Appendix F

Cement-Bentonie cutoff wall mix design

Title of document: **Whale Tail Dike Cement-Bentonite Cut-off Wall Mix Design**

Client: **AGNICO EAGLE LIMITED**

Project: **Amaruq Whale Tail Dike Detailed Design**

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REVISION INDEX

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1.0 Introduction

Agnico Eagle Mines Limited, Meadowbank Division ("AEM") is proposing to develop the Whale Tail Pit, a satellite deposit found in the Whale Tail Lake, on the Amaruq property, as a continuation of current mine operations and milling at the Meadowbank Mine. Therefore, the construction and operation of the Whale Tail Pit Project (the Project) would extend the life of the process operational facilities at Meadowbank Mine.

The Amaruq property is a 408 km² site located on Inuit Owned Land, approximately 150 km north of the Hamlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the Kivalliq region of Nunavut. The property was acquired by AEM in April 2013 and is subject to a mineral exploration agreement with Nunavut Tunngavik Incorporated.

A permitting level study for developing the water management infrastructure for the Amaruq project was completed in 2016 (SNC-Lavalin, 2016). As part of this water management infrastructure, there is an important dewatering dike that is required to enable mineral extraction in an open pit, located in the northern part of Whale Tail Lake. This dike, named the Whale Tail Dike (WTD), is located on a shallow plateau of the lake floor with an approximate 2 m depth of water. The WTD incorporates a cement-bentonite (CB) secant pile cutoff wall for providing seepage control. The preliminary design for the CB secant pile cutoff wall, which will be keyed into bedrock, was developed in 2017 during the feasibility level study (SNC-Lavalin, 2017).

The secant pile cut-off wall is composed of self-hardening cement-bentonite slurry. The slurry acts as supporting fluid during construction of the cut-off wall and forms the final cut-off wall material. The typical ingredients used are water, cement, bentonite, and additives (if required). Additives are used to improve the workability and control the setting of the CB slurry mixes.

The mix design for the composition of the CB secant pile cut-off wall of the WTD takes into consideration 3 parameters: strength, permeability, and constructability.

2.0 Objective of the present study

The objective of the present study is to determine a cement-bentonite (CB) mix that meets strength, permeability and constructability requirements. The preliminary design requirements of the CB mix were set based on SNC-Lavalin's experience, literature, standards and experience from BAUER Foundations Canada Inc. (BAUER) in similar projects. The preliminary design requirements for fresh and hydrated CB slurry mix for the cutoff wall are presented in Table 2-1 below.

Table 2-1: Preliminary Requirements for Cement-Bentonite Mix Design

Characteristic	Requirement
Permeability (cm/sec)	≤ 10^{-6}
Unconfined compressive strength (UCS), (kPa)	≥ 400 for warm-cured testing
	≥ 200 for cold-cured testing
Minimum Early Strength	Minimum UCS of 50 kPa after 7 days of curing
Marsh Viscosity (seconds)	≤ 80 in 8 hours
Density (g/cm^3)	≥ 1.2

Laboratory tests were carried out in order to determine the mix design according to the proposed design requirements. The laboratory testing program was carried out in three phases: Phase I, Phase II and Phase III. The results from the three phases of the laboratory testing program are discussed in the following sections.

Laboratory testing to determine the UCS should take into account the effect of curing condition on strength. If laboratory tests are to be carried out under cold-cured condition, the minimum UCS has to be 200 kPa. However, if the laboratory tests are to be carried out on warm-cured samples, the minimum UCS has to be 400 kPa. These requirements were set assuming that the ratio of warm-cured to cold-cured strength is about 2. This requirement also assumes that the curing condition at the project site would be cold curing condition.

3.0 Phase I Laboratory Testing Program

3.1 CB Mixes Considered for Phase I of the Laboratory Testing Program

Phase I of the laboratory testing program included preparing samples under three different mix ratios shown in Table 3-1 below. The samples for the laboratory testing were prepared under warm curing condition (i.e., temperature of about 20°C).

Table 3-1: Cement-Bentonite Mix Ratios for Phase I Laboratory Testing

Material	Mix 1	Mix 2	Mix 3
Cement (C/W)	0.4	0.32	0.25
Bentonite (B/W, %)	5	5	5
Note: Proportions are estimated by weight of material. Mix 1 was proposed by BAUER and is considered as the Base Case Mix			

The following laboratory tests were conducted as part of the laboratory testing program for Phase I

- Viscosity test using Marsh Funnel as per ASTM D6910-04 or API 13B
- Unconfined compression test as per ASTM D2166
- Triaxial unconsolidated-undrained (UU) test as per ASTM D2850
- Permeability test as per ASTM D5084

3.2 Results from Phase I of the Lab Testing Program

The results from the laboratory tests in Phase 1 are summarized and presented in Table 3-2 below. The stress-strain plots from the unconfined compression test on samples cured for 28 days is presented in Figures 3-1 to 3-3. Details of the laboratory test results from Phase I are presented in Appendix 1.

Table 3-2: Summary of Laboratory Test Results for Phase I

Parameter	Mix 1	Mix 2	Mix 3
28 days UCS (kPa)	644.6	301.6	124.7
28 days Tangent Modulus of Elasticity (MPa), from UCS	93.7	58.7	33.5
28 days Cu from Triaxial UU Test (kPa)	330.4	158.9	77.4
28 days Tangent Modulus of Elasticity (MPa), from Triaxial UU test	122.7	60.2	22.2
28 days Permeability (cm/sec)	1.04×10^{-6}	2.55×10^{-6}	5.22×10^{-6}
Marsh Viscosity	non-viscous mix	non-viscous mix	non-viscous mix

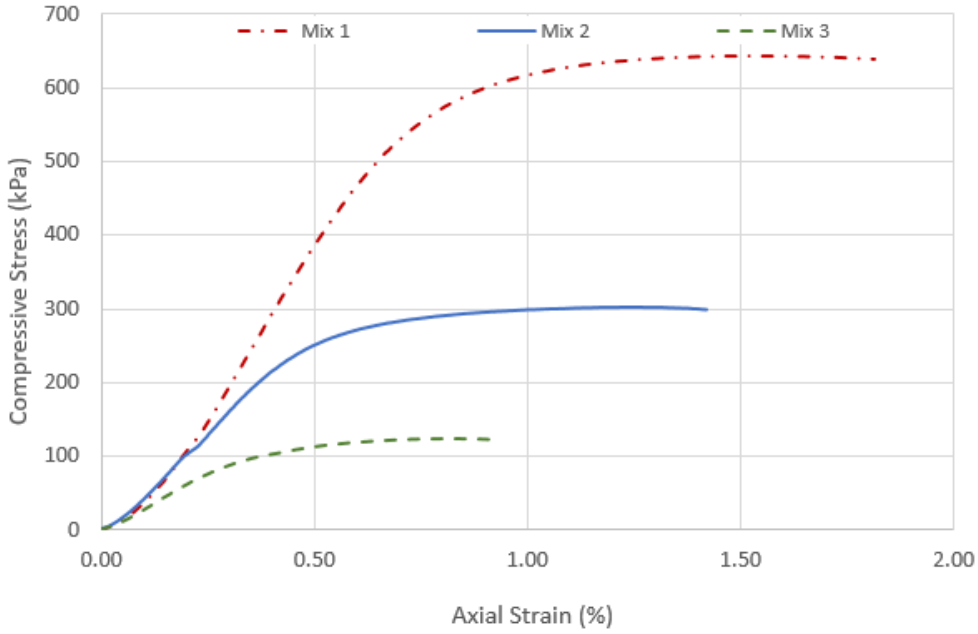


Figure 3-1: Stress-strain plot from UCS test on CB Mix 1, Mix 2 and Mix 3 (28 days of curing)

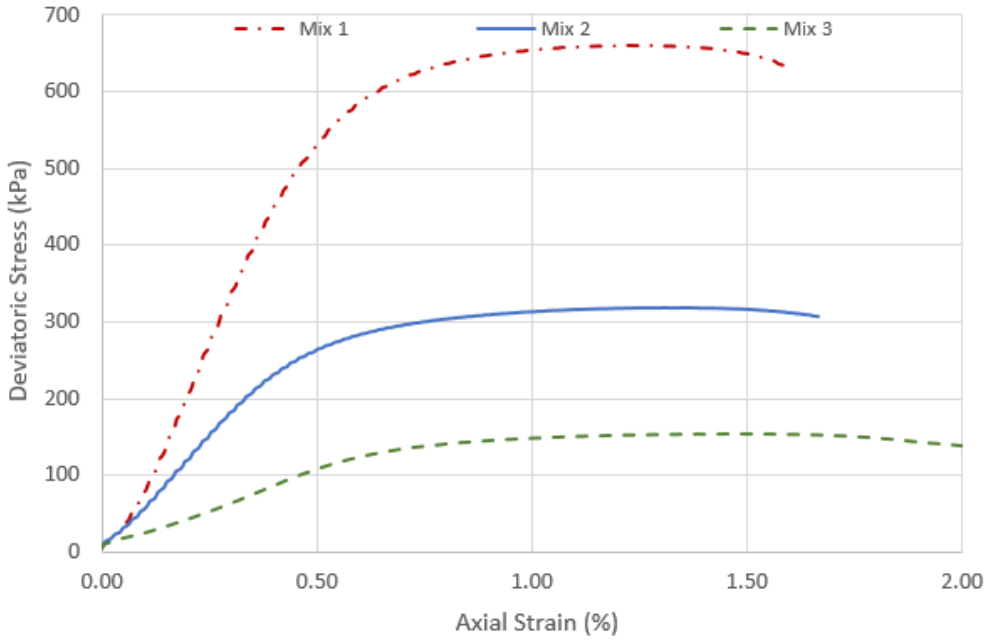


Figure 3-2: Stress-strain plot from Triaxial UU test on CB Mix 1, Mix 2 and Mix 3 (28 days of curing)

3.3 Discussion on Phase I Laboratory Test Results

Phase I of the laboratory testing program included carrying out tests on three different CB mixes shown in Table 3-1. The laboratory tests carried out on Mixes 1 to 3 indicated that.

- The permeability of all the three mixes is close to the expected permeability requirement.
- The UCS at 28 days is sensitive to the cement content. Mix 1 has a UCS greater than the design requirement. Hence, it meets the compressive strength requirement. The other two mixes have UCS values lower than the required UCS.
- The Marsh viscosity test results indicated that all the three mixes are non-viscous and hence do not meet the viscosity requirement.

4.0 Phase II Laboratory Testing Program

Phase II of the laboratory testing program was needed to address the following issues:

- As discussed in Section 3, the mixes used in Phase I did not meet viscosity requirement. Hence, new set of mixes had to be prepared using additives to improve workability/viscosity.
- The mixes considered in Phase I laboratory testing program were prepared under warm curing condition only. However, based on the conditions of the project site, the temperature of the lake water (2.5°C) that will be used for preparing the CB slurry on site and the temperature of the ground that the slurry would be emplaced within, could have a significant effect on the curing of the mixture. Hence, the behaviour of the CB mixes under cold curing condition should be investigated. Therefore, Phase II testing program was required to assess the behaviour of the CB mixes under cold curing condition.
- Early–strength tests were not conducted in Phase I laboratory testing program. One of the requirements to be met by the CB mixes is that they have a minimum early-strength of 50 kPa in 4 to 5 days of curing (earlier than these, if possible). Therefore, Phase II test program is required to determine the early-strength behaviour of the CB mixes.

The objectives of the Phase II testing program were, therefore to:

- Determine mix designs that satisfy viscosity requirement
- Determine mix designs that meet early-strength requirement
- Determine type and dosage of additives needed to improve the workability of the CB mixes so that the mixes meet design requirements
- Determine the behavior of the mixes under cold curing conditions (2°C-5°C)
- Try to optimize the cement content of the mixes

The following laboratory tests were conducted during Phase II of the laboratory testing program:

- Viscosity test using Marsh Funnel as per ASTM D6910-04 or API 13B
- Unconfined compression test as per ASTM D2166
- Permeability test as per ASTM D5084
- Bleeding test as per API13B
- Vane shear test ax per ASTM D2573
- Density testing as per ASTM D4380-84

4.1 CB Mixes Considered for Phase II of the Laboratory Testing Program

As stated in the section above, the use of additives was required to improve the workability of the CB mixes. Hence, two different types of additives from two different suppliers were considered, as per the recommendation from BAUER based on their experience. The two different additives considered to improve the workability of the mixes were:

- Sika P300-N, from SIKA Canada Inc.
- ARBO S01_P (Sodium Lignosulfonate), from KemTek Industries Inc.

The product descriptions for the additives are presented in Appendix 3.

The mix ratios that were assessed during Phase II of the lab testing program are summarized in Table 4-1 below. A brief description of the mixes is presented below.

- Mixes 4 to 6 were prepared to check repeatability of the mixes considered in Phase I (Mixes 1 to 3) and to determine base case scenario for the rest of the mixes considered in Phase II. No additives were applied to these mixes.
- Mixes 7 to 10 were prepared to check the applicability of the Sika P-300N additive to improve the workability of the mixes under warm curing condition.
- Mixes 11 to 13 were prepared to check the applicability of the ARBO S01P additive to improve the workability of the mixes under warm curing condition.
- Mixes 14 to 16 were considered to check the behaviour of Mixes 11 to 13 under warm storage (for only cement and bentonite) and cold curing condition. These mixes were considered since there were no samples of cement and bentonite stored under cold condition by the time these tests were carried out.
- Mixes 17 to 19 were considered to check the behaviour of the mixes stored and cured under cold condition.
- Mixes 20 to 21 were considered to optimize the cement content. These mixes have a lower cement content of 300 kg per cubic meter cube, compared to the other mixes which have a cement content of 350 kg per cubic meter of slurry.

The results from the lab testing program for the mixes described above are presented and discussed in the sections below.

Table 4-1: Mix Ratios Investigated during Phase II of the Lab Testing Program

Mix ID #	Cement (C/W)	Bentonite (B/W, %)	Additive		Remark
			Type	Dosage* (%)	
4	0.4	5	N/A	N/A	Stored and cured warm
5	0.4	5	N/A	N/A	Stored and cured warm
6	0.4	5	N/A	N/A	Stored and cured warm
7	0.4	5	Sika P-300N	0.5	Stored and cured warm
8	0.4	4.6	Sika P-300N	0.5	Stored and cured warm
9	0.4	4	Sika P-300N	0.5	Stored and cured warm
10	0.4	3.4	Sika P-300N	0.5	Stored and cured warm
11	0.4	4.6	ARBO S01P	0.5	Stored and cured warm
12	0.4	4	ARBO S01P	0.5	Stored and cured warm
13	0.4	3.4	ARBO S01P	0.5	Stored and cured warm
14	0.4	4.6	ARBO S01P	0.5	Stored warm, cold-cured
15	0.4	4	ARBO S01P	0.5	Stored warm, cold-cured
16	0.4	3.4	ARBO S01P	0.5	Stored warm, cold-cured
17	0.4	4.6	ARBO S01P	0.5	Stored and cured cold
18	0.4	4	ARBO S01P	0.5	Stored and cured cold
19	0.4	3.4	ARBO S01P	0.5	Stored and cured cold
20	0.34	4	ARBO S01P	0.58	Stored and cured warm
21	0.34	4	ARBO S01P	0.58	Stored and cured cold

* The additive dosage is by weight of cement.

4.2 Results from Phase II of the Lab Testing Program

A summary of the results from early-strength test, density test, bleeding test, and marsh viscosity test is presented in Table 4-2 below. Details of the results from Phase II laboratory testing program are presented in Appendix 2.

Figures 4-1 to 4-3 show the results from the Marsh test on viscosity of the different CB slurry mixes. The influence of the two different additives on improving the viscosity of the CB mix is shown in Figure 4-1. Figure 4-2 shows the influence of curing condition, where Mixes 11 to 13 were stored and cured under warm condition and Mixes 14 to

16 were prepared from cement and bentonite stored under warm condition (the water was stored under cold condition) but cured under cold condition.

Figure 4-3 shows the influence of storage condition based on Mixes 14 to 16 (where the cement and bentonite were stored under warm condition before mixing them with water stored under cold condition) and Mixes 17 to 19 (where the cement, bentonite and water were all stored under cold condition before mixing).

