ARAPLEX SBR
CEMENT MORTAR MODIFIER

DESCRIPTION

Araplex SBR has been used extensively over the last 20 years by the building industry as an admixture for cement and concrete applications, including repair and renovation, surfacing of floors and bonding generally.

Important application areas include patching, terrazzo flooring spray and fill coats, precast architectural concrete panels, stucco, industrial cement floors and highway and bridge repairs.

FEATURES/BENEFITS:

Cementitious mixes containing Araplex SBR have the following advantages:

- Greatly improved adhesion to a wide range of substrates including dense concrete, glass, steel, tiles etc.
- Mixes may be applied in much thinner sections.
- Excellent resistance to water and water vapour.
- A high level of resistance to salt permeation/carbonation.
- Much improved toughness and flexibility.
- Reduced surface dusting of concrete.
- Greatly improved resistance to many chemicals.
- Reduced water : cement ratio for equivalent workability.
- Improved frost resistance.
- Increased crack resistance.

In addition, Araplex SBR has the advantage over PVA bonding aids in that it is not adversely affected in wet condition and is therefore recommended for exterior use.

Latex content will vary subject to application, but typically it will be in the range 20-40% on cement weight (10-20 litres on 50kg cement). The higher level of addition is used for thin screeds where maximum performance is required, or for renders etc with high water resistance. Levels lower or higher than these may be needed in special circumstances.

The colour of latex modified compositions may be a little darker than that of ordinary mixes. If this is undesirable it can be overcome by the inclusion of a small quantity of white cement.

NUPLEX CONSTRUCTION PRODUCTS

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ARAPLEX SBR (cont'd)

TYPICAL PROPERTIES:

Composition:	Carboxylated styrene/butadiene co polymer emulsion containing non-staining antioxidants.
Appearance:	White milky liquid
Solids Content:	47%
Specific Gravity:	1.01 kgs/litre
PH:	10
Freeze-thaw Stability:	Good
Minimum Film Forming Temperature:	10°C

SURFACE PREPARATION:

Carry out standard concrete floor preparation to the existing concrete slab.

Remove all dust, dirt, laitance (cure or release agents) and any unsound areas of materials that will impede the adhesion of the polymer modified screed. Abrade surfaces by shot/grit blasting, coarse grinding, acid etch or other suitable methods or as appropriate. Check for contaminants by wetting with water. If the water beads or does not rapidly absorb into the concrete, re-prepare as per above.

Ensure substrate is stable, solid and control/relief joints are properly designed and installed.

Priming (Concrete):

Saturate the prepared concrete with clean water (at least 1 hour prior to the application of the primer).

Squeegee off excess water and apply one full coat of primer consisting of one part by volume of Araplex SBR admixture to 2 parts cement mixed to a thin slurry. Work this slurry well into the prepared surface using a stiff bristle brush or broom. (Do not allow to dry prior to application of the Araplex SBR modified render.)

While primer is wet apply Araplex SBR modified cement screed (as required).

Where water-resistant renders are required, a different technique for priming is necessary. A second priming or sealing coat (2 parts OPC to 1 part Araplex SBR) should be brushed on as soon as the first coat is touch-dry, ie: after approximately 20-30 minutes. To ensure complete coverage these coats should be applied at right angles across each other. Maximum thickness of the sealing coats should be 1.6mm otherwise crazing may occur.

These two coats must be allowed to fully dry out for eg; at least 48 hours. A further coat of the slurry is then brushed on and the render applied while this coat is still wet, as for a standard render.

Application of Renders (Walls) and Toppings (Floors):

Renders (Walls)

The thickness of latex-modified renders should not exceed 6mm for each coat. Thicker coats can result in sagging, or in the case of soffits actual fall-off. However, several coats may be applied in fairly quick succession, allowing each coat time to set-off before the next one is applied. This is usually between 15-30 minutes.

A single trowelling technique is normally sufficient to achieve a moderately smooth finish. If a smoother surface is required, the rendering should be floated using a clean steel, or preferably, wooden float after a suitable interval has elapsed. This interval is about ½ to 1 hour, but is best found by experience.

Standard render over moderately strong stable backgrounds.

Portland Cement	1 part by volume (uncompacted)
Moist Sand	4.5 parts by volume (uncompacted)
Araplex SBR	0.2 parts by volume (uncompacted)
Water	As required

Waterproof renders above ground over strong stable backgrounds also for carbination protection.

Portland Cement	1 part by volume (uncompacted)
Moist Sand	3 parts by volume (uncompacted)
Araplex SBR	0.28 parts by volume (uncompacted)
Water	As required

Note: Refer to priming (waterproof renders)

Toppings (Floors)

General purpose screeds based on Araplex SBR can be laid to any thickness, down to a feather edge if necessary, providing that a sufficiently fine grade of sand or aggregate is used. Heavy duty flooring compositions are normally laid as 12mm or greater thickness toppings.

