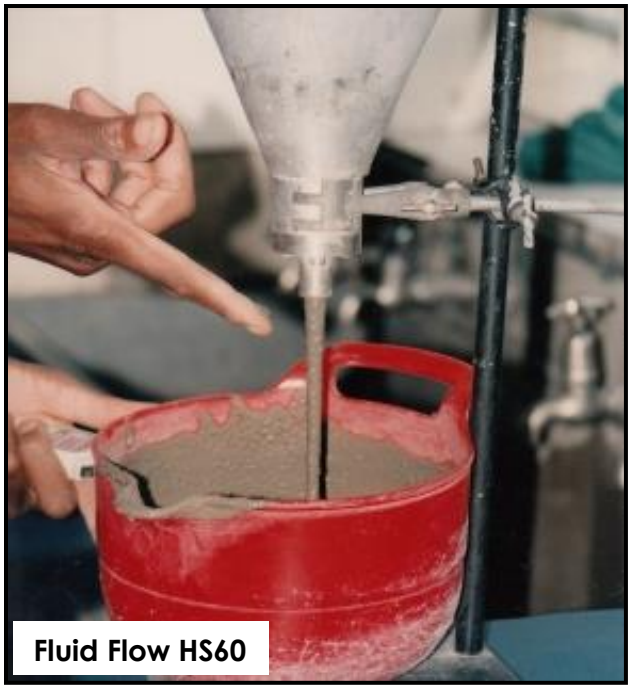
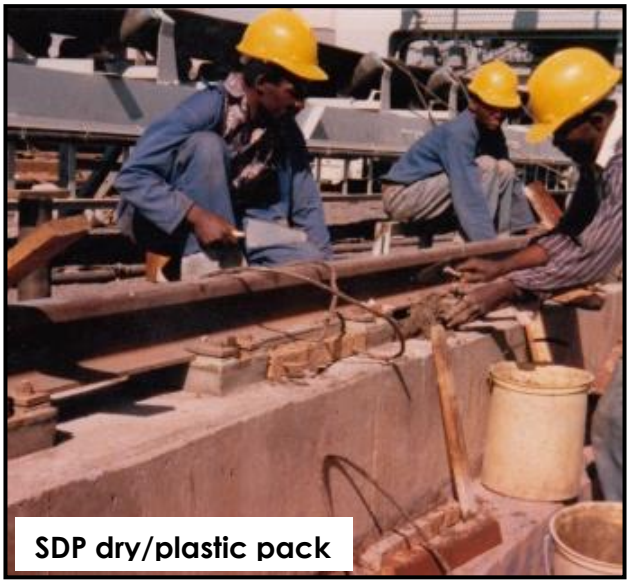


Fluid Flow HS60

Samson Technologies cc

Structural Grouts



SDP dry/plastic pack

Fluid Flow MS40

MicroConcrete

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There is a myth often repeated by contactors that all grouts are the same.

Recognizing that different grout technology is needed to produce "fit for purpose" materials Samson Technologies offers four different grouts to satisfy different needs on construction sites.
Another common myth is that grout excellence is to be judged by its compressive strength as a main criterion. Strength is the most easily achieved property of a grout mix design. In terms of both ASTM and US corp of engineers requirements, grout need only reach 35MPa at 28 days cure. Much more important are properties such as flow retention, total absence of bleed and plastic settlement, effective bearing area and installation technique.
Below you will find a chart for the selection of the appropriate grout for various installation requirements.
Samson Grouts have a significant South African track record having been used in various industrial facilities such as power station and electrical generating turbines, industrial structures and plants, mining including coal handling plants and water treatment sluice gates and the like.