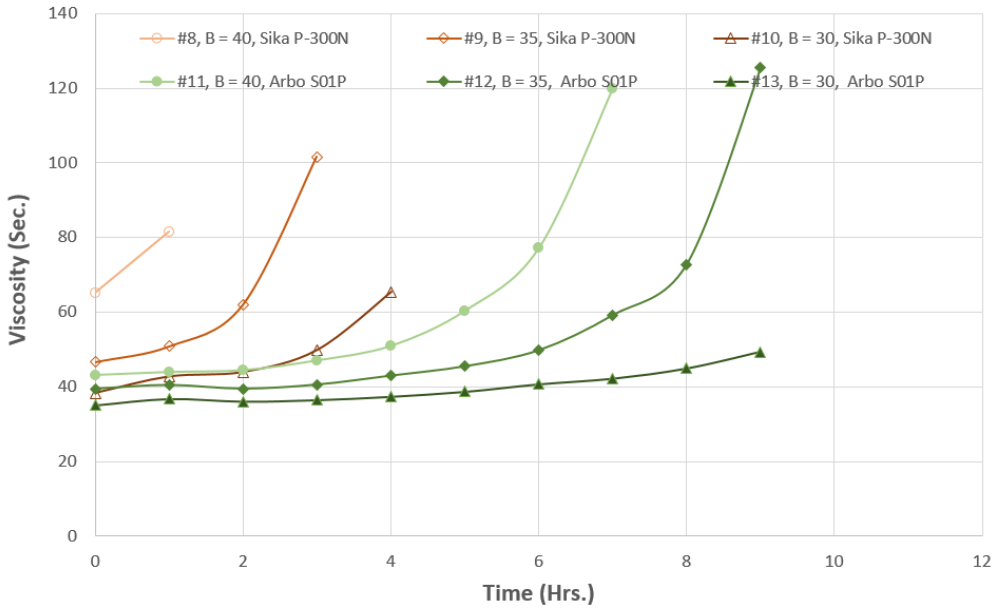


Figure 4-1: Variation of viscosity with time for Mixes 8 to 13 using different additives

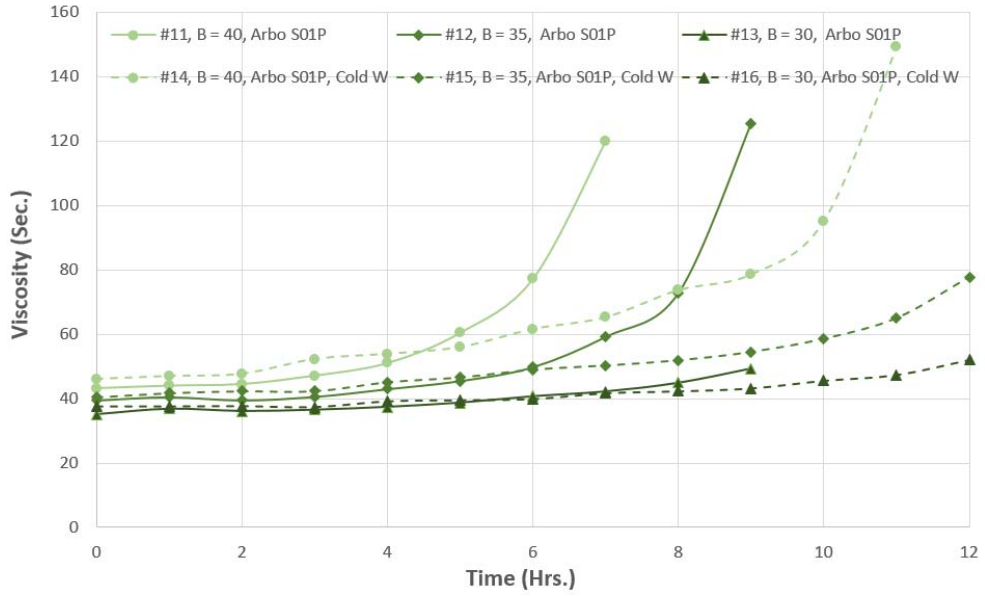


Figure 4-2: Variation of viscosity with time for Mixes 11 to 16 – Influence of Curing Condition

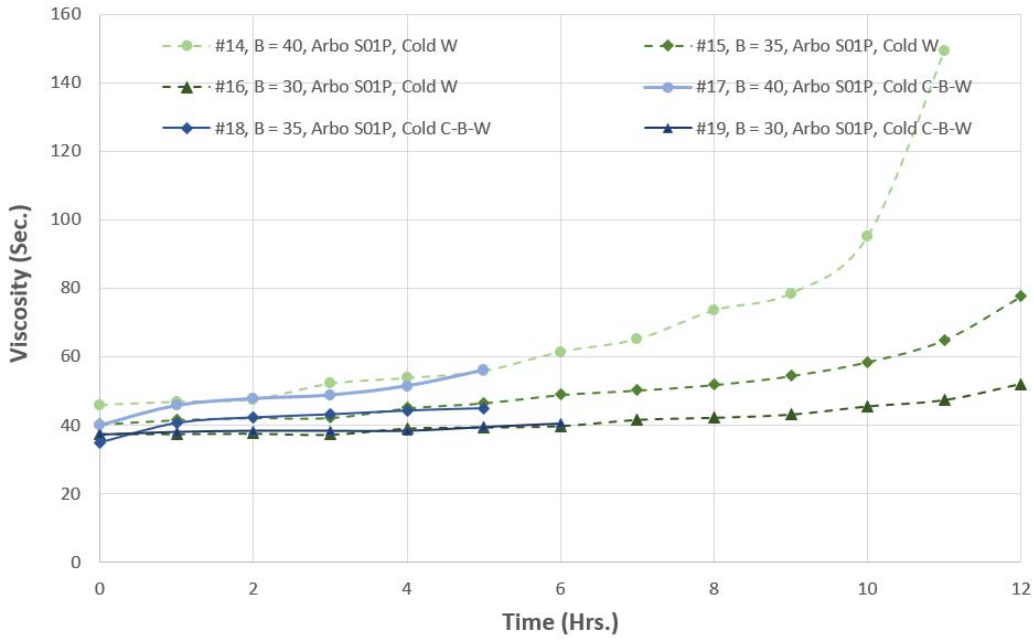


Figure 4-3: Variation of viscosity with time for Mixes 14 to 19 – Influence of Storage Condition

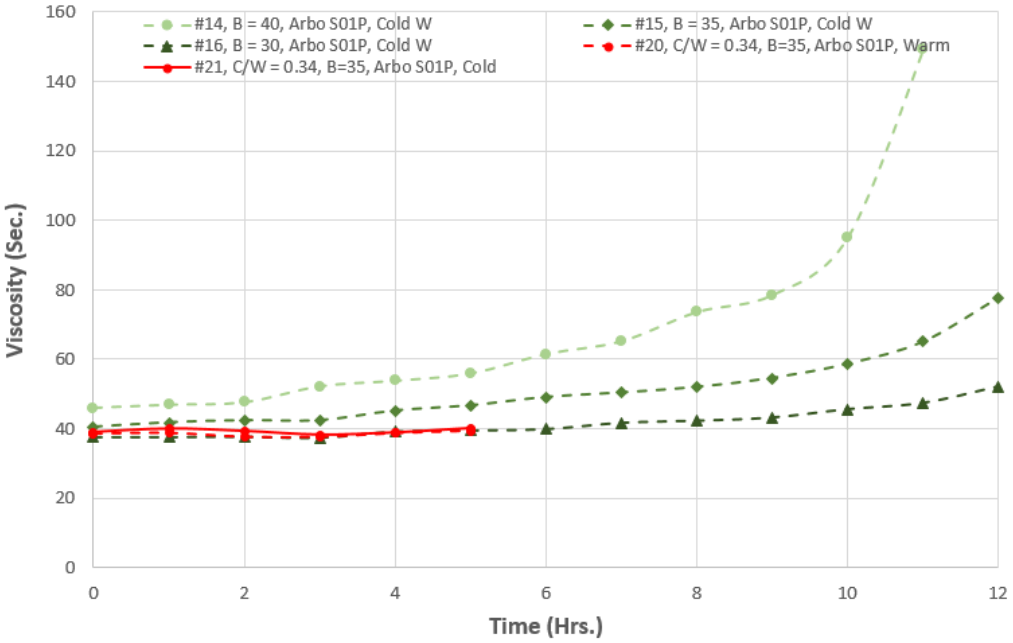


Figure 4-4: Variation of viscosity with time for Mixes 14 to 16, and Mixes 20 and 21 (with optimized cement content)

Table 4-2: Slurry density, bleeding and early-strength (4th day) from Phase II Lab Testing Program

Mix #	Density (g/cm^3)	UCS 4-days (kPa)	Viscosity after 8hrs (Sec.),	Bleeding (%, 2 Hrs.)	Bleeding (%, 3 days)
4	1.27	N/R	Non-viscous	1	N/R
5	1.26	N/R	Non-viscous	0.7	N/R
6	1.25	N/R	Non-viscous	1.2	N/R
7	1.25	N/R	> 80	0	N/R
8	1.26	N/R	> 80	0.5	N/R
9	1.26	N/R	> 80	0.5	N/R
10	1.24	N/R	> 80	0.5	N/R
11	1.24	N/R	> 80	1	N/R
12	1.22	N/R	73	0.7	N/R
13	1.19	N/R	45	1	N/R
14	1.23	74	74	0.8	N/R
15	1.21	87	52	1	N/R
16	1.19	106	42	1.3	N/R
17	1.23	98	N/R	1	4
18	1.22	112	N/R	0.5	4.5
19	1.19	112	N/R	1.8	8
20	1.19	152	< 80*	0.9	3
21	1.19	60	< 80*	1.9	7.5

N/R = Not Recorded, * the viscosity for these mixes were measured only up to 5 hrs and based on the observed trend it is expected that the viscosity at 8 hrs would be less than 80 seconds

4.3 Discussion on Phase II Early Performance/Workability Test Results

4.3.1 On Additives

A comparison of the performance of the additives is presented in Figure 4-1. The test results indicated that, for the mix ratios considered in this lab testing program, the mixes prepared with the Sika P-300N additive (Mixes 8 to 10) do not meet the workability/viscosity requirement. The Arbo S01P additive (Mixes 11 to 13) showed a better

performance in terms of workability. Hence, more mixes were considered for the current investigation using the Arbo S01P additive.

4.3.2 Influence of Cold-Curing on Workability/Viscosity

Figures 4-2 indicates that the cold-cured mixes (Mixes 14 to 16) have better workability (for viscosity aspect) than the warm-cured samples (Mixes 11 to 13).

4.3.3 Early-strength Test Results

The early-strength test results, presented in Table 4-2, indicated that Mixes 14 to 21 meet the early-strength requirement (UCS of 50 kPa) in 4-days. Early-strength measurements were not carried out up-to 4 days for the other mixes (Mixes 4 to 13). Mixes 7 to 13 have the same mix ratio as Mixes 14 to 16 but are stored under warm condition. Hence, Mixes 7 to 13 are also expected to satisfy early-strength requirement.

4.3.4 Bleeding Test Results

The bleeding test results indicate that the all the mixes have bleeding less than 2% in 2 hours. Longer period monitoring of up to 3 days was conducted on selected mixes (Mixes 17 to 22). The longer-period bleeding test results indicated that Mixes 19 and 21 show bleeding more than 7% in three days and the rest of the mixes show bleeding less than 5% in three days.

4.3.5 Mixes with Optimized Cement Content

The mixes with the optimized cement content (Mix 20 and Mix 21, warm-cured and cold-cured, respectively) meet the early-strength requirement. The viscosity tests on these mixes were done only up to 5 hrs. Based on the observed trend shown in Figure 4-4, it is expected that these mixes would meet the viscosity requirement. These mixes also satisfy the bleeding requirement. As indicated above, longer period (3 days) bleeding monitoring was carried out for these samples. The bleeding after 3 days in Mix 20 (warm-cured) is 3% and that in Mix 21 (cold-cured) is 7.5%.

4.4 Long-Term Performance Assessment

Based on the test results on early-strength, viscosity, bleeding and density, the mixes presented in Table 4-3 were considered for further investigation into the long-term performance (i.e., 28-days permeability and unconfined compressive strength tests on 7-days, 14-days, and 28-days curing time) for the following reasons:

- Mix 17 showed good performance in terms of early-strength, viscosity, bleeding and density. Hence, it was considered for further investigation into long-term performance (i.e., 28-days permeability and unconfined compressive strength tests [7-day, 14-days, and 28-days]). It was, however, labelled as Mix 22. Tests were performed on warm-cured and cold-cured samples to assess the influence of cold-curing condition on strength and establish relationship between warm-cured strength and cold-cured strength.
- For the mixes with optimized cement content (Mix 20 and Mix 21), the warm-cured mix (Mix 21) showed good performance in terms of early-strength, viscosity, bleeding and density requirements. However, the early-strength of the cold-cured mix (i.e., UCS of 60 kPa) is very close to the required early-strength (i.e, UCS of 50 kPa). It also demonstrated considerable bleeding of 7.5% after 3 days. Therefore, these mixes were not considered for long-term performance assessment.

Table 4-3: Phase II Mix Ratios for Long-Term Performance Evaluation

Mix ID #	Cement (C/W)	Bentonite (B/W, %)	Additive		Remark
			Type	Dosage*	
22-Warm	0.4	4.6	ARBO S01P	0.5	Stored and cured cold
22-Cold	0.4	4.6	ARBO S01P	0.5	Stored and cured cold

4.4.1 Results from the long-term Performance Assessment

The long-term performance assessment was carried out only on Mix 22. Table 4-4 below summarizes the laboratory test results from the tests conducted on Mix 22. Details of the laboratory test results are presented in Appendix 2.

The long-term strength and early-strength test results are summarized in Table 4-5 and plotted in Figure 4.5. Figure 4.6 presents the variation of the ratio of warm-cured strength to cold-cured strength with age of curing.

Table 4-4: Summary of Laboratory Test Results on Mix 22

Mix #	Density (g/cm^3)	Average Permeability (cm/sec)	UCS 4-days (kPa)	Average UCS 28-days (kPa)	Viscosity after 8hrs (Sec.)	Bleeding in 2 Hrs (%)
22- Warm	1.24	3.5×10^{-6}	220	475	< 80*	0.2
22-Cold	1.24	6.6×10^{-6}	72	227	< 80*	0.2

* the viscosity for these mixes were measured only up to 2 hrs and based on the observed trend (and since it is the same mix as Mix 17, which had a viscosity value less than 80 seconds) it is expected that the viscosity at 8 hrs would be less than 80 seconds

Table 4-5: Strength test results (early-strength and long-term strength) on Mix 22

Curing Age (Days)	Warm Cured				Cold Cured				UCS Ratio Warm/Cold
	Test #	UCS, Warm (kPa)	Failure Strain (%)	Tangent Modulus of Elasticity (MPa)	Test #	UCS, Cold (kPa)	Failure Strain (%)	Tangent Modulus of Elasticity (MPa)	
1	NA	10	NA	NA	NA	0	NA	NA	NA
2		103				7			14.71
3		174				42			4.14
4		220				72			3.06
7	1	237.7	1.04	52.6	4	96.2	1.25	15.7	2.47
	2	239.5	1.03	44.2	5	81.4	1.01	14.6	2.94
	3	249.8	1.24	50.7	6	91.9	0.77	21.1	2.72
14	7	341.4	1.09	66.6	9	171.2	0.7	35.9	1.99
	8	315.6	1.03	56.7	10	164.6	0.72	38.1	1.92
28	11	451	0.93	83.1	14	223.2	0.73	49.3	2.02
	12	502.8	0.94	115.8	15	228.1	0.83	48.9	2.20
	13	470.4	1.03	88	16	228.5	0.9	42	2.06

Note: the early strength test results (days 1 to 4) are from vane shear test and the long-term strength test results are from unconfined compression test.
NA = Not applicable