Because Araplex SBR allows "feather-edging" of suitable mortar compositions, it is therefore possible to patch up only the damaged portions of existing concrete floors. These portions must of course be prepared and primed as previously described.

Note: Feathered edges are more vulnerable to damage in industrial/heavy duty applications i.e. wheeled traffic and are not recommended in these situations.

ARAPLEX SBR (cont'd)

After mixing, the Araplex mortar should be poured over the still wet priming coat, and screed to achieve required surface finish tolerances. It may then be trowelled to the required finish. An experienced floor layer will readily achieve a finish of satisfactory smoothness without having to do any further trowelling. However, as an alternative procedure, it is possible with care to carry further trowelling after a suitable interval, when initial stiffening of the mortar has commenced. A clean steel trowel is recommended for this operation. With a little experience, the correct timing at which this re- trowelling should be carried out will be properly judged. If sufficient time has been allowed to elapse, a thin surface skin will be present over soft unset material and the skin will be torn giving surface cracking. Too great a time interval on the other hand would result in the mortar having set too much to be smoothed. The whole surface should be trowelled, not just sections of it, to avoid variations in shade, texture, etc.

Cure Times

Although Araplex SBR improves adhesion and flexural strength, the cure time of mixes using Araplex SBR remain the same as normal concrete.

Light Traffic:	48 hours
Medium Traffic	7 days
Full Strength:	28 days

STEEL PROTECTION:

	Weight	Ratio
Portland Cement	50kg	1
Sand	125kg	2.5
Araplex SBR	15kg	0.3
Water	As required	
Yield	Approx 0.1m^3	

Remove loose ruse and scale from steel surface. Prime the steel and allow to dry. Damp surrounding masonry and apply full coat of primer to both masonry and steel. Whilst still wet apply the above mix.

N.B. Cement containing calcium chloride must not be used over bare steel.

THIN SECTION MORTARS FOR REPAIRING CONCRETE:

	Weight	Ratio
Portland Cement	50kg	1
Sand	125kg	2.5
Araplex SBR	15kg	0.3
Water	As required	
Yield	Approx 0.1m^3	

Damp and prime surface (unnecessary when repointing).

ARAPLEX SBR (cont'd)

HEAVY DUTY FLOORING:

a) Granolithic over 12 -25mm

	Weight	Ratio
O.P Cement	50 Kg	1
Zone 2 sand	62.5 Kg	1.25
Granite chippings (3mm to 6mm)	62.5 Kg	1.25
Araplex SBR	10 Kg	.02
Water	As required	
Yield	Approx .01m^3	

b) Granolithic over 25mm

	KGS
Chipped Grewake, Granite 10mm in size or other suitable stone chip	800.00
Pap 6 Stone Chip	500.00
Graded fine washed river sand	600.00
(OR BM20 for use over 50mm thickness)	**2000.00)**
Ordinary Portland Cement	300.00
Araplex SBR	60.00
Water	as required
Defoamer	as required
Yield (approximately)	1m^3

POLYSTYRENE THERMAL INSULATION:

	Weight	**Ratio**
O.P Cement	50 Kg	
Zone 2 sand	33 Kg	
Polystyrene bead (l-3mm)	115 Kg	1 0.7
Araplex 29Y40	15 Kg	2.3
Water	As required	
Dry density	Approx 1.4	0.3

Mix in a normal mechanical mixer. Apply by trowel. This mix may be used for wall and ceiling insulation. It can also be used as insulation and anti-corrosive layer under screed floor finishes. The mix exhibits excellent adhesion. It can be made into blocks and nailed in place, or rendered in the normal way.