GROUT SELECTION CHART

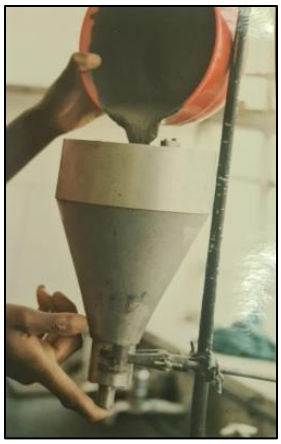
Application requirements	**HS60 Grout** **	**MS40 Grout** **	**SDP Grout**	**MicroConcrete**
Early return to service	Yes	No	Yes	Yes
Base Plates with bolt hole pockets	Yes	Yes	No	No
Small Base Plates with easy access and no shims to encapsulate	No	No	Yes	Yes
Base plates with shims	Yes	Yes	No	No
Continuous heavy duty rails	No	No	Yes	Yes
Easy Access no bolt hole thick sections (60mm up to 150mm depth)	No	No	No	Yes
Use of non-shrink grout for concrete repairs	No	No	Yes	Yes
Re-surfacing of industrial Floor with grout	No	No	No	Yes
Thick set repairs of concrete beams, etc	No	No	No	Yes
Polymer modification for thin set application	No	No	Yes	Yes
Skid mounted machinery	No	No	Yes	Yes

** How to choose between HS60 and MS40

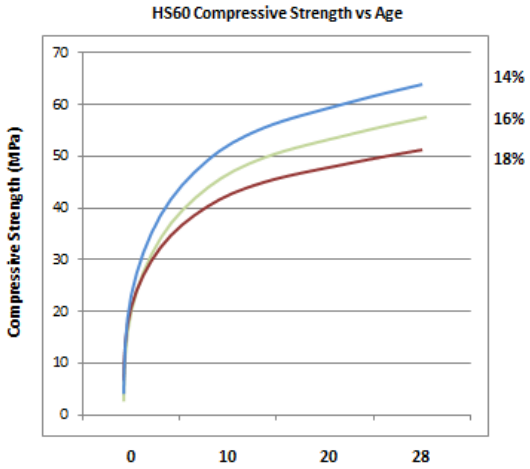
	HS60	***MS40***
Require early strength development and quick setting?	Yes	No
Over 60MPa compressive strength needed?	Yes *minimum compressive strength 60Mpa if mixed according to our literature	No *Minimum compressive strength of 40Mpa if mixed according to our literature, will achieve 50 to 55MPa at 28 days
Extended flow in hot weather?	No	Yes *lower heat of hydration at development
Cost effective not dependent on compressive strength?	No	Yes

Structural Grout – HS60

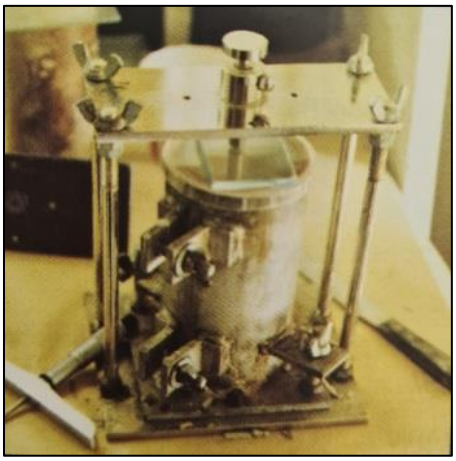
Samson **HS60** structural grout is comprised of rapid hardening Cem I 52,5 portland cement selected aggregates flow aides and an expansive component for the preparation of a fluid flow grout by the addition of specified amounts of water only.
HS60 grout meets the requirements of ASTM C1 107 and US Corp of Engineers CRD-C621 for flow strength and dimensional stability.