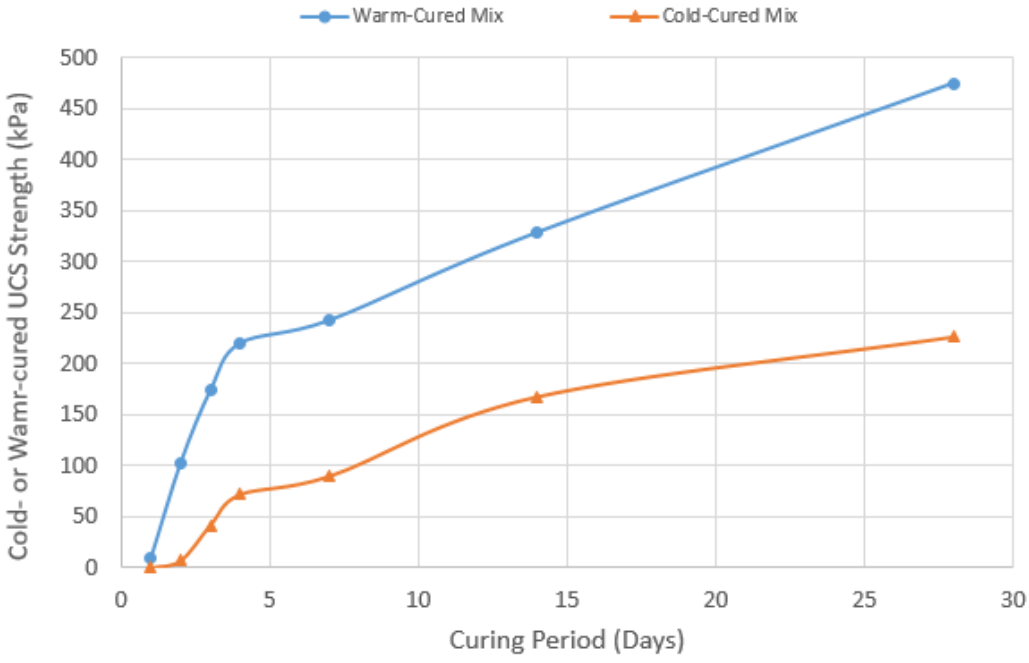


Figure 4-5: Comparison of Cold-cured and warm-cured strength

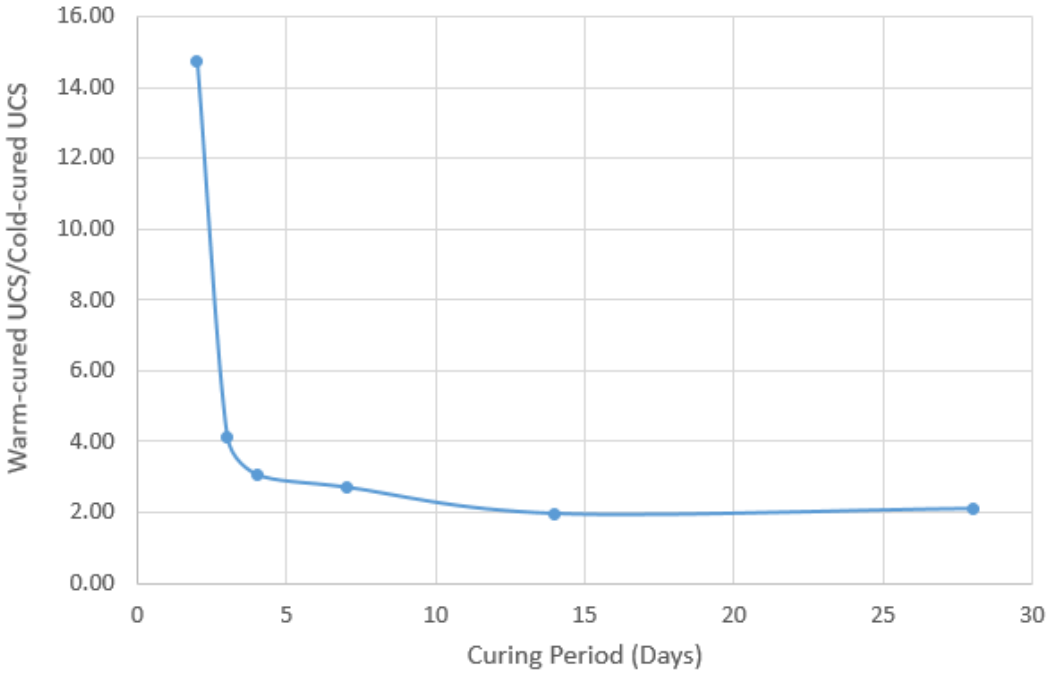


Figure 4-6: Variation of ratio of warm-cured strength to cold-cured strength with curing age

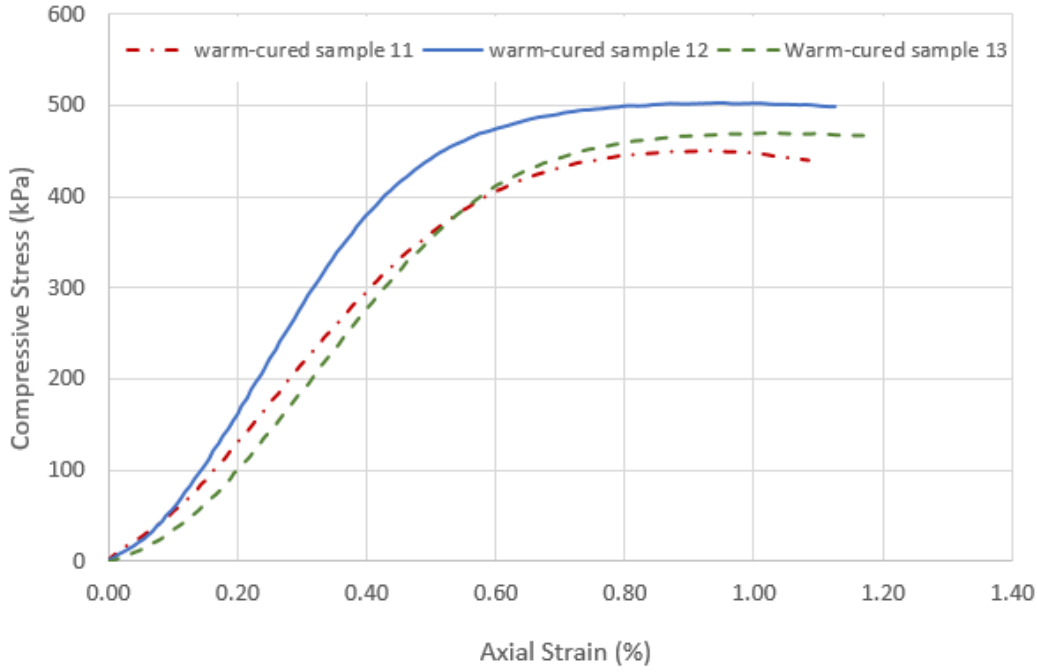


Figure 4-7: Stress-strain plot for Mix 22 warm-cured samples at curing age of 28 days

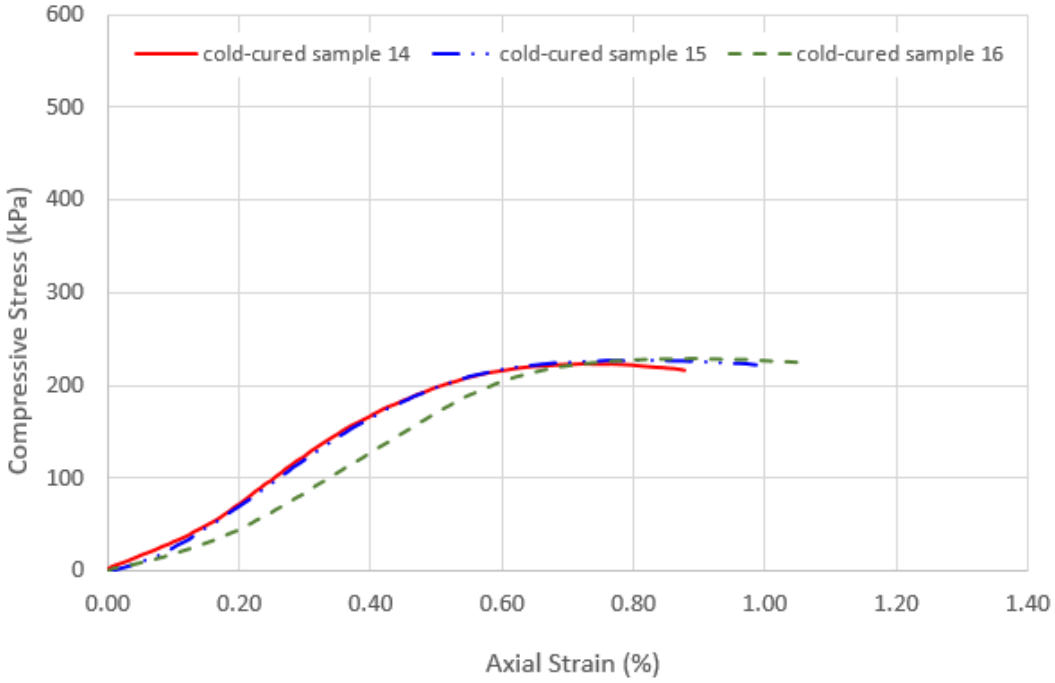


Figure 4-8: Stress-strain plot for Mix 22 cold-cured samples at curing age of 28 days

4.4.2 Discussion of the Laboratory Test Results from the long-term Performance Assessment

The results presented in Table 4-4 indicate that Mix 22 satisfies the density, early-strength, 28-days strength and bleeding requirement under both cold-cured and warm-cured conditions. The viscosity measurement on Mix 22 was done only for a couple of hours. However, based on the recorded data for a couple of hours and based on the fact that this mix is the same as Mix 17, which satisfies viscosity requirement, it can be concluded that the viscosity of Mix 22 would be less than 80 seconds in 8 hours and hence it meets the viscosity requirement.

As shown in Figure 4-5, the strength tests conducted on the samples indicated that cold curing condition decreases the rate of strength gain with curing age. Both the warm-cured and cold-cured samples continued to harden with time. However, as expected, longer curing periods were required for the cold-cured samples (4-days) compared to the warm-cured samples (2 days) to meet the early-strength requirement of 50 kPa.

Figure 4-6 shows that the ratio of the warm-cured strength to the cold-cured strength decreases with time and the ratio approach a value of about 2 with longer period of curing.

Figure 4-7 and Figure 4-8 show the stress-strain plots form UCS tests carried out on Mix 22 under warm-cured and cold-cured conditions, respectively. The stress-strain plots show that for the same curing age of 28 days, cold curing condition results in lower UCS and also lower modulus of elasticity (as shown in Table 4-5 as well) than warm curing condition. Therefore, the cold-curing condition influences not only the compressive strength of the material but also the modulus of elasticity of the material.

The cold curing condition also influences the failure strain resulting in a lower failure strain (as shown in Table 4-5) compared to warm curing condition.

5.0 Phase III Laboratory Testing Program

All the CB slurry mixes considered in Phase I and Phase II were prepared by using tap water. However, it is expected that the actual mixes on the project site would be prepared using water from Whale Tail Lake. The water chemistry may affect the performance of the CB mix. Hence, it has been proposed by SNC-Lavalin (during MDRB 23) that laboratory testing program is necessary on CB mix samples prepared by using water from Whale Tail Lake. The review board agreed that such tests need to be conducted before deciding the final CB mix design ratio to be used for the project.

Therefore, the main objective of Phase III lab testing program is to make laboratory tests on the selected design mix prepared using water from Whale Tail Lake. In addition to that, pin-hole tests (which were not performed during Phase I and Phase II) would be carried out to assess erodability of the CB mixes during early-stage of curing. Tensile strength tests will also be carried out to determine the tensile strength of the CB mixes.

The laboratory tests in Phase III will be carried out on CB mixes with the same mix ratio as Mix 22, under cold curing condition and the CB slurry would be prepared using water from Whale Tail Lake.

6.0 References

SNC-Lavalin, 2016. Permitting Level Engineering Report for Geotechnical and Water Management Infrastructure, 627215-10000-40ER-0004-01, February 2016.

SNC-Lavalin, 2017. Preliminary Studies for Water Management and Geotechnical Infrastructure at Amaruq, Whale Tail Dike Secant Pile Cutoff Wall Preliminary Design, 645003-3000-4GER-0003, October, 2017

Appendix 1
Phase I Laboratory Test Results

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**1**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -01**

Initial characteristics

Diameter	D_O	mm	101.58
Length	L_O	mm	198.37
Cross-sectional area	A_0	cm^2	81.04
Total volume	V_T	cm^3	1607.48
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.953
Total wet mass	Mh	g	2075.48
Total dry mass	Ms	g	730.85
Water volume	V_w	cm^3	1348.68
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	267.05
Degree of saturation	S_R	(%)	100.6

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.7
Total dry	ρ_d		4.5

Water content

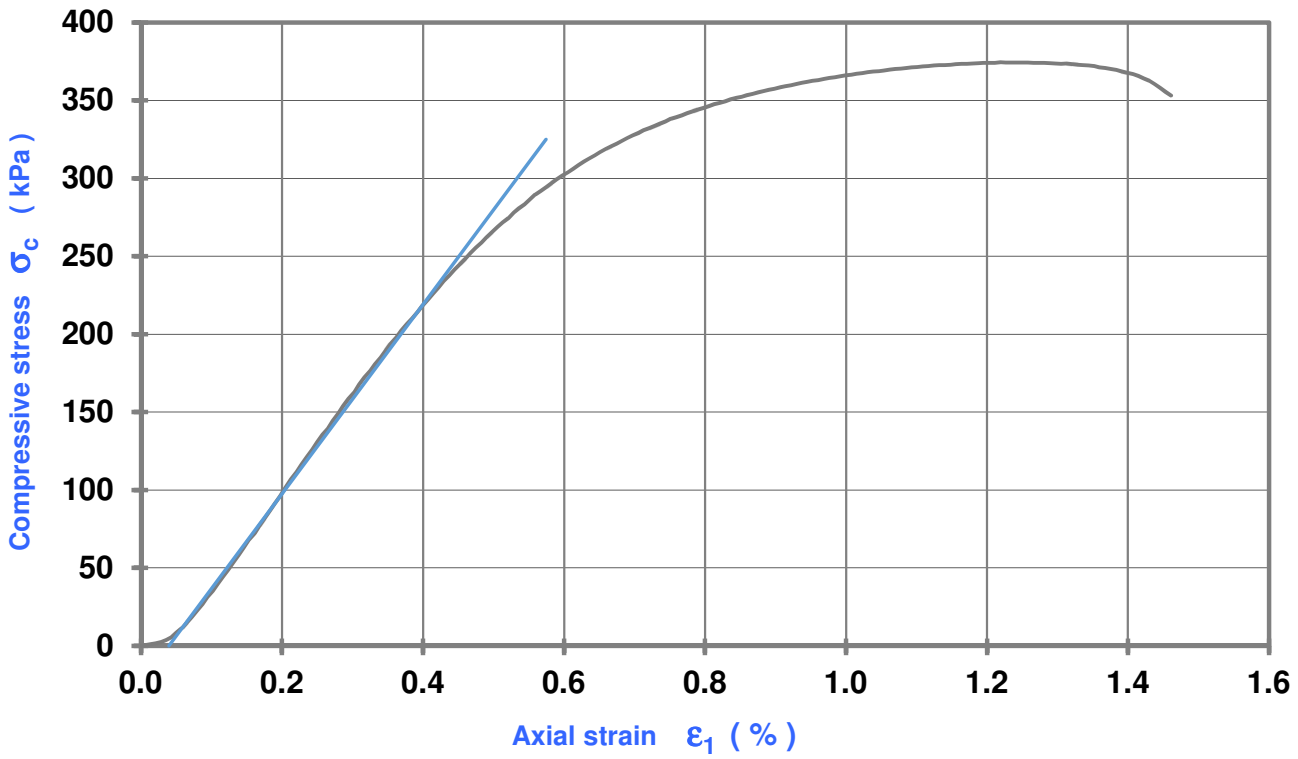
	Auxiliary	Total
Total wet mass (g)		2453.64
Total dry mass (g)		1109.01
Container nr		N-14
Container mass (g)		378.16
Water content (%)		**183.98**

TEST CONDITION

Compression rate	mm/min	0.183	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	374.4
Axial strain	ε_1	(%)	1.22
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.04
Axial strain (%)	1.18		0.31
E_u (MPa)	31.8		61.6



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-11-29 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-01
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**1**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -07**