TYPICAL TEST RESULTS

ARAPLEX SBR / CEMENT RATIO		0	0.1	0.2	0.25	0.3	0.4	0.5
Adhesion to concrete								
1W27D:DRY	N/mm^2	0.07	1.4	2.0		2.1	3.4	2.4
1W20D7W:WET	"	0.3	0.7	1.0		0.9	1.4	1.4
1W20D63W:WET	"	0	1.6	1.4		1.8	2.1	
Adhesion to steel								
DRY	"	0		2.0			1.6	
WET	"	0					1.3	
Tensile strength								
DRY	"	3.0					4.3	
WET	"	1.8					3.9	
Compressive strength								
DRY	"	56		50				
Flexural strength								
DRY	"	7.1			13.2		10.6	
WET	"	5.8					9.6	
Effect of Chemical on Flexural Strength after 6 months immersion								
DRY								
Untreated	"	7.2			13.2			
10% Potassium Hydroxide		6.1			12.3			
10% Magnesium Sulphate		4.3			13.3			
5% Lactic Acid	'	5.9			8.0			
10% Sucrose	'	5.9			9.2			
5% Hydrochloric Acid		0			2.2			
20% Ammonium Nitrate	"	2.6			4.8			
Petroleum Spirit	"	7.7			7.5			
Effect of Extremes of Temperature								
Flexural strength		7.1					10.6	
Untreated	"							
After 60 freeze-thaw		0					10.4	
cycles at -18°C	"	5.2					14.3	
After 1 year at 70°C								
Adhesion to Concrete		0.1					3.4	
Untreated	"	0					2.6	
After 6 months at 7°C	"							
Thermal Expansions (Linear)								
from -20°C to +20°C	(Coeff x 10^6)	12.7				12.8		
from +20°C to +60°C		12.8				12.9		
Shrinkage during drying								
water/cement ratio		0.40		0.34		0.34	0.30	
% shrinkage		0.07		0.02		0.01	0.01	
Water Vapour Permeability	(kg/m^2/24 hrs)	46.9		38.1		3.9	1.9	
Water Penetration	(kg/m^2/24 hrs)							
with Araplex 29Y40 in mortar	"	100		35		0	0	
using 2 Araplex/cement sealing	"							
coats on unmodified mortars	"	0						

Note: 1 N/mm^2 = 1 MN/m^2 = IMpa = 145 psi

RESISTANCE TO SODIUM CHLORIDE (SALT)

INTRODUCTION:

Araplex SBR modified concretes have been tested in the USA for resistance to sodium chloride penetration, where they have given good results. The tests were carried out by the Fairbanks Highway Research Station, McLean, Va. - Dept. of Transportation, Federal Highway Administration, using US-produced Araplex SBR. Comparisons were made with unmodified concretes.

TEST RESULTS	Water/ Cement Ratio	Chloride content 1mm - 50mm depth		Chloride content 25mm- 12mm	
		Average	Range	Average	Range
Araplex Mix	0.4	5.9	2.92-9.44	0.59	0.07-1.58
	0.4	12.4	10.8-15.7	2.25	1.43-3.27
	0.5	13.7	12.2-15.8	3.85	2.80-4.44

TEST DETAILS:

Four test samples 230 x 250m x >6mm of each mix were prepared by normal techniques, using reasonable vibration by rodding and mould wall tapping. The samples were covered with dry burlap (hessian-like material) and polythene sheet for 24 hours. Samples were then de-moulded and cured for a further 19 days at 21± 1°C and 50± 5% relativehumidity.

The top surface of the cured samples was dry abraded by grinding or sandblasting to reduce the height by 1 - 3mm. Dams, 18mm high by 12mm wide, were placed round the top edges of three of each set of four samples. The three samples were covered with 12mm of 3% aqueous sodium chloride solution for 90 days. Glass covers were used to retard evaporation and the 'ponds' were topped up as and when required with 3% aqueous sodium chloride solution. During 'ponding', the samples were kept at 21± 1°C and 50± 5% relative humidity.

At the end of 90 days, the solution was removed. After drying, the surfaces of the samples were wire brushed until all salt build-up had been removed.

ARAPLEX SBR (cont'd)

Three samples of concrete were taken from each specimen (including the 'unponded' ones) by dry coring (48mm minimum diameter) and the cores cut to obtain specimens.

a) 1 - 12mm depth from the surface, and
b) 12mm - 25mm depth from the surface.
c)

These sections were crushed and analysed for chloride content. The average value obtained from the 'unponded' samples was subtracted from the average value obtained from the 'ponded' samples, and the result expressed as pounds of chloride (CI) per cubic yard of concrete. (Although not yet officially specified, a maximum acceptable value of chloride in the 12mm - 25mm depth is less than 0.7kgs of chloride per m^3. Usual values in the 1 - 12mm depth sections are 2.9 - 5.2kgs of chloride per m^3.

MIX DESIGN:

The mix design used in the tests were as follows;

	Kgs
Portland cement, Type 1	43
Concrete sand	125
Coarse aggregate, #8	82
Araplex SBR	12

Water: added as required to give water/cement ratio of 0.40 with a slump of 100 - 150mm and air content of less than 6%.

Control mixes (no Araplex SBR) were made with water/cement ratios of 0.40 and 0.50.

Concrete sand graduation was:

100%	Smaller than 12.5mm
85-100%	Smaller than 9.5mm
10-30%	Smaller than 4.75mm
01-10%	Smaller than 2.36mm

Coarse aggregate (#8) graduation was:

100%	Smaller than 9.5mm
95-100%	Smaller than 4.75mm
80-100%	Smaller than 2.36mm
50-85%	Smaller than 1.18mm
25-60%	Smaller than 0.06mm
10-30%	Smaller than 0.03mm
2-10%	Smaller than 0.015mm

CONCLUSIONS:

Araplex SBR gave very good results in these tests, showing a great improvement compared with the controls. It has been approved by the U.S. Federal Highway Administration for use in Highway Systems, particularly in bridge deckings.