Flow cone test stability



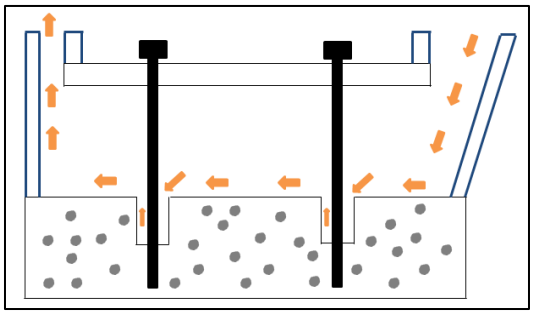
Compressive strength



Dimensional
ASTM C1107/CRD-C621

HS60 grout is placeable by pump letter-box shutter or tremie methods as illustrated.

HS60 being pumped under large base plate



Letter-box shutter system

Tremie placement

Samson **HS60 grout** correctly placed to Samson requirements achieves exceptional effective bearing area (over 90%) is totally bleed free and has mild expansion in the plastic phase to overcome any possible settlement. On reverse of this sheet is further critical technical data which may be required for engineering purposes.

HS60 Grout Technical Data

Description
Samson **HS60 grout** is a specially formulated fluid flow Portland cement structural grout with a large number of application suitablities. (See Grout selection chart)

Flow
By varying water addition rates the workability and flow of the grout can be adjusted to meet a number of site requirements.

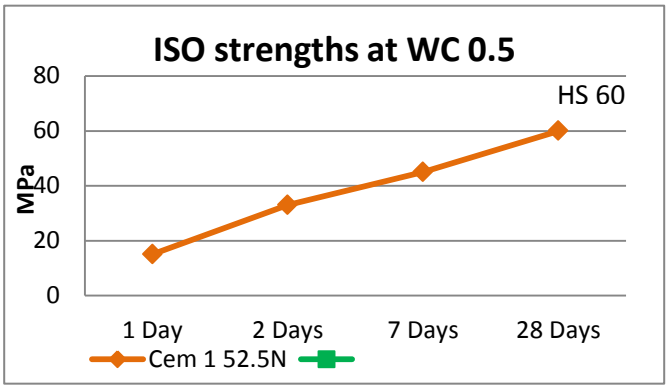
Dimensional stability
Tested in accordance with the requirements of international standards ASTM C1107 US core of engineers CRD-C621 **HS60** meets the test requirements for dimensional stability and compressive strength. For the grout to be dimensionally stable upon installation proper care must be taken to ensure that mix-water is not sucked out of the grout by surrounding or juxtaposed concrete. This should be achieved by ensuring that shuttering is leak-proof and that surrounding encasement is adequately pre-quenched with clean water.

Compliance

Volume control	Grade A – expands during set
Fluid flow	exits flow cone within 30 seconds
Strength	exceeds 35MPa at 28 days
Temperatures	may be placed from 4 to 32 degrees C

Strength range (28 days)

Water/Cement		
16%	0.40	60 to 65 MPa
18%	0.44	55 to 60 MPa



Placing
Flow requirements will vary according to specific site requirements. Do not use **HS60** for dry-pack grouting. It is designed for fluid flow where dry-pack or plastic placement is preferred. Use Samson **SDP grout**. For high effective bearing area request SAMSON method statement.

Curing
All exposed areas of grout should be covered immediately after placement until set, after which it should be coated with a good quality curing compound. (SAMSON CureSeal)

Yield
At water addition of 4.5lt per 25kg bag yield is 12.5lt per bag. Approximately 80 bags per m³.

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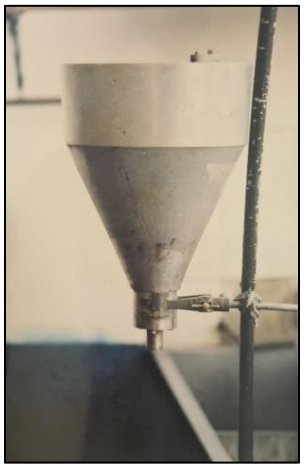
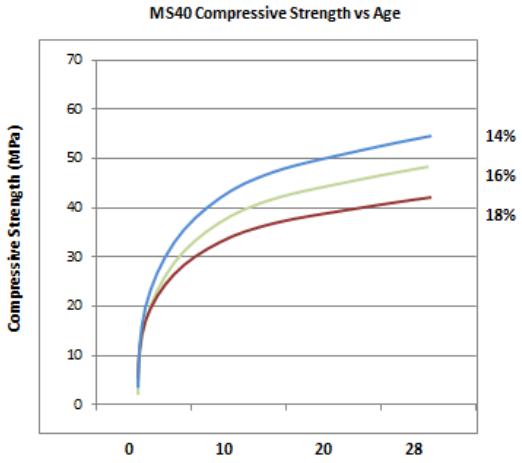
Structural Grout – MS40