Initial characteristics

Diameter	D_O	mm	101.49
Length	L_O	mm	196.65
Cross-sectional area	A_0	cm^2	80.89
Total volume	V_T	cm^3	1590.69
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.938
Total wet mass	Mh	g	2067.59
Total dry mass	Ms	g	739.48
Water volume	V_w	cm^3	1332.11
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	270.20
Degree of saturation	S_R	(%)	100.9

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.7
Total dry	ρ_d		4.6

Water content

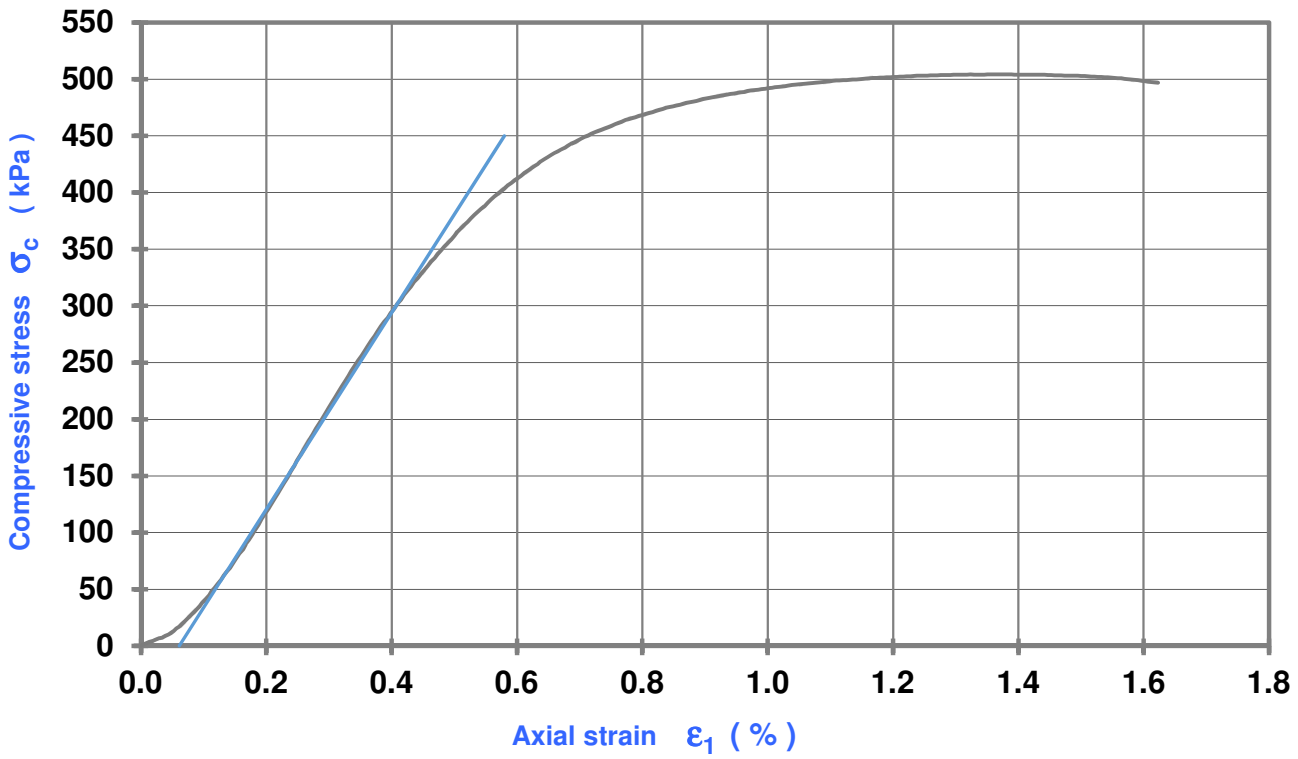
	Auxiliary	Total
Total wet mass (g)		2453.51
Total dry mass (g)		1125.40
Container nr		23
Container mass (g)		385.92
Water content (%)		**179.60**

TEST CONDITION

Compression rate	mm/min	0.150	%/min	0.08

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	504.2
Axial strain	ε_1	(%)	1.37
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.06
Axial strain (%)	1.31		0.29
E_u (MPa)	38.6		88.0



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-06 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-12
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**1**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -13**

Initial characteristics

Diameter	D_O	mm	101.69
Length	L_O	mm	194.93
Cross-sectional area	A_0	cm^2	81.21
Total volume	V_T	cm^3	1583.01
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.917
Total wet mass	Mh	g	2049.09
Total dry mass	Ms	g	730.24
Water volume	V_w	cm^3	1322.82
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	266.83
Degree of saturation	S_R	(%)	100.5

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.7
Total dry	ρ_d		4.5

Water content

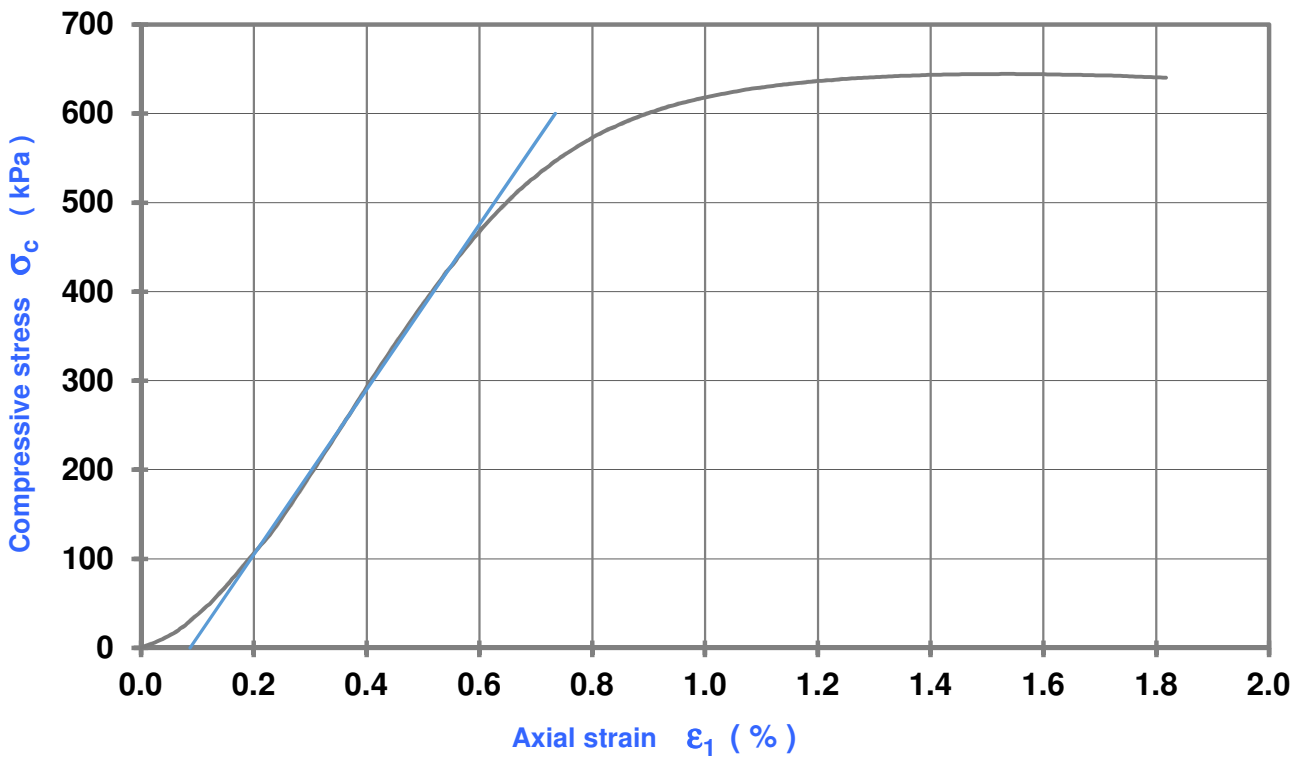
	Auxiliary	Total
Total wet mass (g)		2436.51
Total dry mass (g)		1117.66
Container nr		N-21
Container mass (g)		387.42
Water content (%)		**180.61**

TEST CONDITION

Compression rate	mm/min	0.150	%/min	0.08

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	644.6
Axial strain	ε_1	(%)	1.53
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.09
Axial strain (%)	1.44		0.35
E_u (MPa)	44.6		93.7



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-20 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-22
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**1**
PROJECT	: AMARUQ	**CURING TYPE :**	**FROZEN AT -18 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -05**

Initial characteristics

Diameter	D_O	mm	101.24
Length	L_O	mm	201.67
Cross-sectional area	A_0	cm^2	80.49
Total volume	V_T	cm^3	1623.34
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.992
Total wet mass	Mh	g	1996.94
Total dry mass	Ms	g	714.32
Water volume	V_w	cm^3	1286.48
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	261.01
Degree of saturation	S_R	(%)	94.4

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.1
Total dry	ρ_d		4.3

Water content

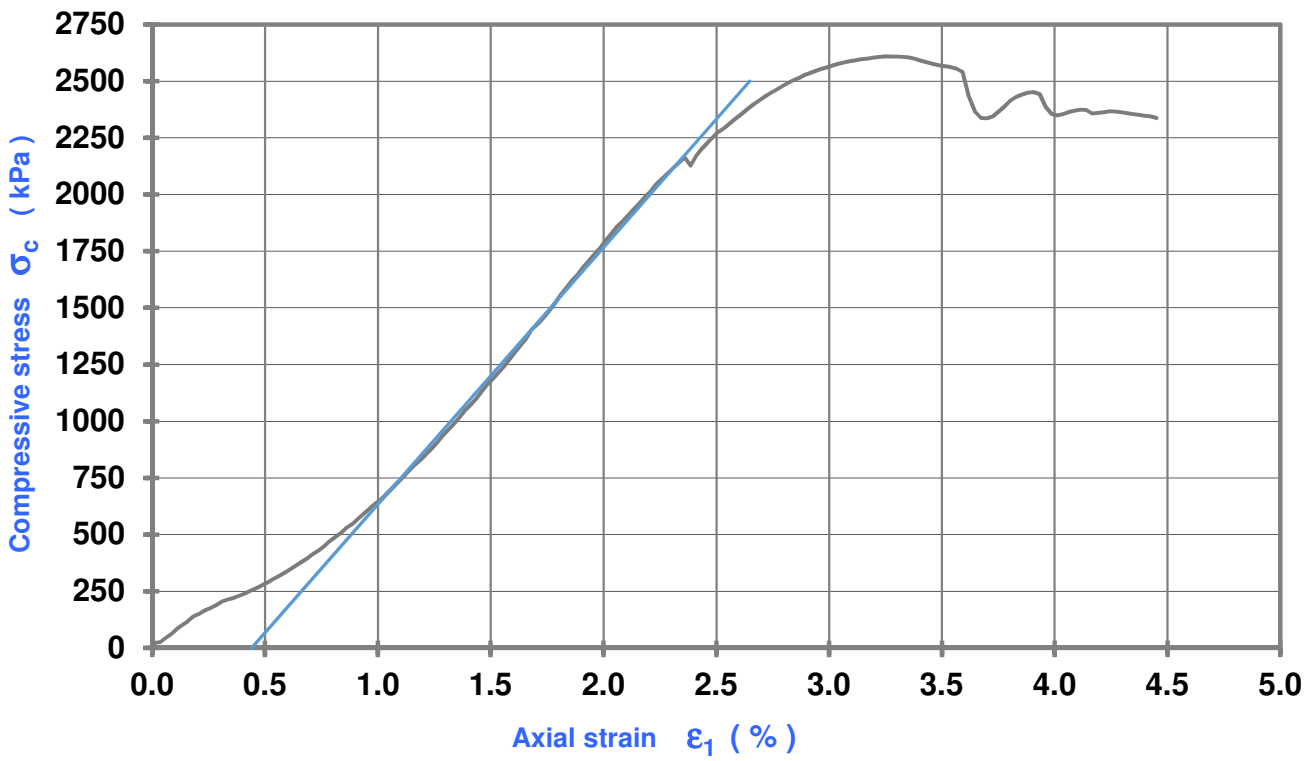
	Auxiliary	Total
Total wet mass (g)		2447.70
Total dry mass (g)		1165.08
Container nr		Bo6
Container mass (g)		450.76
Water content (%)		**179.56**

TEST CONDITION

Compression rate	mm/min	0.750	%/min	0.37

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	2609.5
Axial strain	ε_1	(%)	3.25
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.44
Axial strain (%)	2.81		1.17
E_u (MPa)	92.9		111.9



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-11-29 (7 days curing)**
The specimen expelled water during compression at the bottom only
Prepared by : Richard Courchesne (100736) Date: 2017-12-01
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**1**
PROJECT	: AMARUQ	**CURING TYPE :**	**FROZEN AT -18 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -10**

Initial characteristics

Diameter	D_O	mm	101.46
Length	L_O	mm	199.79
Cross-sectional area	A_0	cm^2	80.85
Total volume	V_T	cm^3	1615.40
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.969
Total wet mass	Mh	g	1977.40
Total dry mass	Ms	g	712.55
Water volume	V_w	cm^3	1268.66
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	260.36
Degree of saturation	S_R	(%)	93.6

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.0
Total dry	ρ_d		4.3

Water content

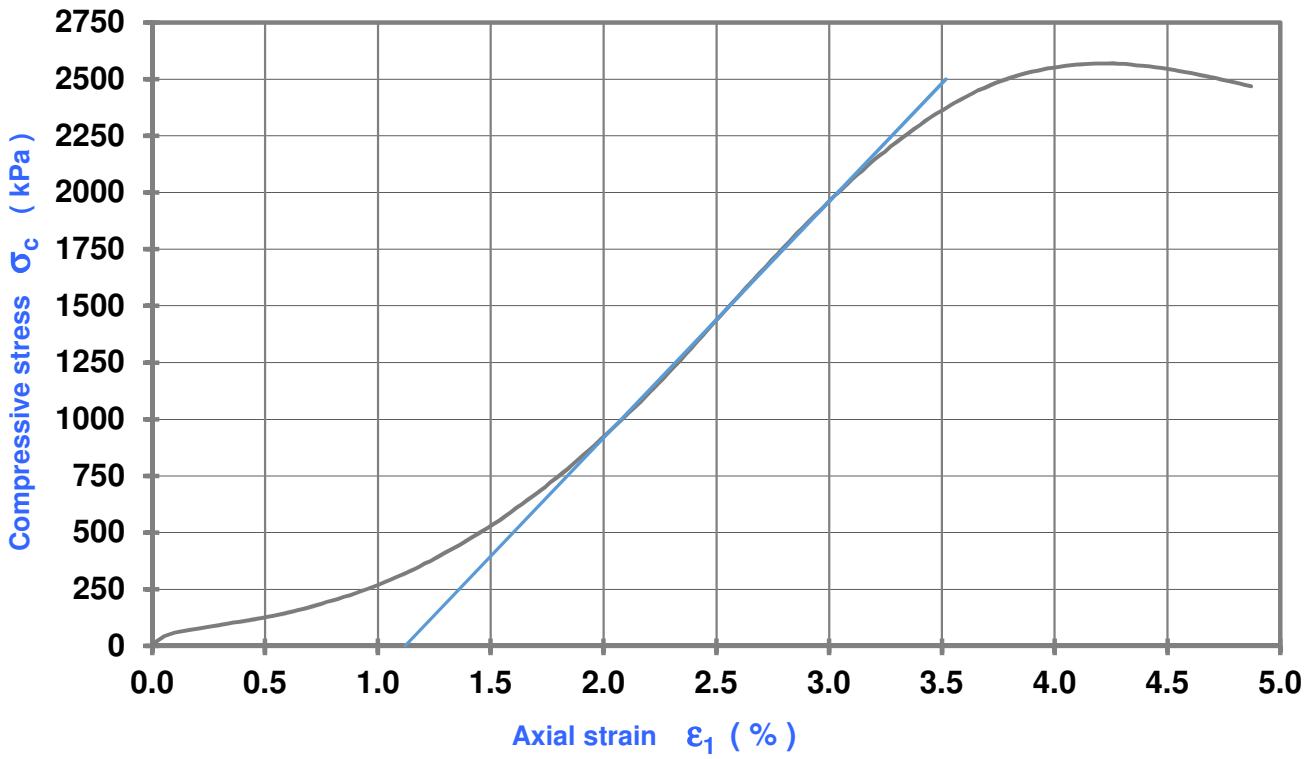
	Auxiliary	Total
Total wet mass (g)		2436.58
Total dry mass (g)		1171.73
Container nr		S-9
Container mass (g)		459.18
Water content (%)		**177.51**

