6 percentages by weight of cement (different doses for different products) is recommended by manufacturers; however, it should be fixed as per design requirement and after site trials.

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3.4 Super plasticizer Admixtures

An admixture for mortar or concrete, which imparts very high workability or allows a large decrease in water content for a given workability.

Normal water reducers are well-established admixtures called plasticizers in concrete technology. A normal water reducer is capable of reducing water requirement by 10 to 15%. Higher water reductions by incorporating larger amounts of these admixtures result in undesirable effects on concrete like bleeding, segregation and hardening. So, a new class of water reducers, chemically different from the normal water reducer and capable of reducing water content by about 30% has been developed. The admixtures belonging to this class are known as super plasticizers. Super plasticizers are, in fact, the extended version of plasticizers.

At a given water/cement ratio and water content in the mix, the dispersing action of super plasticizers increases the workability of concrete, typically by raising the slump from 75 mm to 200 mm, the mix remaining cohesive. The resulting concrete can be placed with little or no compaction and is not subject to excessive bleeding or segregation. Such concrete is termed as flowing concrete and is useful for placing in very heavily reinforced sections, in inaccessible areas, in floor or road slabs, and also where very rapid placing is desired. The principle mode of action of super plasticizers is their ability to disperse cement particles very efficiently. As they do not entrain air, they can be used at high dosage rates without affecting strength.

There are four main categories of super plasticizers based on their chemical composition:

(i) Sulfonated melamine formaldehyde condensates

(ii) Sulfonated naphthalene formaldehyde condensates

(iii) Modified lignosulfonates

(iv) Others such as sulfonic acid esters and carbohydrate esters.

3.4.1 Why it is used

(i) Cement content can be reduced to greater extent keeping the same water-cement ratio. This will lead to **economy.**
(ii) Water cement ratio can be reduced significantly keeping same cement content and workability. This will lead to **increase in strength.**
(iii) Higher workability can achieved at very low water cement ratio, like casting concrete with heavy reinforcement.
(iv) To reduce permeability.
(v) Where early strength development is required in pre-stressed concrete or casting of floor, where early access for finishing equipment is required.

3.4.2 Effects of use of Super plasticizers

By use of different dosage of super plasticizers, the slump is increased resulting into better workability of concrete and the better strength can be achieved by reduced water cement ratio.

Saving of cement up to 20% can be achieved by different dosage of super plasticizers in the concrete at constant water cement ratio (0.55) and workability (80-90) slump.

The normal dosages of super plasticizers are 1 to 3 litres per cu. m. of concrete of the liquid super plasticizers containing about 40% of active material. When super plasticizers are used for large water reduction and for high strength, their dosage is much higher; 5 to 20 litres per cubic metre of concrete. Generally, the dosage recommended by the manufacturer should be taken as guidelines and the correct dosage is decided based on site trials. The typical test results show the increase in workability and increase in strength due to use of super plasticizers.

3.5 Air Entraining Admixture

Air Entraining Admixture causes air to be incorporated in the form of minute bubbles in the concrete or mortar during mixing, usually to increase workability and resistance to freezing and thawing and disruptive action of de-icing salts. Air entrained also breaks the continuity of capillaries.

The dosages required are between 0.005 to 0.05% by mass of concrete and it is advisable to mix it with batching water for uniform dispersion. The air content is controlled between 3 to 6%. Method of measuring air content is given in IS 1190.

3.5.1 Chemical composition

The major proportion of commercial product is based on the following chemical materials, set out in order of probable decreasing use.

i) Abietic and pimeric acid salts
ii) Fatty Acid salts
iii) Alkyl-aryl sulphonates

iv) Alkyl sulphonates
v) Phenol ethoxylates

3.5.2 Why it is used

(i) To get durability.
(ii) To reduced bleeding and segregation because of :
- Attachment of air bubbles with cement particles and linking them.
- Increase in inter particle attraction caused by adsorption of air entrainer.
- Bubble acting as extra fine filler and increased total surface area of constituents relative to water volume.
- Water flow between cement particles is restricted.

(iii) Workability increased due to action of air bubbles as ball bearing, which assists movement of particles, each other.

4.0 Requirements of Admixtures

Concrete made with admixtures when compared with identical concrete made without the admixture shall confirm to the requirements appropriate to the type of admixtures given in table (control sample), should meet the applicable physical requirement as given in following table as per IS: 9103 & in the case of air entraining admixtures, a reference of approved quality shall be used in control concrete to entrain identical amount of air.