Samson **MS40** structural grout is comprised of blended cement Cem III 32,5 and selected aggregates flow aides and an expansive component for the preparation of a fluid flow grout by the addition of specified amounts of water only.
MS40 grout meets the requirements of ASTM C1107 and US Corp of Engineers CRD-C621 for flow strength and dimensional stability.



Flow cone test

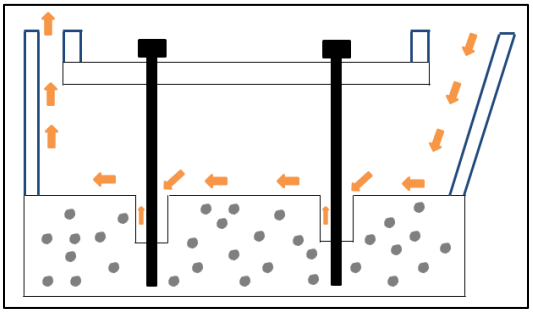


Compressive strength

Dimensional stability
ASTM C1107/CRD-C621

MS40 grout is placeable by pump letter-box shutter or tremie methods as illustrated.

MS40 being pumped under a machine



Letter-box shutter system

Tremie placement

Samson **MS40 grout** correctly placed to Samson requirements achieves exceptional effective bearing area (over90%) is totally bleed free and has mild expansion in the plastic phase to overcome any possible settlement. On reverse of this sheet is further critical technical data which may be required for engineering purposes.
For details of how to choose between **HS60** and **MS40** see the grout selection chart on the back of our general leaflet about grouts.

MS40 Grout Technical Data

Description
MS40 is a specially formulated fluid flow blended cement (Cem III 32,5)structural grout with a large number of application suitabilities. (See Grout selection chart)

Flow
By varying water addition rates the workability and flow of the grout may be adjusted to meet a number of site requirements. **MS40** is better suited to hot weather conditions than **HS60** where very early strengths is not required.

Dimensional stability
Tested in accordance with the requirements of international standards ASTM C1107 US corp of engineers CRD-C621, **MS40** meets the test requirements for dimensional stability and compressive strength.
For the grout to be dimensionally stable upon installation proper care must be taken to ensure that mix-water is not sucked out of the grout by surrounding or juxtaposed concrete. This should be achieved by ensuring that shuttering is leak-proof and that surrounding encasement is adequately pre-quenched with clean water, or using wetted hessian bags to cool down base plates.

Compliance

Volume control	Grade A – expands during set
Fluid flow	exits flow cone within 30 seconds
Strength	exceeds 35MPa at 28 days
Temperatures	may be placed from 4 to 36 degrees C

Strength range (28 days)

Water/Cement		
14%	0.40	55 to 60MPa
16%	0.44	50 to 55MPa
17%	0.47	45 to 50MPa
18%	0.50	40 to 45MPa

Placing
Flow requirements will vary according to specific site requirements. Do not use **MS40** for dry-pack grouting. It is designed for fluid flow. Where dry-pack or plastic placement is preferred, use SAMSON **SDP grout**. For winter or cold condition grouting **HS60** is preferred because of its CEM I 52,5 content.