TEST CONDITION

Compression rate	mm/min	0.750	%/min	0.38

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	2569.8
Axial strain	ε_1	(%)	4.26
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	1.12
Axial strain (%)	3.14		1.17
E_u (MPa)	81.9		103.2



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-07 (15 days curing)**
The specimen expelled water during compression at the bottom only
Prepared by : Richard Courchesne (100736) Date: 2017-12-12
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**2**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -02**

Initial characteristics

Diameter	D_O	mm	101.50
Length	L_O	mm	196.17
Cross-sectional area	A_0	cm^2	80.92
Total volume	V_T	cm^3	1587.38
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.933
Total wet mass	Mh	g	1990.08
Total dry mass	Ms	g	619.34
Water volume	V_w	cm^3	1374.86
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	226.30
Degree of saturation	S_R	(%)	101.0

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.3
Total dry	ρ_d		3.8

Water content

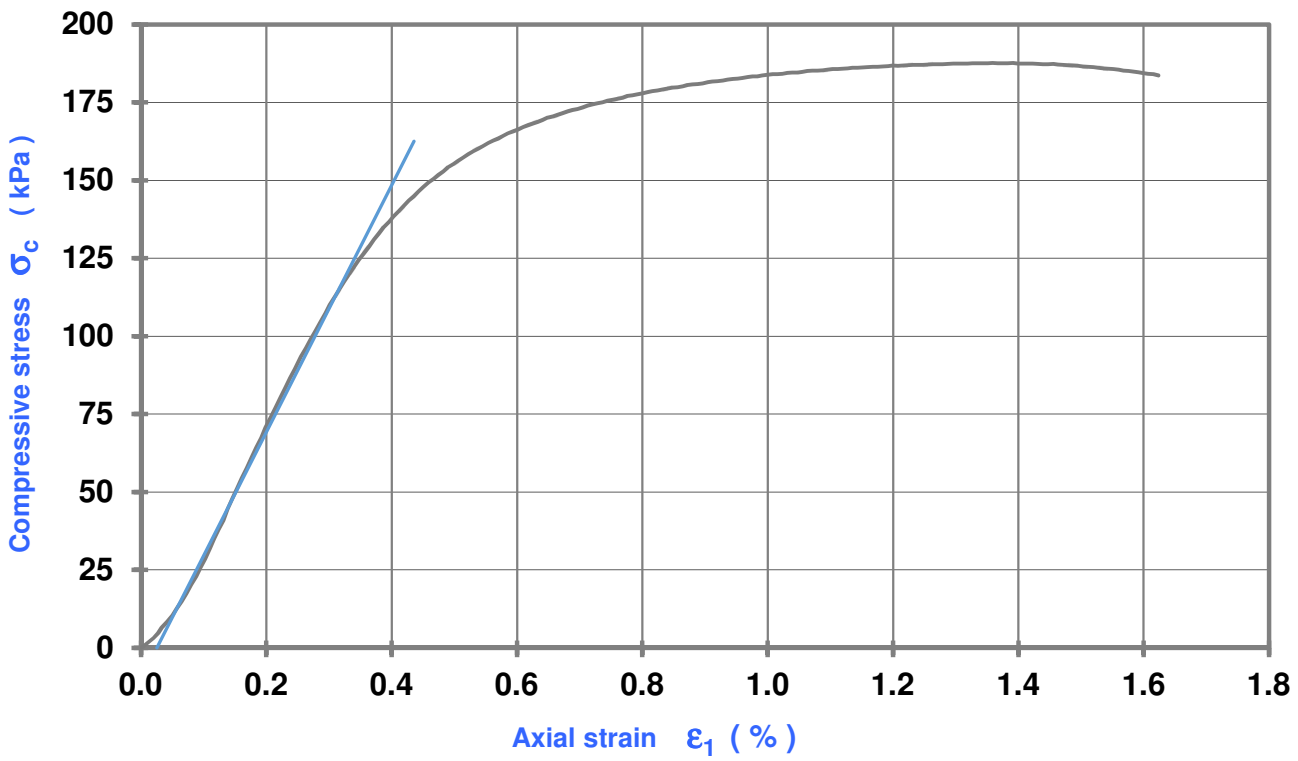
	Auxiliary	Total
Total wet mass (g)		2417.81
Total dry mass (g)		1047.07
Container nr		N-26
Container mass (g)		427.73
Water content (%)		**221.32**

TEST CONDITION

Compression rate	mm/min	0.183	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	187.6
Axial strain	ε_1	(%)	1.36
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.03
Axial strain (%)	1.34		0.24
E_u (MPa)	14.0		39.3



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-11-29 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-01
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**2**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -08**

Initial characteristics

Diameter	D_O	mm	101.46
Length	L_O	mm	194.56
Cross-sectional area	A_0	cm^2	80.85
Total volume	V_T	cm^3	1573.02
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.918
Total wet mass	Mh	g	1976.42
Total dry mass	Ms	g	625.84
Water volume	V_w	cm^3	1354.64
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	228.68
Degree of saturation	S_R	(%)	100.8

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.3
Total dry	ρ_d		3.9

Water content

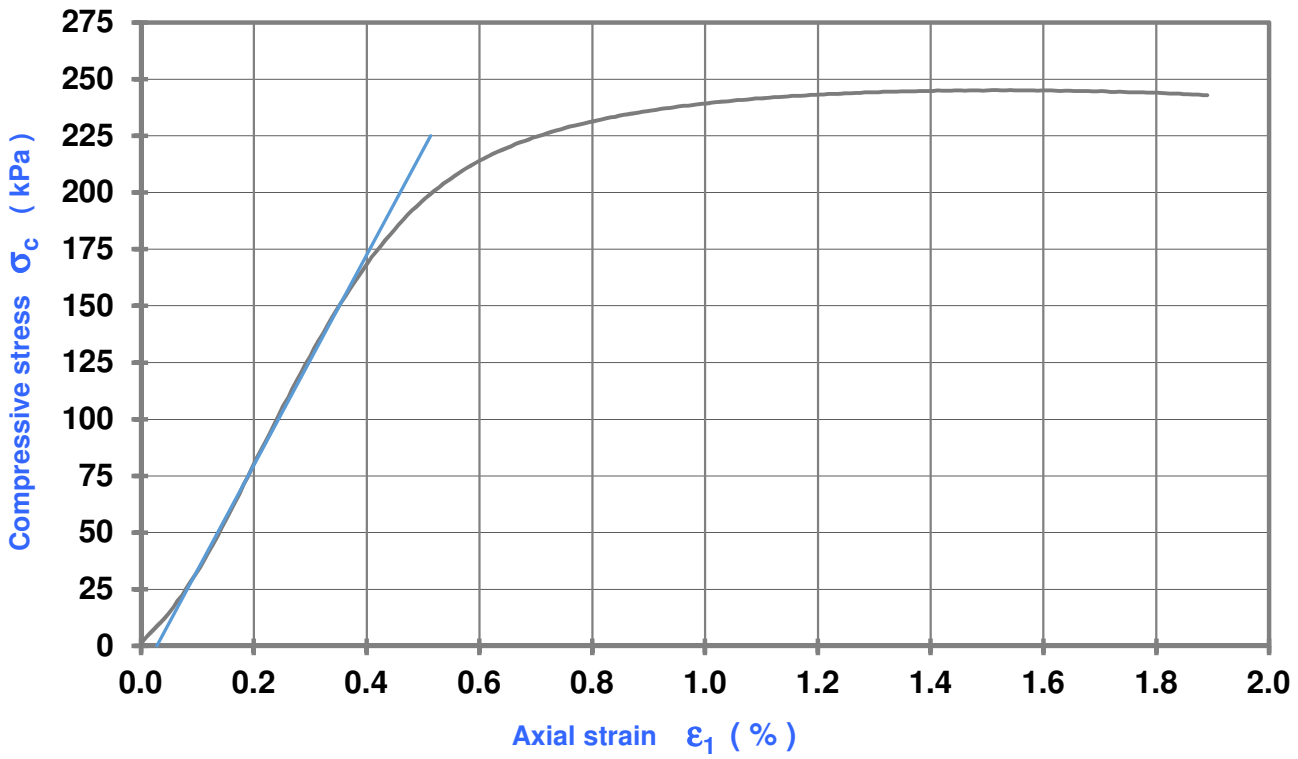
	Auxiliary	Total
Total wet mass (g)		2363.89
Total dry mass (g)		1013.31
Container nr		N-21
Container mass (g)		387.47
Water content (%)		**215.80**

TEST CONDITION

Compression rate	mm/min	0.183	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	245.2
Axial strain	ε_1	(%)	1.51
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.03
Axial strain (%)	1.48		0.26
E_u (MPa)	16.6		47.3



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-06 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-12
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**2**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -14**

Initial characteristics

Diameter	D_O	mm	101.60
Length	L_O	mm	194.89
Cross-sectional area	A_0	cm^2	81.07
Total volume	V_T	cm^3	1580.04
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.918
Total wet mass	Mh	g	1980.27
Total dry mass	Ms	g	617.66
Water volume	V_w	cm^3	1366.71
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	225.69
Degree of saturation	S_R	(%)	100.9

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.3
Total dry	ρ_d		3.8

Water content

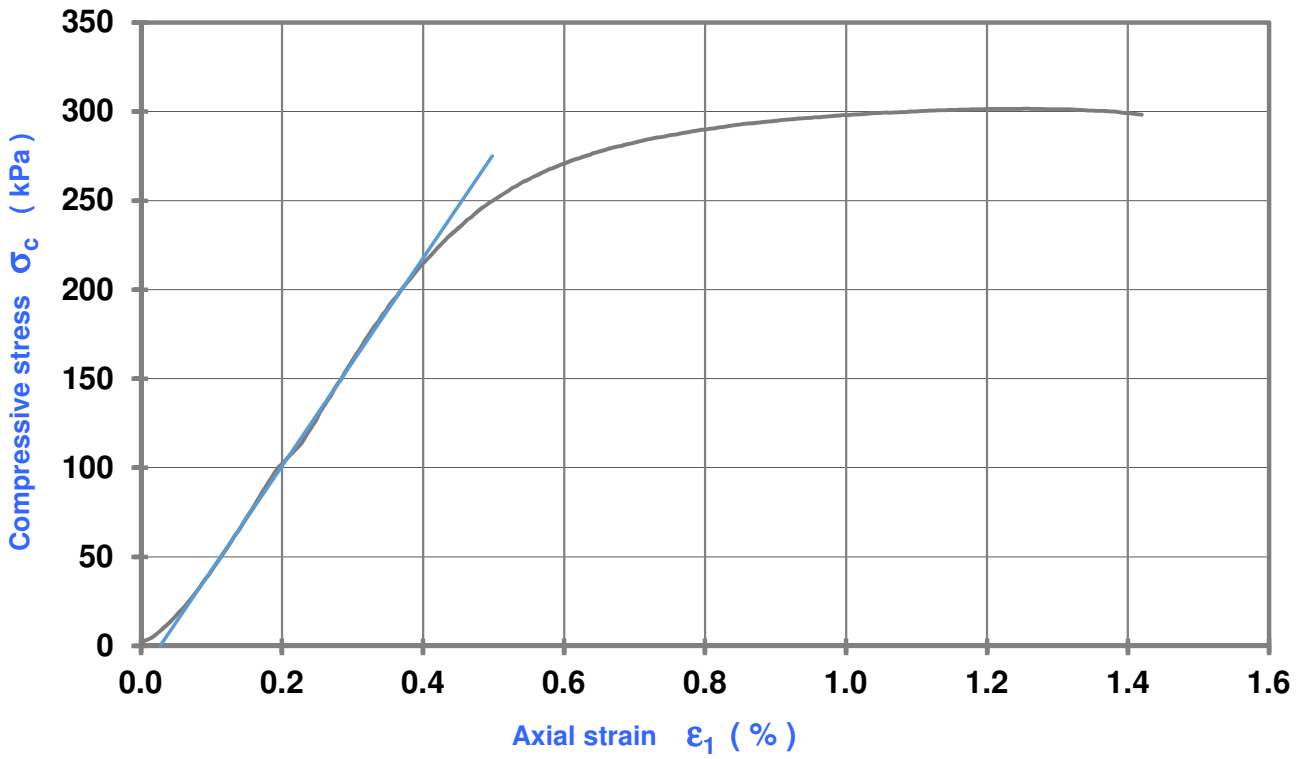
Water content	Auxiliary	Total
Total wet mass (g)		2366.00
Total dry mass (g)		1003.39
Container nr		23
Container mass (g)		385.73
Water content (%)		**220.61**

TEST CONDITION

Compression rate	mm/min	0.150	%/min	0.08

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	301.6
Axial strain	ε_1	(%)	1.25
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.03
Axial strain (%)	1.23		0.26
E_u (MPa)	24.6		58.7



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-20 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-22
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**2**
PROJECT	: AMARUQ	**CURING TYPE :**	**FROZEN AT -18 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -04**

Initial characteristics

Diameter	D_O	mm	101.40
Length	L_O	mm	199.27
Cross-sectional area	A_0	cm^2	80.75
Total volume	V_T	cm^3	1609.15
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.965
Total wet mass	Mh	g	1901.90
Total dry mass	Ms	g	604.91
Water volume	V_w	cm^3	1300.89
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	221.03
Degree of saturation	S_R	(%)	93.7

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.6
Total dry	ρ_d		3.7

Water content

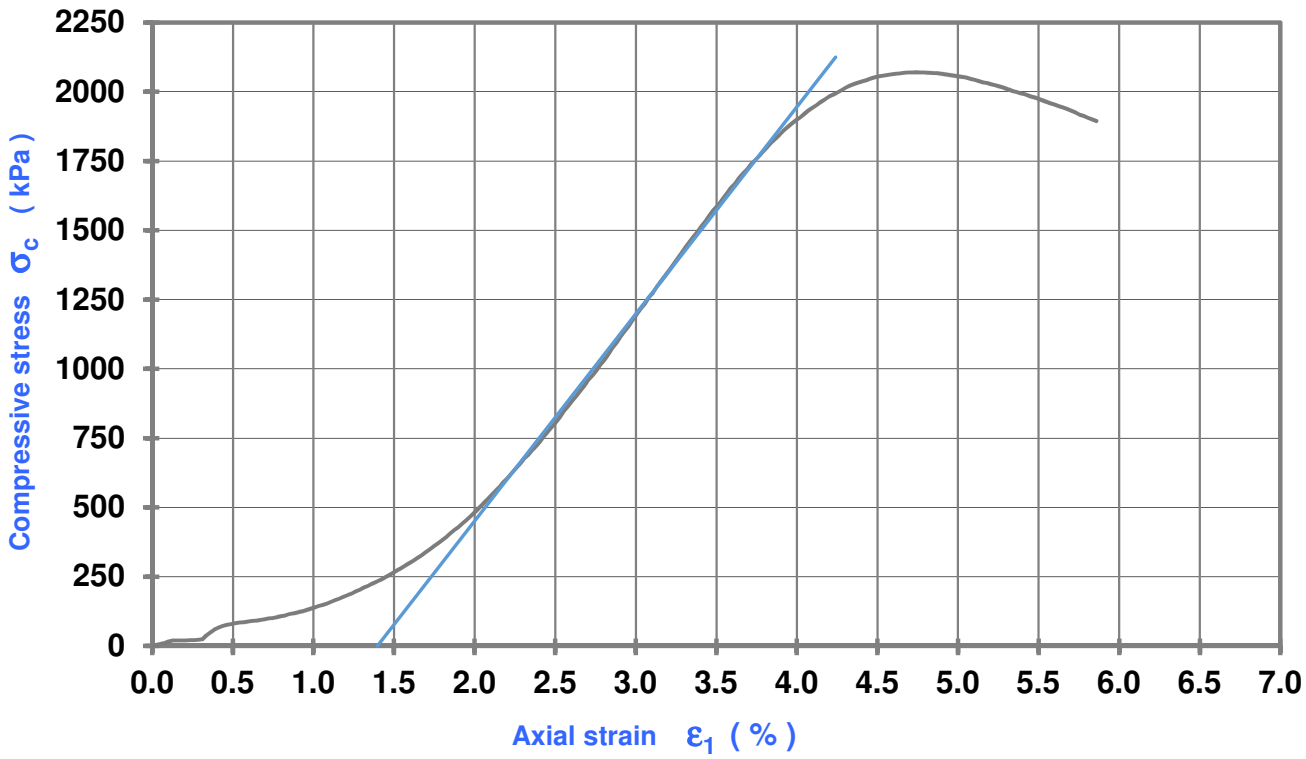
	Auxiliary	Total
Total wet mass (g)		2328.16
Total dry mass (g)		1031.17
Container nr		D-13
Container mass (g)		426.26
Water content (%)		**214.41**