4.1 Physical Requirement

S. N.	Requirement	Accelerating Admixture	Retarding Admixture	Water Reducing Admixture	Air-Entraining Admixture	Super plasticising	
						Normal	Retarding type
1	Water content, percent of control sample, mix.	-	-	95	-	80	80
2	Slump	-	-	-	-	Not more than 15mm below that the control mix concrete	Not more than 15mm below that the control mix concrete
3	Time of setting allowable deviation from control sample hours.						
	Initial						
	Max.	-3	+3	±1	-	±1.5	+4
	Min.	-1	+1		-	-	+1
	Final						
	Max.	-2	+3	±1	-	±1.5	+3
	Min.	-1	-	-	-	-	-
4	Compressive strength percent of control sample, Min						
	1 day	-	-	-	-	140	-
	3 days	125	90	110	90	125	125
	7 days	100	90	110	90	125	125
	28 days	100	90	110	90	115	115
	6 months	90	90	100	90	100	100
	1 year	90	90	100	90	100	100
5	Flexural strength, percent of control sample, Min.						
	3 days	110	90	100	90	110	110
	7 days	100	90	100	90	100	100
	28 days	90	90	100	90	100	100
6	Length change, percent increase over control sample, Max.						
	28 days	0.010	0.010	0.010	0.010	0.010	0.010
	6 months	0.010	0.010	0.010	0.010	0.010	0.010
	1 year	0.010	0.010	0.010	0.010	0.010	0.010
7	Bleeding, percent increase over control sample, Max.	5	5	5	5	5	5
8	Loss of workability	-	-	-	-	-	-
9	Air content % Max. over control	-	-	-	-	1.5	1.5

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4.2 Requirement for high workability test mix

Sr. No.	Requirement	Type of super plasticising admixtures	
		Normal	Retarding type
1.	Flow	510-620 mm	510-620 mm
2.	Loss of workability on standing	At 45 minute slump shall be not less than that of control mix concrete at 15 minute.	At 2 hours the slump shall be not less than that of control mix concrete at 15 minute.
3.	Minimum Compressive strength. Percent of control mix concrete		
	7 days	90	90
	28 days	90	90
	06 months	90	90
	01 year	90	90

4.3 Uniformity test and requirement of an admixture

Any batch of admixture shall have the same physical state and composition, as that of admixtures tested for acceptance. To check the uniformity of composition, a representative sample of the batch shall be tested and shall satisfy the requirement given in table as under,

S. No.	Property	Requirement reference
1.	Dry material content for liquid or solid admixtures	Within 3 percent of the value stated by the manufacturer
2.	Ash content	Within 1 percent of the value stated by the manufacturer
3.	Relative density	Within 0.02 percent of the value stated by the manufacturer
4.	Chloride ion content	Within 10 percent of the value or 0.2 percent which ever is greater as stated by the manufacturer
5.	Ph value	Within plus minus 1 percent of the value stated by the manufacturer

Note - Uniformity requirement for ash content is not applicable to accelerating admixtures, which may contain more than 1% chloride content.

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5.0 Precautions

i) Chief engineer may permit the use of admixtures for imparting special characteristics to the concrete or mortar on satisfactory evidence that the use of such admixtures does not adversely affect the properties of the concrete or mortar particularly with respect to the strength, volume change, durability, and has no deleterious effect on reinforcement.

ii) The admixture, when permitted, shall confirm to IS: 9103.

iii) Calcium Chloride or admixtures containing Calcium chloride shall not be used in structural concrete containing reinforcement, prestressed tendons or other embedded metals.

iv) The admixtures containing Cl or SO_3 ions shall not be used. Admixtures containing nitrates shall also not be used. Admixtures based on thiocynates may promote corrosion and therefore, shall be prohibited.

v) It is ensured that the admixture is chloride free.

vi) Self-life of admixtures should be monitored continuously.

vii) All container of admixtures should be correctly levelled with the following information

a) Identification of the source of manufacture
b) Year and date of manufacture
c) Type of admixture whether accelerating, retarding, water reducing, air entraining normal super plasticisers or retarding super plasticisers
d) Batch number and,
e) Chloride ion content

viii) Reliable liquid dispenser should be used for liquid admixtures and it is calibrated.

ix) It is relatively easy to verify the specific gravity as claimed by the manufacturer. This will indicate defect at first hand.