Curing
All exposed areas of grout should be covered immediately after placement until set, after which it should be coated with a good quality curing compound. (SAMSON CureSeal)

Yield
At water addition of 4,5lt per 25kg bag yield is 12,5lt per bag. Approximately 80 bags per m³.

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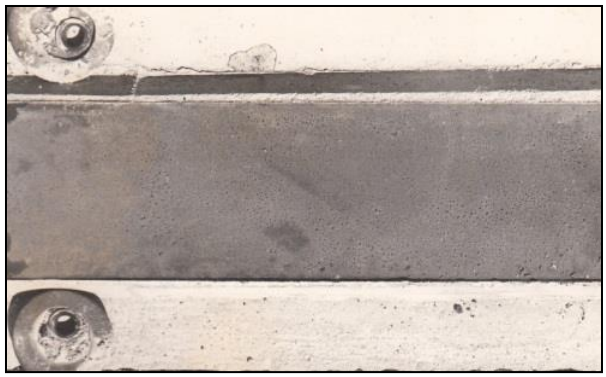
Structural Grout – SDP

Samson Technologies has used the letters **SDP** to denote that the grout is designed as a standard dry-pack grout to distinguish it from the fluid flow grouts. **SDP** is formulated to be installed either as a classical dry-pack (a crumbly but cohesive mix capable of being caulked into place) Samson experience has shown that site personnel all too often do not put sufficient energy into the caulking process and thus results in insufficiently filled cavities with compromised effective bearing area (see photo below). By adding the specified amount of water described in the technical data sheet overleaf a plastic consistency "thixotropic" mortar may be prepared with significant improvement in the ease of placement and achievement of full effective bearing area (see second photo depicting excellent achievement of bearing area)

Samson has prepared a case study and method statement as used for heavy duty rail grouting at several coal mines and in particular at Sasol 2. The incorrectly filled rail as depicted in the first photo failed in less than six months. The correctly filled rail grout has given many years of excellent service without failure.

Compromised bearing area



SDP Grout with full effective bearing area

Thixotropic means that in the passive state the grout does not flow however when submitted to kinetic energy shear thinning takes place at micro particle level and allows the grout to flow as in the second photo.

Passive

Response to energy

Dimensional stability of **SDP grout** in the plastic phase is achieved by the inclusion of a mildly expansive agent which overcomes any tendency for settlement.

SDP Grout Technical Data

Description

SDP grout is a blend of selected and graded aggregate with CEM I, CEM III and other pozzolanic fillers suitability modified with chemicals to produce either a crumbly caulkable mortar or a plastic mortar with thixotropic properties. The mortar is mildly expansive in the plastic phase. Dimensional stability of **SDP grout** is achieved through two mechanisms. Firstly, through the total absence of bleed-water and secondly, through the inclusion of expansive agents.

Compliance

Volume control	Grade A – expands during set
Consistency	Dry pack, thixotropic pourable
Strength	See table below
Temperatures	May be placed at 4 to 32 degrees C

SDP grout is an effective corrosion inhibitor.

Strength	**16%**
	14%
1 day	**22MPa**
	32MPa
3 days	**40MPa**
	50MPa
7 days	**50MPa**
	60MPa
28 days	**65MPa**
	75MPa

Placing

The placing method for **SDP grout** varies according to the consistency of mortar chosen. Traditional dry-pack requires caulking with a suitable paddle and wooden hammer to ensure proper consolidation. Plastic consistency **SDP** should be placed by packing against suitably designed shutters and the paddled into place in lifts without requiring a wooden mallet for consolidation. See the SAMSON method statement as used for rail grouting at Sasol 2. **SDP grout** mixed to flowable consistency may be poured, rodded or pumped into place. See case study document describing the use of thixotropic pumpable **SDP grout** as used for tensometer duct grouting at Koeberg Power Station.

Curing

All exposed areas of grout should be covered immediately after placement until set, after which it should be coated with a good quality curing compound. (SAMSON CureSeal)

Yield

One 25kg bag of **SDP grout** yields approximately 11 to 12lt of mortar.