TEST CONDITION

Compression rate	mm/min	0.750	%/min	0.38

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	2070.2
Axial strain	ε_1	(%)	4.74
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	1.40
Axial strain (%)	3.34		1.43
E_u (MPa)	61.9		73.6



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-11-29 (7 days curing)**
The specimen expelled water during compression at the bottom only
Prepared by : Richard Courchesne (100736) Date: 2017-12-01
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**2**
PROJECT	: AMARUQ	**CURING TYPE :**	**FROZEN AT -18 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -11**

Initial characteristics

Diameter	D_O	mm	101.40
Length	L_O	mm	199.28
Cross-sectional area	A_0	cm^2	80.75
Total volume	V_T	cm^3	1609.23
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.965
Total wet mass	Mh	g	1899.88
Total dry mass	Ms	g	607.82
Water volume	V_w	cm^3	1295.95
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	222.09
Degree of saturation	S_R	(%)	93.4

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.6
Total dry	ρ_d		3.7

Water content

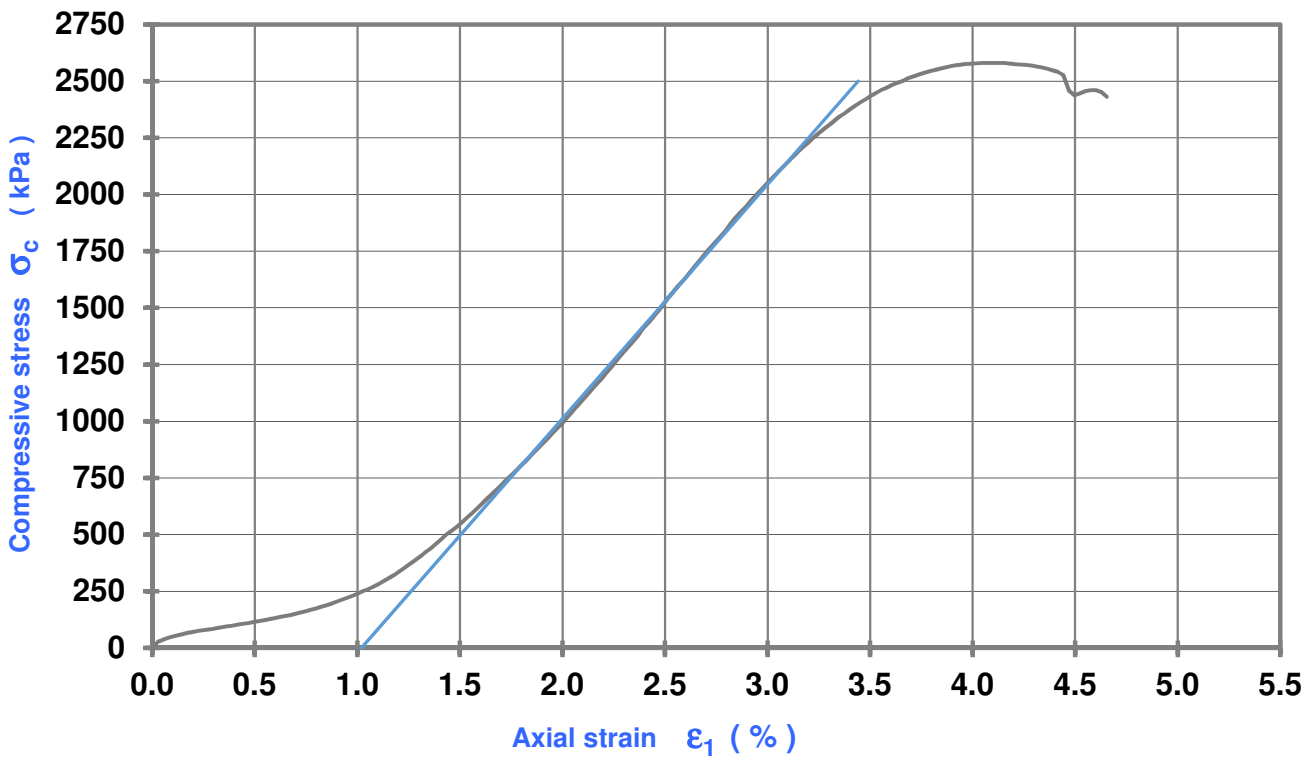
	Auxiliary	Total
Total wet mass (g)		2348.86
Total dry mass (g)		1056.80
Container nr		N-2
Container mass (g)		448.98
Water content (%)		**212.57**

TEST CONDITION

Compression rate	mm/min	0.750	%/min	0.38

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	2580.9
Axial strain	ε_1	(%)	4.10
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	1.02
Axial strain (%)	3.08		1.27
E_u (MPa)	83.7		102.1



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-06 (14 days curing)**
The specimen expelled water during compression at the bottom only
Prepared by : Richard Courchesne (100736) Date: 2017-12-12
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**3**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -03**

Initial characteristics

Diameter	D_O	mm	101.69
Length	L_O	mm	193.51
Cross-sectional area	A_0	cm^2	81.21
Total volume	V_T	cm^3	1571.57
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.903
Total wet mass	Mh	g	1892.64
Total dry mass	Ms	g	498.55
Water volume	V_w	cm^3	1398.28
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	182.17
Degree of saturation	S_R	(%)	100.6

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.8
Total dry	ρ_d		3.1

Water content

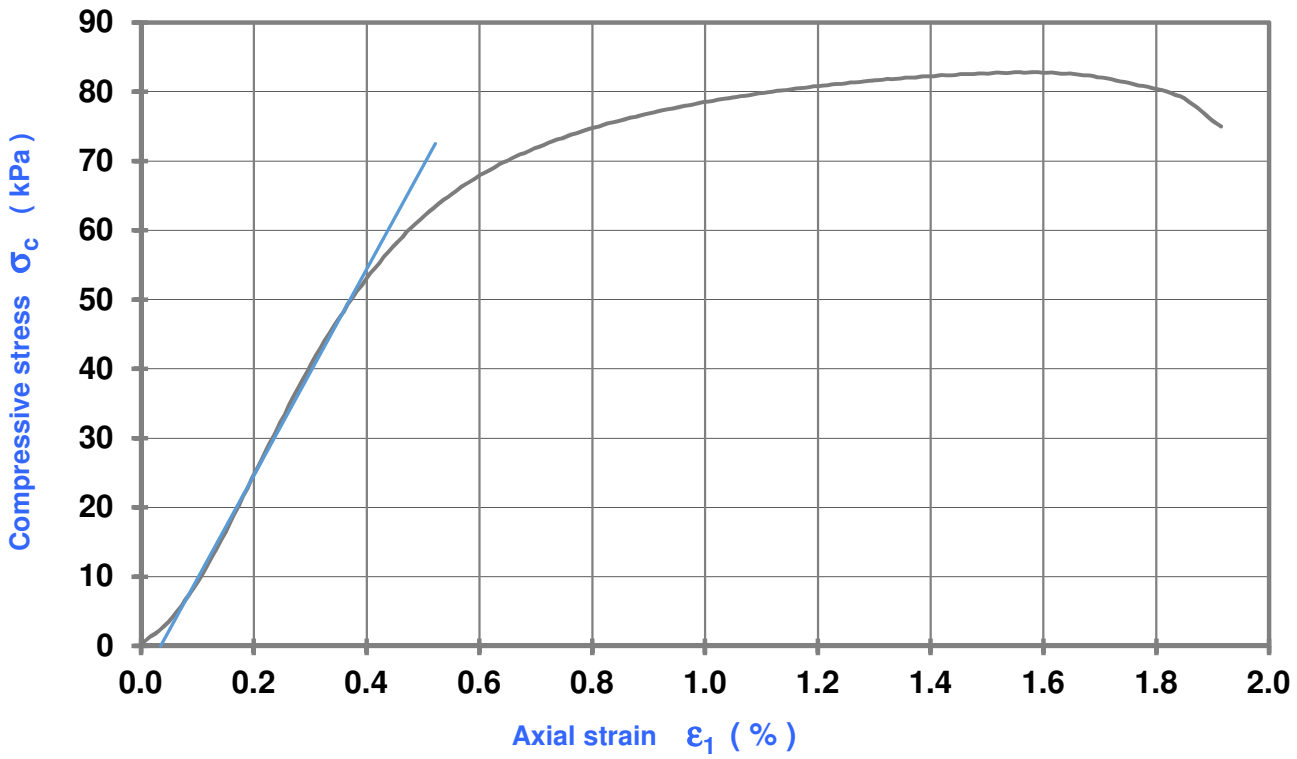
Water content	Auxiliary	Total
Total wet mass (g)		2317.26
Total dry mass (g)		923.17
Container nr		N-12
Container mass (g)		424.62
Water content (%)		**279.63**

TEST CONDITION

Compression rate	mm/min	0.183	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	82.8
Axial strain	ε_1	(%)	1.58
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.03
Axial strain (%)	1.55		0.28
E_u (MPa)	5.4		15.2



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-11-29 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-01
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**3**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -09**

Initial characteristics

Diameter	D_O	mm	101.42
Length	L_O	mm	196.24
Cross-sectional area	A_0	cm^2	80.79
Total volume	V_T	cm^3	1585.37
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.935
Total wet mass	Mh	g	1919.79
Total dry mass	Ms	g	510.38
Water volume	V_w	cm^3	1413.65
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	186.49
Degree of saturation	S_R	(%)	101.1

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.9
Total dry	ρ_d		3.2

Water content

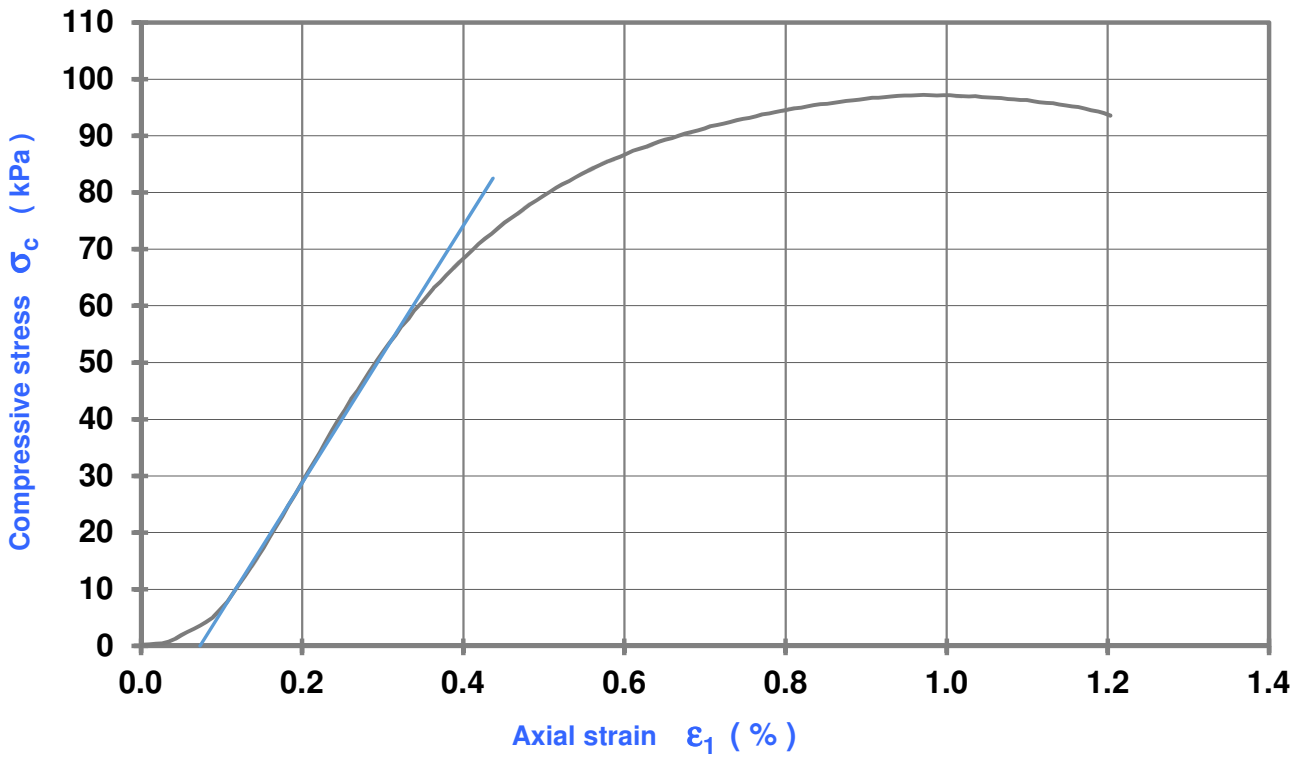
Water content	Auxiliary	Total
Total wet mass (g)		2346.12
Total dry mass (g)		936.71
Container nr		D-13
Container mass (g)		426.33
Water content (%)		**276.15**

TEST CONDITION

Compression rate	mm/min	0.183	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	97.2
Axial strain	ε_1	(%)	0.97
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.07
Axial strain (%)	0.90		0.22
E_u (MPa)	10.8		22.9



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-06 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-12
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**3**
PROJECT	: AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -15**

Initial characteristics

Diameter	D_O	mm	101.58
Length	L_O	mm	193.89
Cross-sectional area	A_0	cm^2	81.04
Total volume	V_T	cm^3	1571.22
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.909
Total wet mass	Mh	g	1898.89
Total dry mass	Ms	g	499.17
Water volume	V_w	cm^3	1403.93
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	182.39
Degree of saturation	S_R	(%)	101.1

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.9
Total dry	ρ_d		3.1

Water content

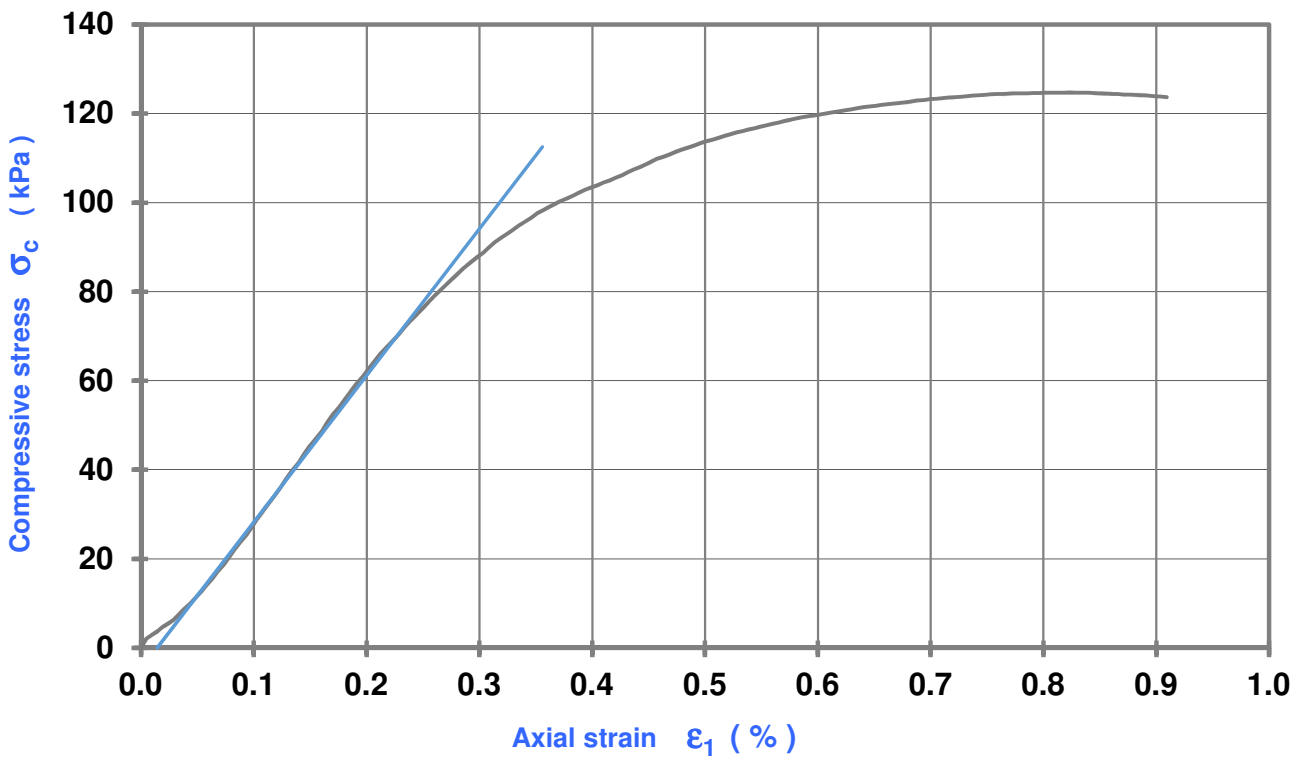
Water content	Auxiliary	Total
Total wet mass (g)		2276.98
Total dry mass (g)		877.26
Container nr		N-14
Container mass (g)		378.09
Water content (%)		**280.41**