x) Manufacturer should be asked to furnish adequate technical data such as,

a) Additional influence whether detrimental or beneficial
b) Potential occupational hazards for the users
c) Presence of detrimental substances like chloride, sulphates, sugar etc.
d) Recommended dosages, preparations, and procedures to be used
e) Any other data required
f) Physical state that is liquid or solid and colour

g) Composition
   - Generic type of main active constitutes for example, lignosulphonate, organic hydroxyearboxylie acid or carbohydrades
   - Dry material content
   - Ash content
   - Relative density of liquid admixtures
   - Chloride ion contents expressed as a percentage by mass of total admixtures.

h) The chloride ion contents relative to the cement mass contributed by the recommended dosage or dosage expressed as percentage by mass of chloride ions.

i) Recommended storages conditions, maximum storage time before use and necessary safety precautions for example toxic or corrosive.

j) Any known incompatibility with other admixtures or with certain type of cement etc.

k) Recommended dosage or dosages.

l) The effect of under dosage and over dosages and

m) Expiry date.

n) The selection of admixtures should be done only after trials in laboratory and consultation with the manufacturer.

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6.0 Guide lines on effects of types of admixtures in frequent use on concrete properties

Items	Types of Admixtures				
	Water reducers	**Super plasticizers**	**Accelerator**	**Retarders**	**Air Entrainers**
Dosage (% of cement)	Less than 0.5	0.5 to 3.0	Less than 0.5	Less than 0.5	0.02 to 0.10
Method of use	Into mixing water	Before placing	Into mixing water	Into mixing water	Into mixing water
Air content	0 or +	0 or +	0	0 or +	+
Fresh stage unit weight Kg/m^3					
Workability	+	+	0	0 or +	-
Water demand	-	-	0	0 or -	-
Slump for constant w/c ratio	+	+	0	0 or +	-
Segregation	-	0 or -	0	0 or -	0 or -
Setting and hardening stage					
Initial setting time	0 or +	0 or +	-	+	0 or +
Final setting time	0 or +	0 or +	-	+ or 0	0 or +
Strength development	+	+	+	-	0 or -
Bleeding	-	-	-	0 or +	-
Hardened stage					
Flexural (28 Days)	0 or +	+	0	0 or -	-
Compressive (28 days)	0 or +	+	0	0 or -	-
Modulus of elasticity	0 or +	0 or +	0	0 or -	-
Durability					
Permeability	-	-	0	0 or -	+
Thermal expansion	0	0	0	0	-
Creep	0 or +	0	0	+	+
Shrinkage	0 or +	0	0	0 or +	0 or +
Corrosion of steel	-	- or 0	0	0 or +	-

Note: (0) No effect, (+) Increase and (-) Decrease

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7.0 Guidelines on frequently used admixtures modifying the strength and workability

Items	Types of admixtures			
	Water reducer	**Super Plasticisers**	**Retarders**	**Accelerator**
Main chemical family	Lignosulphonates Hydroxy carboxylic acid, Carbohydrates	Melamine and Naphthalene formaldehyde, Condensates modified Lignosulphonates, Acrylic copolymers, Amino Aeromatic Sulphonic Acid	Gluconates, Salicylic Acid, Calcium – Lignosulphonates, Hydroxy Carboxylic Acid	Calcium Nitrates/ Formate triethanolamines
Main effects				
Effects on strength < 3days	Higher than ref. At all stages. Increase due to water reduction for same workability	At constant workability much higher than ref. At all stages.	Lower than the reference.	Hardening possible between 2 to 10^0 C.
< 28 days	Increase	Utilisation in high strength concrete.	Possible increase in final strength.	Possible reduction of final strength depending on nature of admixtures.
Secondary effects				
Favourable	• Increase in compactness. • Improvement in chemical resistant • Improvement of surface aspects	• Increase in compactness. • Improvement in chemical resistant • Improvement of surface aspects • No air entrapment even at higher dosages	-	Setting acceleration for certain formulae
Un-Favourable	• Retardation with certain formulations • Possible increase in shrinkage • Air entrapment	• Possible increase in shrinkage • Possible incompatibility with different cements.	Possible increase in shrinkage	Possible increase in shrinkage

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8.0 Known manufacturer and suppliers

A list of known manufacturers and suppliers and their addresses are tabulated below for information only. So many other suppliers and manufacturers are also available. Users may contact to the firms and may get all technical and other information from the suppliers before they use admixtures.