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Structural Grout – MicroConcrete

Samson **MicroConcrete** is comprised of rapid hardening CEM 1 52,5 and other pozzolanic secondary binders and selected aggregates including a 5mm chip, flow aides and two expansive components. The expansive components are designed to induce mild expansion during the plastic phase and then a second chemically shrinkage induced compensation to reduce the effects of longer term drying shrinkage.

By addition of specified amount of water only or water and diluted polymer emulsions consistencies fit for different purposes may be achieved. For example, see the photos below showing semi-self levelling **MicroConcrete** being applied to the prepared surface inside concrete sewer pipes.
The secondary shrinkage compensation mechanism in **MicroConcrete** makes it suitable for relatively large area repairs of heavy duty concrete floors. (See SAMSON case studies and method statements.)

"Semi-self levelling" MicroConcrete being placed

Simple device used for" Armco" profiling

MicroConcrete may be placed in a number of methods according to site requirements. Different consistencies will be required and consultation with SAMSON will ensure a "fit for purpose" method for particular intricacies to be selected.

MicroConcrete placed by tremie

MicroConcrete repair to industrial floor

On reverse of this sheet is further critical data required for engineering purposes.

MicroConcrete Grout Technical Data

Description
Samson **MicroConcrete** is comprised of rapid hardening CEM I 52,5 and pozzolanic secondary binders and selected aggregates including 5mm chip, flow aides and two expansive components.

Consistencies
Mixed with water at the following rates per 25kg bag, **MicroConcrete** will have the following fresh and hardened properties:

Litres per bag:	2,5	Consistency – Semi-self levelling
Litres per bag:	3,0	Consistency – Flowable
Litres per bag	3,5	Consistency – Self levelling

Strength expectations (MPa)

	2,5 L	3 L	3,5 L
1 day	30	25	20
7 days	50	45	40
28 days	65	55	50
Water binder ratio	0.42	0.50	0.58

Dimensional stability
Samson **MicroConcrete** has mechanisms to prevent settlement and is shrinkage compensated to decrease shrinkage stresses which often lead to screed de-bonding.

Installation
Samson installation requirements must be faithfully followed. These include good practice preparation of surfaces, the use of Samson P3 bonder and proper after installation protection and curing.

Curing
All exposed areas of grout should be covered immediately after placement until set, after which it should be coated with a good quality curing compound. (SAMSON CureSeal)

Yield
Mixed with 3lt water each 25kg bag will yield 11 to 12 liters of mixed concrete. Approximately 80 bags per m^3.

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Tensometer Duct Grouting – Koeberg Nuclear Power Station

A case study in grouting excellence

The tensometer ducts require a special grout material and a unique method of installation to meet the requirements of complete void filling without any settlement or bleeding of the grout and maximum elimination of entrapped air.

Development of appropriate materials.
The grout material after mixing with an appropriate quantity of water needed to produce a plastic consistency mortar with thixotropic properties.
This was met by the use of micro particulates with appropriate admixtures to produce shear thinning under the kinetic energy of pumping and then chelate and hold its dimensions in the passive state after pumping.

The curved shape of the ducts.
Illustrated below is a diagram showing that the curved shape of the ducts precluded the use of fluid flow grouts if the desired void filling requirement was to be met.
The curved shape also requires an innovative approach to replacement method of the grout for successful installation. Samson believed that its proposals would achieve the desired result but tests were needed to confirm this.