TEST CONDITION

Compression rate	mm/min	0.150	%/min	0.08

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	124.7
Axial strain	ε_1	(%)	0.82
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.01
Axial strain (%)	0.81		0.19
E_u (MPa)	15.4		33.5



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-20 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2017-12-22
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**3**
PROJECT	: AMARUQ	**CURING TYPE :**	**FROZEN AT -18 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -06**

Initial characteristics

Diameter	D_O	mm	101.34
Length	L_O	mm	201.95
Cross-sectional area	A_0	cm^2	80.65
Total volume	V_T	cm^3	1628.70
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.993
Total wet mass	Mh	g	1860.48
Total dry mass	Ms	g	498.18
Water volume	V_w	cm^3	1366.40
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	182.03
Degree of saturation	S_R	(%)	94.5

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.2
Total dry	ρ_d		3.0

Water content

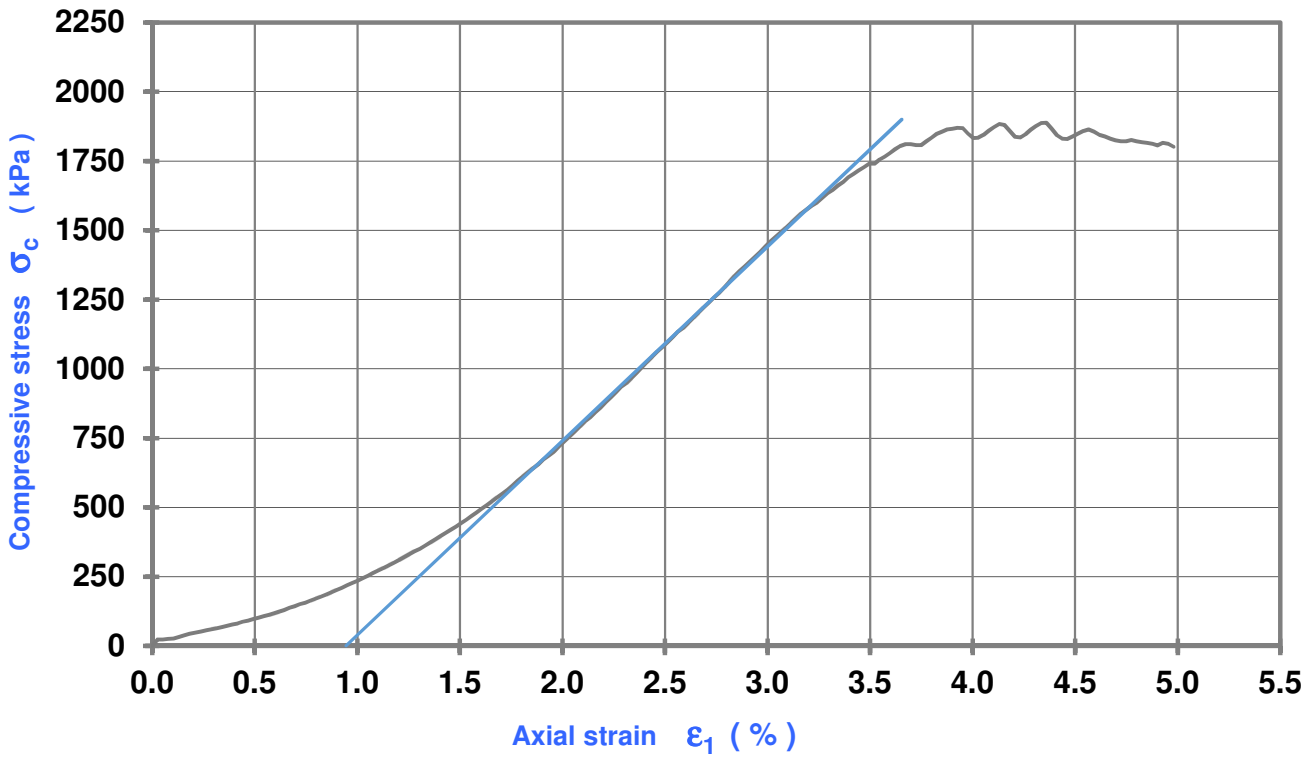
	Auxiliary	Total
Total wet mass (g)		2334.45
Total dry mass (g)		972.15
Container nr		HV-1
Container mass (g)		473.97
Water content (%)		**273.46**

TEST CONDITION

Compression rate	mm/min	0.750	%/min	0.37

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	1888.3
Axial strain	ε_1	(%)	4.36
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.94
Axial strain (%)	3.41		1.37
E_u (MPa)	55.3		69.4



Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-11-29 (7 days curing)**
The specimen expelled water during compression at the bottom only
Prepared by : Richard Courchesne (100736) Date: 2017-12-01
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**3**
PROJECT	: AMARUQ	**CURING TYPE :**	**FROZEN AT -18 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -12**

Initial characteristics

Diameter	D_O	mm	101.15
Length	L_O	mm	200.83
Cross-sectional area	A_0	cm^2	80.35
Total volume	V_T	cm^3	1613.67
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.985
Total wet mass	Mh	g	1842.88
Total dry mass	Ms	g	490.25
Water volume	V_w	cm^3	1356.70
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	179.13
Degree of saturation	S_R	(%)	94.6

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	11.2
Total dry	ρ_d		3.0

Water content

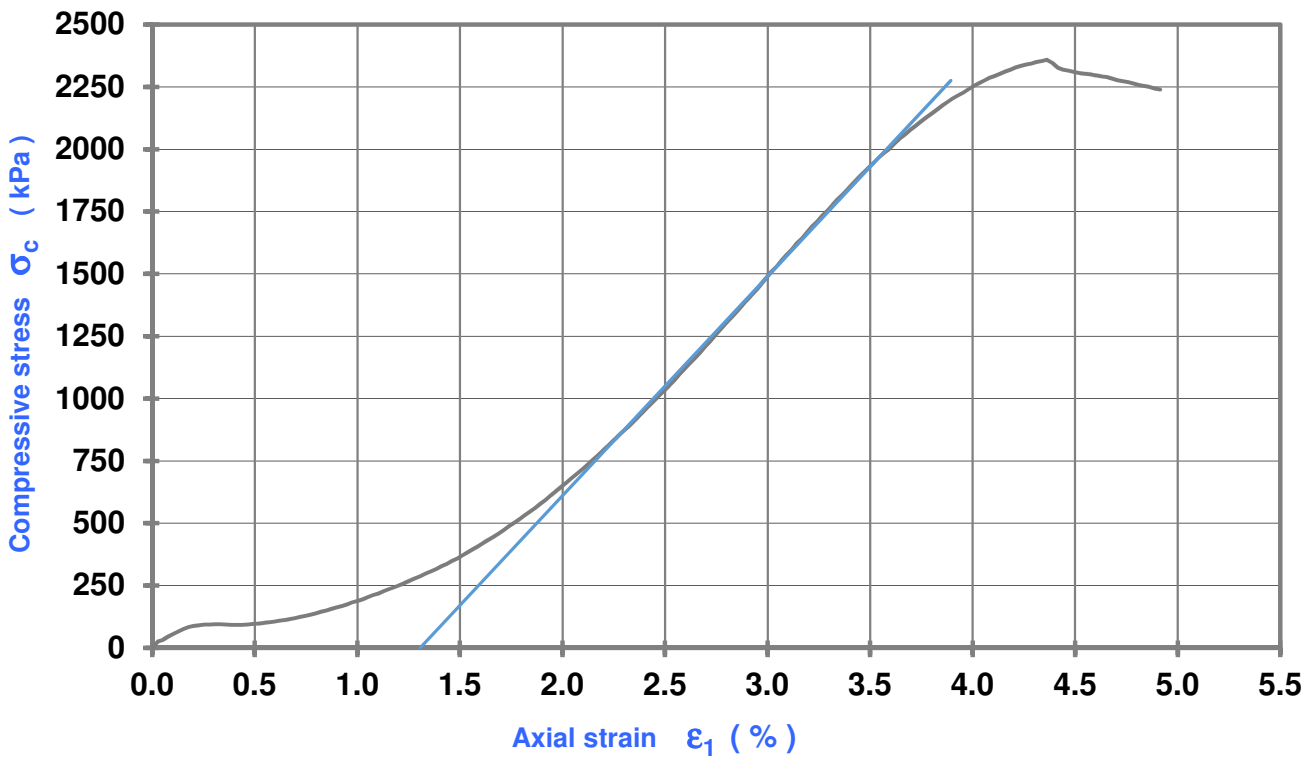
	Auxiliary	Total
Total wet mass (g)		2316.88
Total dry mass (g)		964.25
Container nr		HV-1
Container mass (g)		474.00
Water content (%)		**275.91**

TEST CONDITION

Compression rate	mm/min	0.750	%/min	0.37

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	2358.3
Axial strain	ε_1	(%)	4.36
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	1.31
Axial strain (%)	3.06		1.36
E_u (MPa)	77.2		86.9



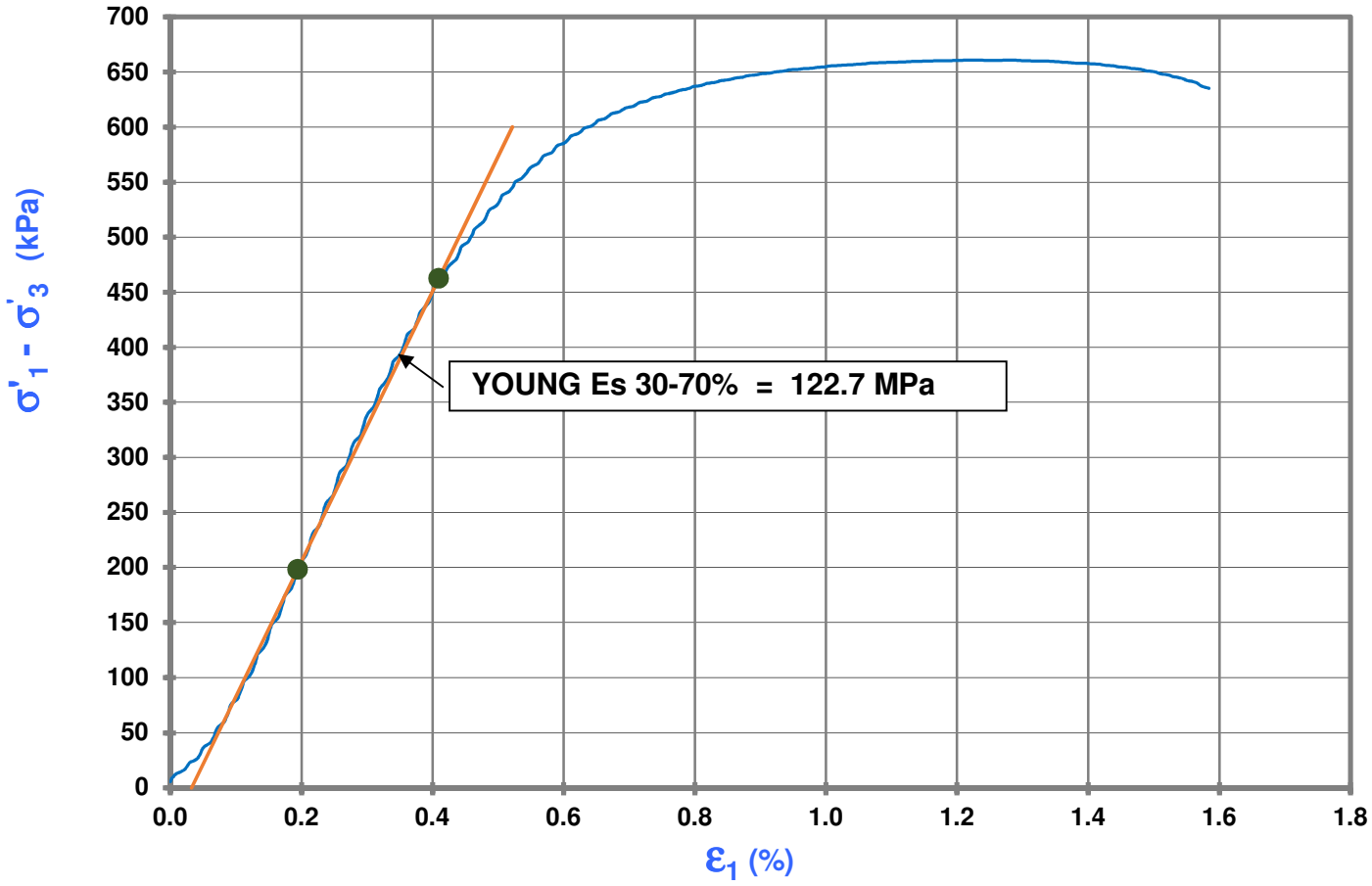
Remarks : **Date of batching : 2017-11-22** **Date of test : 2017-12-06 (14 days curing)**
The specimen expelled water during compression at the bottom only
Prepared by : Richard Courchesne (100736) Date: 2017-12-12
Verfied by : Yohan Jalbert, ing. Date:

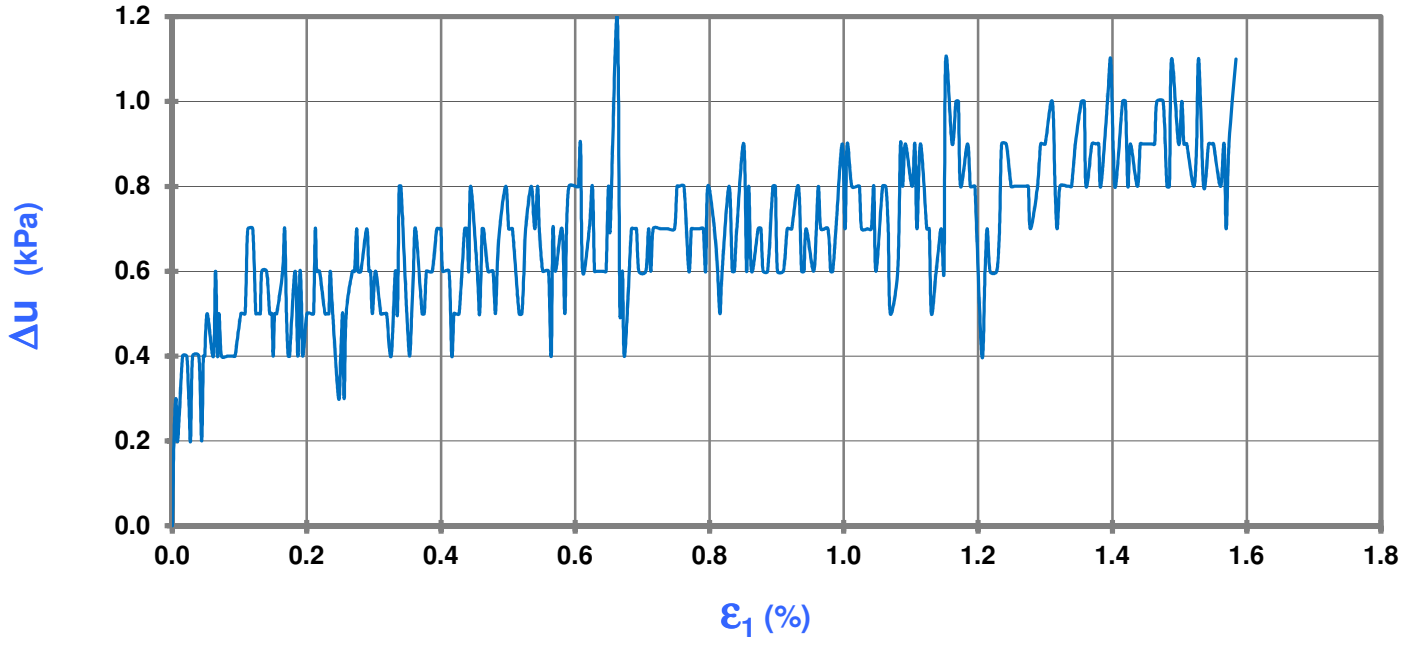
DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