Sr. No.	Name of manufacturer	Address
1.	SiKa	SiKa Qualcrete limited, 24 B, Park street, Calcutta- 700016
2.	Krishna Conchem	Krishna Conchem products private limited, 5B, Mohsin Building, R.K. Vaidya Road, Dadar, Mumbai-400028 & 1 & 2 Building 6, sector 3, Millennium business park, Mahape, Navi Mumbai-400710
3.	MBT	MBT, 22, Old Rajendra Nagar, New Delhi
4.	FOSROC	FOSROC Chemicals (India) limited, Haffeeza Chamber, 2nd floor, P.B. No.2744,111/74 K.H. Road, Banglore-560027
5.	Asian Laboratories	Asian Laboratories, 88, DSIDC Shed , Scheme - 4, New Okhla industrial complex, Phase II, New Delhi –110020
6.	CICO	CICO Structural Waterproofing private limited, 406 Deepali, 92, Nehru Place, New Delhi- 110019
7.	M.C.Bauchemie	M.C.Bauchemie (India) private limited,, Perin Nareeman street, Sangli Bank Building, 5th floor, Fort, Mumbai-400001
8.	ROFFE	ROFFE Construction Chemical private limited, 12/C, Vikas Centre, S.V. Road, Santa Cruz (W), Mumbai – 400054
9.	PIDILITE	PIDILITE Industries limited, Ram Krishana Mandir Road, P.B.No. 17411, Andheri East, Mumbai-400059

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9.0 Admixtures Manufactured/ Available in India

Detailed information about the Admixtures manufactured/ available in India is given in "Guide lines on use of Admixtures in Concrete" issued by R.D.S.O., Lucknow in December-1999 (Report No. BS-25).

Users may contact to the manufacturer for getting catalogues for all available products in the market along with technical and price details etc.

Here we give the tabulated information in brief about the some of Admixtures manufactured / available in India for different Type of Admixtures used in concrete for ready references.

Accelerators

Sr. No.	Product Name	Manufacturer	Standards Compliances
1.	Conplast NC	FOSROC	BS: 5075 (Pt-I), ASTM: C494 Type C
2.	Conplast W	FOSROC	BS: 5075 (Pt-I), ASTM: C494 Type C
3.	Rapid Plast	CICO	ASTM: C494 Type E IS: 9103, IS: 2645
4.	Cemwet ACC	Asian Laboratories	IS: 9103 BS: 5075 (Pt I) ASTM: C494 Type A
5.	ACL -15	Krishna Conchem	IS: 9103

Retarders

Sr. No.	Product Name	Manufacturer	Standards Compliances
1.	Conplast RP-264	FOSROC	IS: 9103
2.	Sikament-227	SIKA	ASTM: C494 Type B, D & G
3.	Sikament- 176 (M1)	SIKA	ASTM: C494 Type G
4.	Rugasol-2 Liquid	SIKA	-
5.	Cemwet SRA Super-1	Asian Laboratories	IS: 9103 ASTM: C494 Type D

Plasticizers

Sr. No.	Product Name	Manufacturer	Standards Compliances
1.	Conplast 509	FOSROC	IS: 9103 BS: 5075 (Pt I) ASTM: C494 Type A &D
2.	Pozzolith LD-10	MBT	ASTM: C494 Type A,B & D BS: 5075 (Pt I)
3.	Cemwet WRA II	Asian Laboratories	IS: 9103 ASTM: C494 Type A & D BS: 5075 (Pt.I)
4.	Pedicrete CF 111-S	PIDILITE	IS: 9103 ASTM: C494 Type G
5.	Plastiment 240	SIKA	IS: 9103 ASTM: C494 Type A

Super plasticizers

Sr. No.	Product Name	Manufacturer	Standards Compliances
1.	Conplast SP 337	FOSROC	BS: 5075 (Pt-3), ASTM: C494 Type F
2.	Rheobuild 850	MBT	ASTM: C494 Type B,D &G
3.	Cemwet SP 3000	Asian Laboratories	ASTM: C494 Type F &G IS: 9103,
4.	Supercon 300	Krishana Conchem	IS: 9103
5.	Sikament 259 (M3)	SIKA	IS: 9103 ASTM: C494 Type F

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OUR OBJECTIVE

To upgrade Maintenance Technologies and Methodologies & achieve improvement in productivity and performance of all Railway assets and manpower which inter-alia would cover Reliability, Availability, and Utilisation.

*The contents of this handbook are for guidance only & are **not statutory**. It also does not supersede any existing specification and instructions from Railway Board, RDSO, and Zonal Railways & the provisions of IRWM, BIS Codes/Reports on the subject. If you have any suggestion & any specific comments, please write to us:*

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