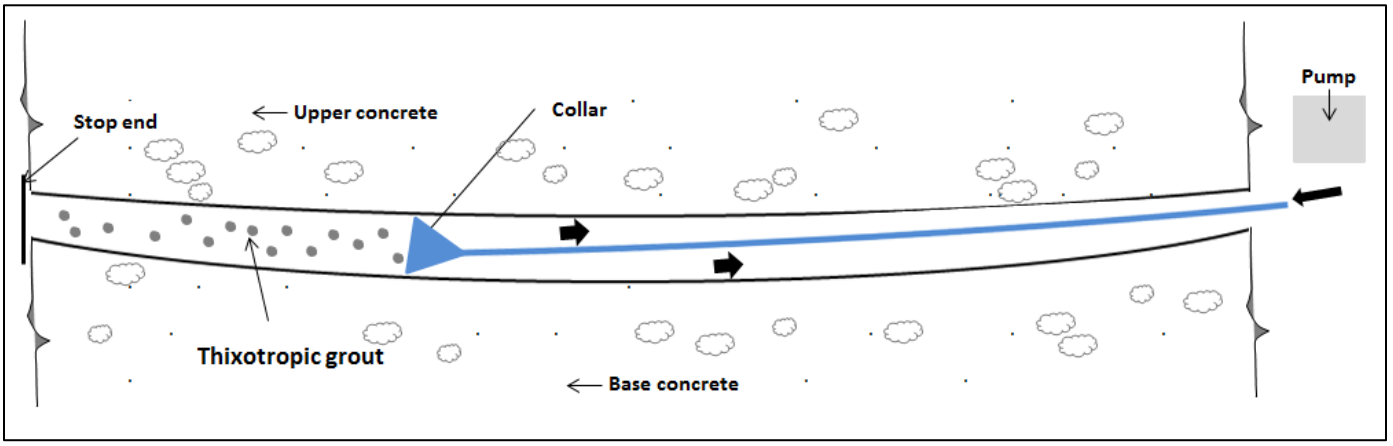

Illustration of Grouting the Tensometer Duct

The test process.
Under the guidance and surveillance of Professor Mark Alexander a test rig was designed and filled with grout.
Suitable pipes were obtained to simulate the ducts but without the curvature being replicated.
On completion of the pumping process the grout was allowed to set. Thereafter, an angle grinder was used to cut open section of the pipe to examine the results. The following photographs show the results of the procedure. The void filling was adjudged to be excellent and fit for purpose.

Modified SDP for pumping with thixotropic properties to facilitate installation

The unique placement system used.
For satisfactory void filling the grout needed to be placed continuously from one side of the ducts to the other. To contain the thixotropic grout for maximum void filling a plastic collar was recommended for attachment to the end of the pump pipe. The concept was that in a similar way to a tremie under the pressure of the grout back filling the collar would cause the pipe to be withdrawn from the duct leaving a completed filled duct behind it.

Conclusion
The trials having been declared successful the system described above was actually implemented at Koeberg with good results.

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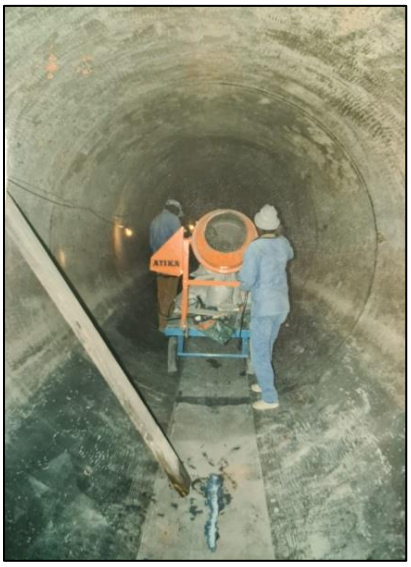
Southern Outfall sewer pipe repair

An example of success with Samson **MicroConcrete**

Cause of Damage

Scouring of the nadir of the 60mm thick concrete pipe was caused by flow of sewerage and abrasion by chemical and solids impact attack.