Araplex SBR may also be recommended for use in other concretes and mortars where protection from salt erosion or damage is required.

CONTROL OF RELIEF JOINTS ETC:

Standard recommended control of relief cuts (to accommodate concrete shrinkage) are to be cut in the Araplex modified renders or toppings as per standard concrete masonry recommendations or grids no greater than 5m x 5m.

SELECTION OF MATERIALS

To obtain maximum strength from mixes modified with Araplex SBR is important that attention is paid to the quality of the other materials used. Variation in these can have a marked effect on performance.

Sand should be clean, sharp and free from excessive fines. Where a very smooth surface is required a fine sand may be used, but no ultra fine clay-like material should be present, and not more than 0.5% should pass a 75-micron sieve.

Portland, High Alumina and certain fast setting cements are compatible with Araplex SBR. Cements containing calcium chloride should not be used in applications over bare steel due to their corrosive nature.

A wide range of aggregates can be incorporated in mixes depending on application and properties required. They should be clean and dust free.

If any special additives are to be considered in latex modified mortars brief tests should be conducted to ensure no adverse effect is produced before introducing for site use.

ARAPLEX SBR (cont'd)

MIXING CONDITIONS:

Mixing procedure for mortars or concretes containing Araplex SBR is similar to that used for conventional compositions, with gauging water being either partly or completely replaced by Araplex SBR.

Mixing should preferably be carried out in a pan-type mixer but normal concrete mixers are often used. For small batches, eg: not exceeding 50kgs, it is possible to hand-mix. The usual procedure is to pre-mix sand and cement in the mixer, pour in the Araplex SBR, mix for eg: 2-3 minutes, and finally slowly add water to the required consistency.

NB - Over addition of water causes rapid thinning of latex modified mortars owing to the plasticising effect of the latex.

WATER: CEMENT RATIOWORKABILITY:

Because of its plasticising action the addition of Araplex SBR to a mortar mix will enable the water: cement ratio to be reduced for a given workability. Typically, if water: cement ratio of 0.5 applies to an unmodified mortar, this could be reduced to 0.28-0.35 depending on the level of Araplex SBR, allowance being made for the water content of the latex (53%).

The workability time is generally increased slightly by the addition of Araplex SBR. As working temperature increases, so workability tune is shortened. Araplex-modified mortars have been shown to give practical workability times at temperatures ranging from about 30°C down to 2°C. However, if applying latex modified mortar to porous substrates at elevated temperatures the loss of water into the substrate due to suction may lead to difficulties with trowelling and poor adhesion.

The British Standard Code of Practise CP114: Part 2:1969 recommends that concreting should not be carried out unless "the concrete has a temperature of at least 4°C and that the temperature of the concrete is maintained above 2°C until it has thoroughly hardened". These recommendations remain valid for latex modified mortars and concretes.

When applying Araplex modified mortar or concrete at temperatures between 2°C and 10°C it is desirable to use a rapid or extra rapid hardening cement such as "Swiftcrete". Alternatively, OPC may be used in conjunction with 2%-4% of calcium chloride (expressed on cement weight); the calcium chloride should be added as a 50% solution in water to the mix.

AIR ENTRAPMENT.

Latex modified mortars tend to entrain higher levels of air than unmodified mortars. To achieve optimum performances from the modified mortar it is therefore important that care is taken at the mixing stage to minimise this effect.

Araplex SBR contains a silicone based antifoam which under most circumstances will give the required detraining properties, but it may be necessary for critical applications to make a further on-site addition of a suitable antifoam. Proprietary products include Silcolapse 5000 (ICI), Antifoam RD (Dow Corning) or Nopco NDW (Diamond Shamrock). Addition levels in the range 0.25-0.5 on Araplex SBR are suggested.

Optimal entrained air is approximately 4%.

CURING CONDITIONS:

Generally, unmodified mortars develop maximum strength properties when cured wet. With Araplex SBR modified mortars however it is necessary for the mortar to dry out at some stage to allow the latex particles to coalesce and so form an interpenetrating lattice of polymer. Subsequent immersion will not redisperse the polymer. Where possible it is recommended that cure comprises an initial wet cure, eg: 24 hours, followed by dry cure.

CLEANING OF EQUIPMENT:

All tools should be cleaned immediately after use because hardened Araplex-modified mortars and concretes have excellent adhesion and are therefore difficult to remove. Solvents such as white spirit, solvent naphtha or preferably toluene can be useful in removing hardened mortar.

STORAGE:

Araplex SBR is best stored at moderate temperatures to avoid the possibility of permanent damage occurring due to prolonged heat or excessive cold. However if frozen, the latex should be thawed slowly. Araplex SBR should preferably be stirred before use.

SHELF LIFE:

24 months in unopened containers.