Typical Conditions



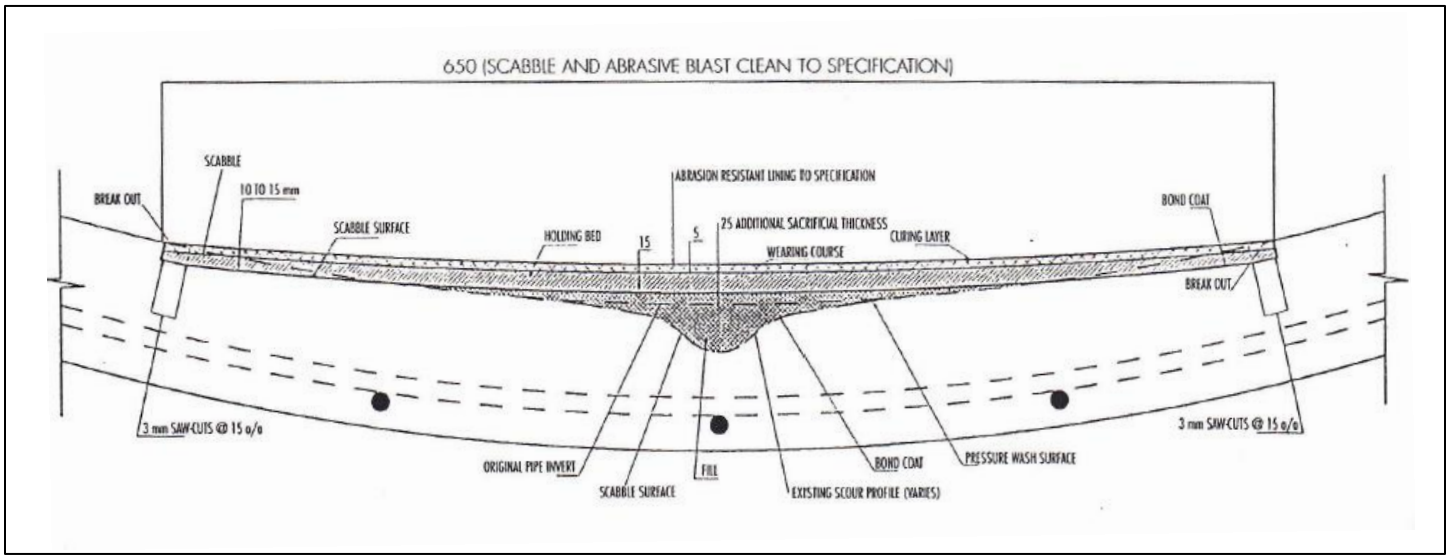
Repair materials required

The repair materials should be high strength (over 60MPa) resistant to humic acid attack and physical impact.

Once placed it should be dimensionally stable with absence of shrinkage stress being transferred to the bond line between the original concrete and the new hardened repair material.

The Samson proposal
Scarify and clean the damaged nadir of the pipes. Apply a slightly flexible but powerful bonding layer. Samson P3 triple blend polymer modified bonder was proposed. A special "Armco" pipe profile for the repairs was proposed to reduce the velocity of flow of the aggressive sewerage. Polymer modification was proposed to protect the alkaline matrix of the cementitious repair material. Lowering the Young's Modulous of the hardened repair material would better absorb impact stress where the brittleness of a high strength material would shatter under impact.

Installation method and profiling
It was considered prudent to have a wearing layer more than the thickness of the pipe, especially at damaged joints. The selected profile was as illustrated below.
A simple profiling device was developed to shape and increase the protective layer to about 75mm. The Micro-Concrete needed to be semi-self levelling, thixotropic and capable of holding its wet-state profile when left passive. See drawing of proposed profile.



Acid attack in concrete sewer pipes

Conclusion
The installation done by Eigenbau was well executed under Samson's advisory service.
Some 5 years after the installation inspection was made to determine damage to the **MicroConcrete** wearing layer.
It was estimated that the repair would last for another 20 years before another repair process would be necessary.
The Samson process provided a repair which would make pipe replacement unnecessary.

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