UNCONSOLIDATED - UNDRAINED SHEAR

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 1
PROJECT	: AMARUQ	**CURING TYPE**	: UNDER WATER AT 20 ℃
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr**	: UU - 01





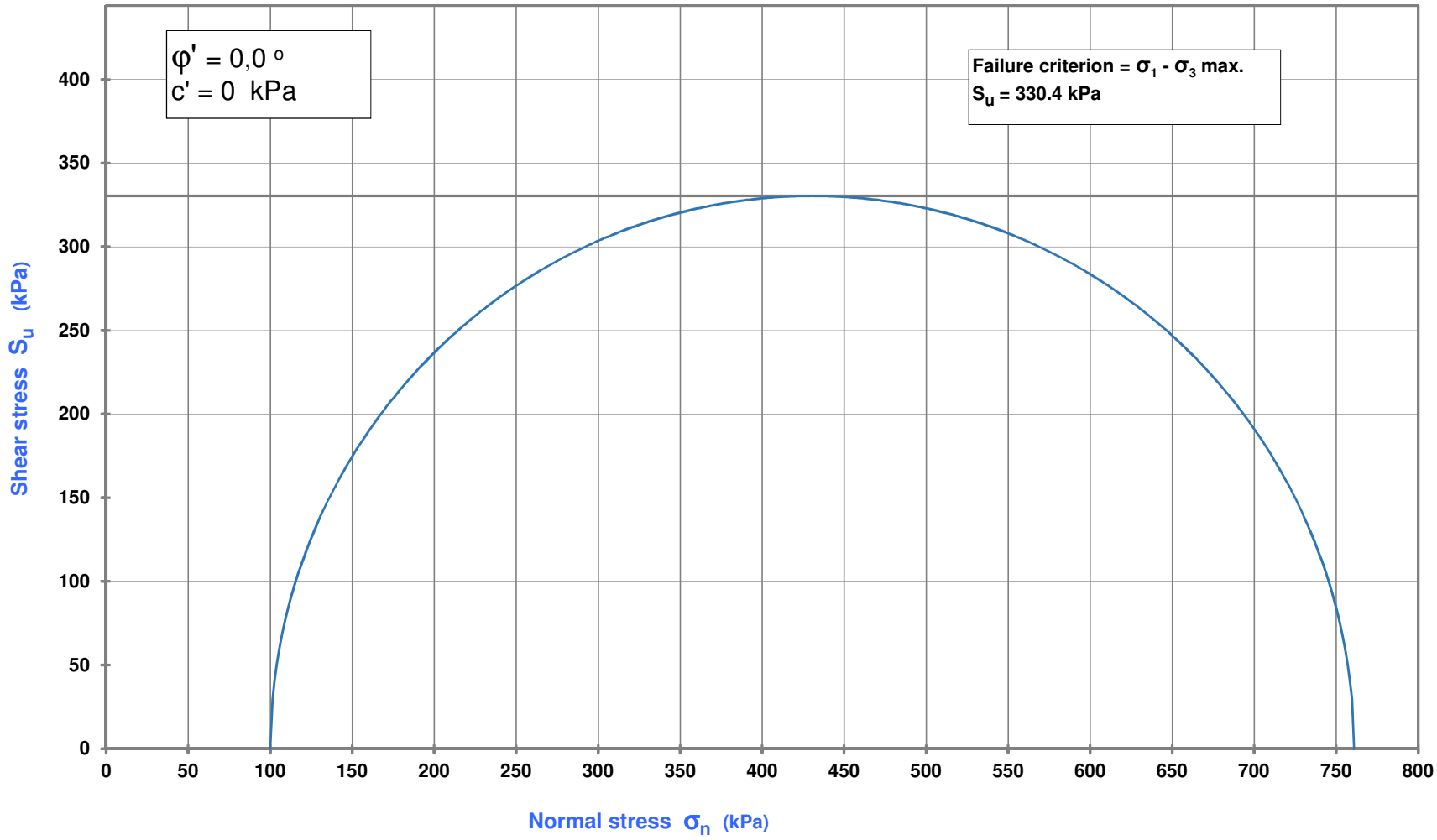
SNC·LAVALIN

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST UU + u

SYNTHESIS - PRESENTATION OF MOHR-COULOMB'S IN TOTAL STRESS

CLIENT : SNC-Lavalin inc.
PROJECT : AMARUQ
LOCATION : NUNAVUT
FILE : 651298

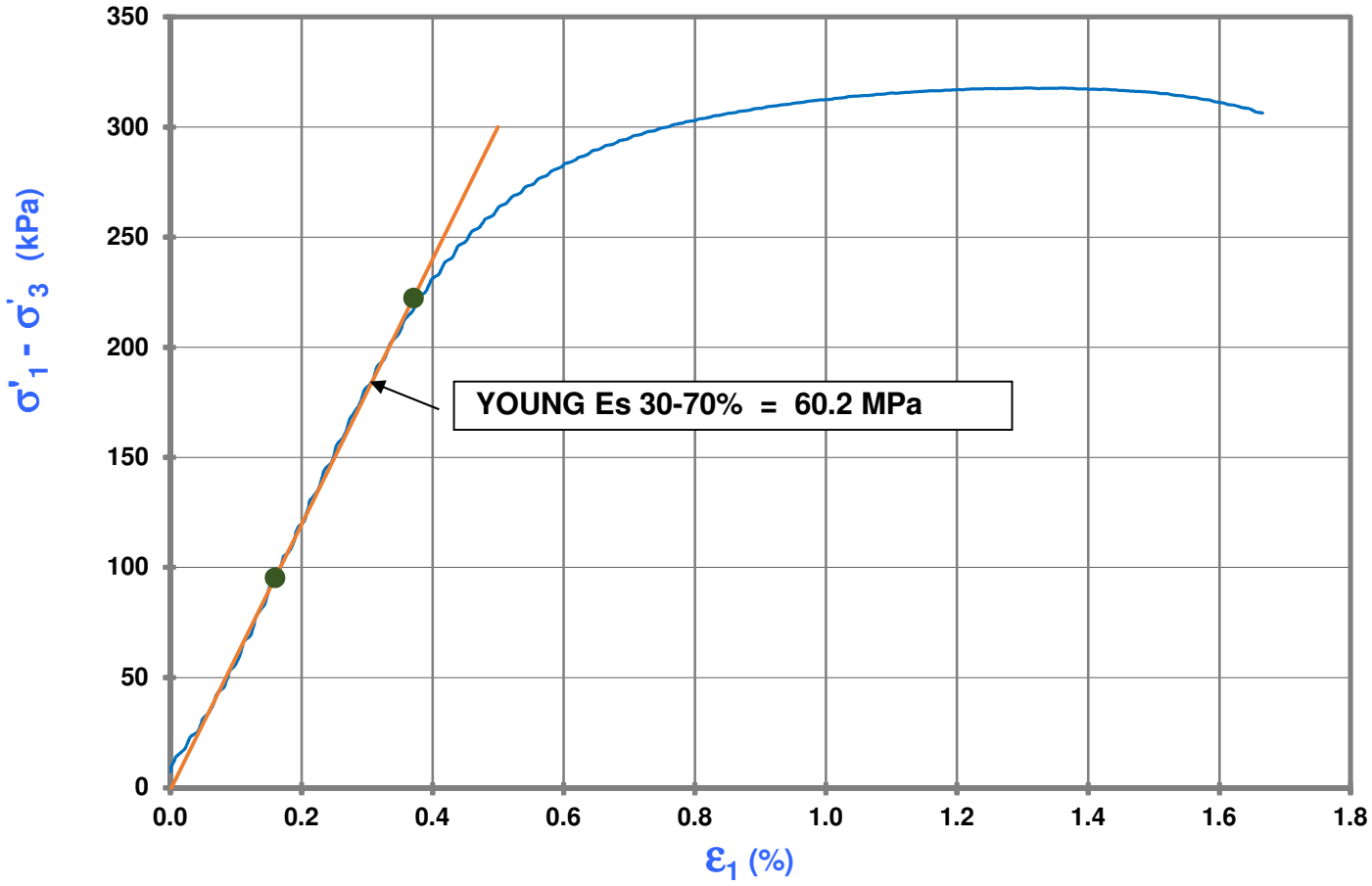
MIX DESIGN # : 1
CURING TYPE : UNDER WATER AT 20 °C
TEST NR : UU - 01

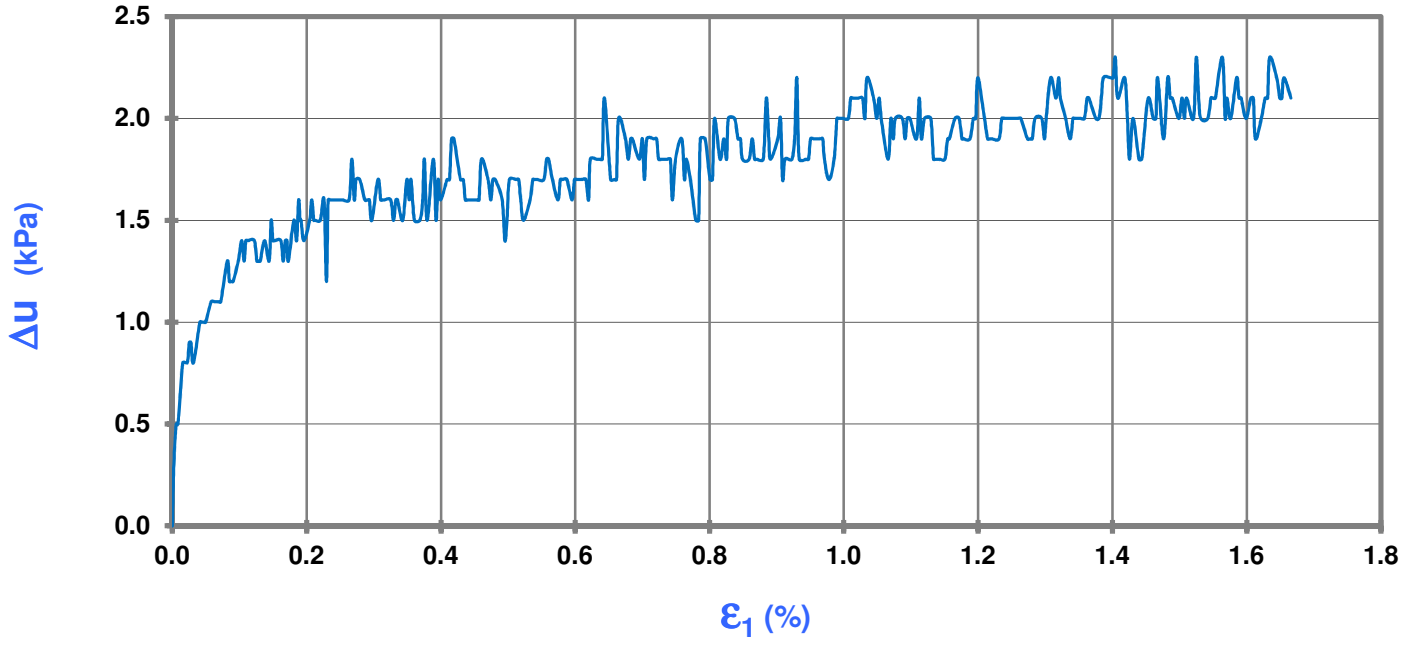


SNC·LAVALIN

UNCONSOLIDATED - UNDRAINED SHEAR

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 2
PROJECT	: AMARUQ	**CURING TYPE**	: UNDER WATER AT 20 ℃
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr**	: UU - 02





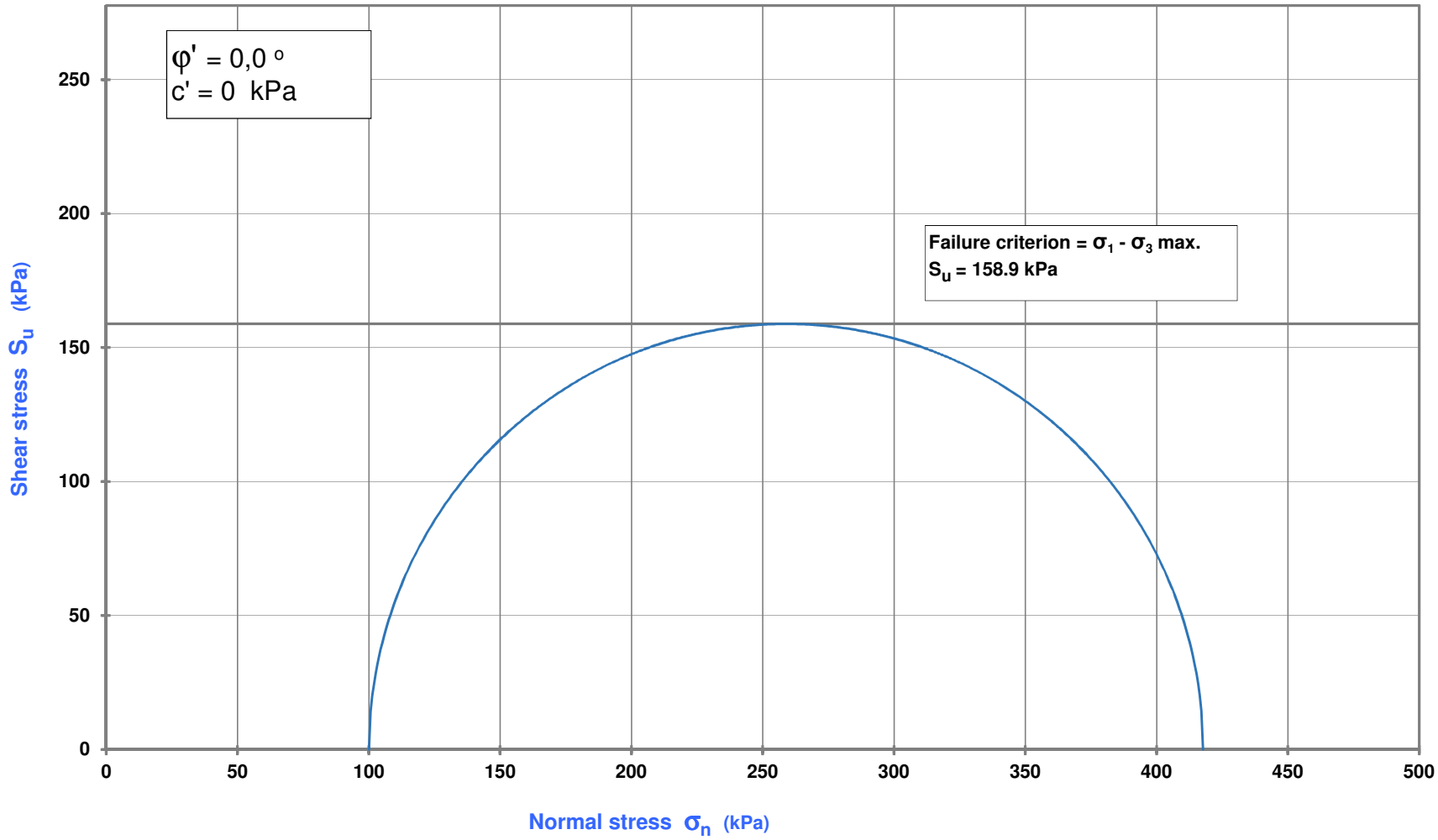
SNC·LAVALIN

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST UU + u

SYNTHESIS - PRESENTATION OF MOHR-COULOMB'S IN TOTAL STRESS

CLIENT : SNC-Lavalin inc.
PROJECT : AMARUQ
LOCATION : NUNAVUT
FILE : 651298

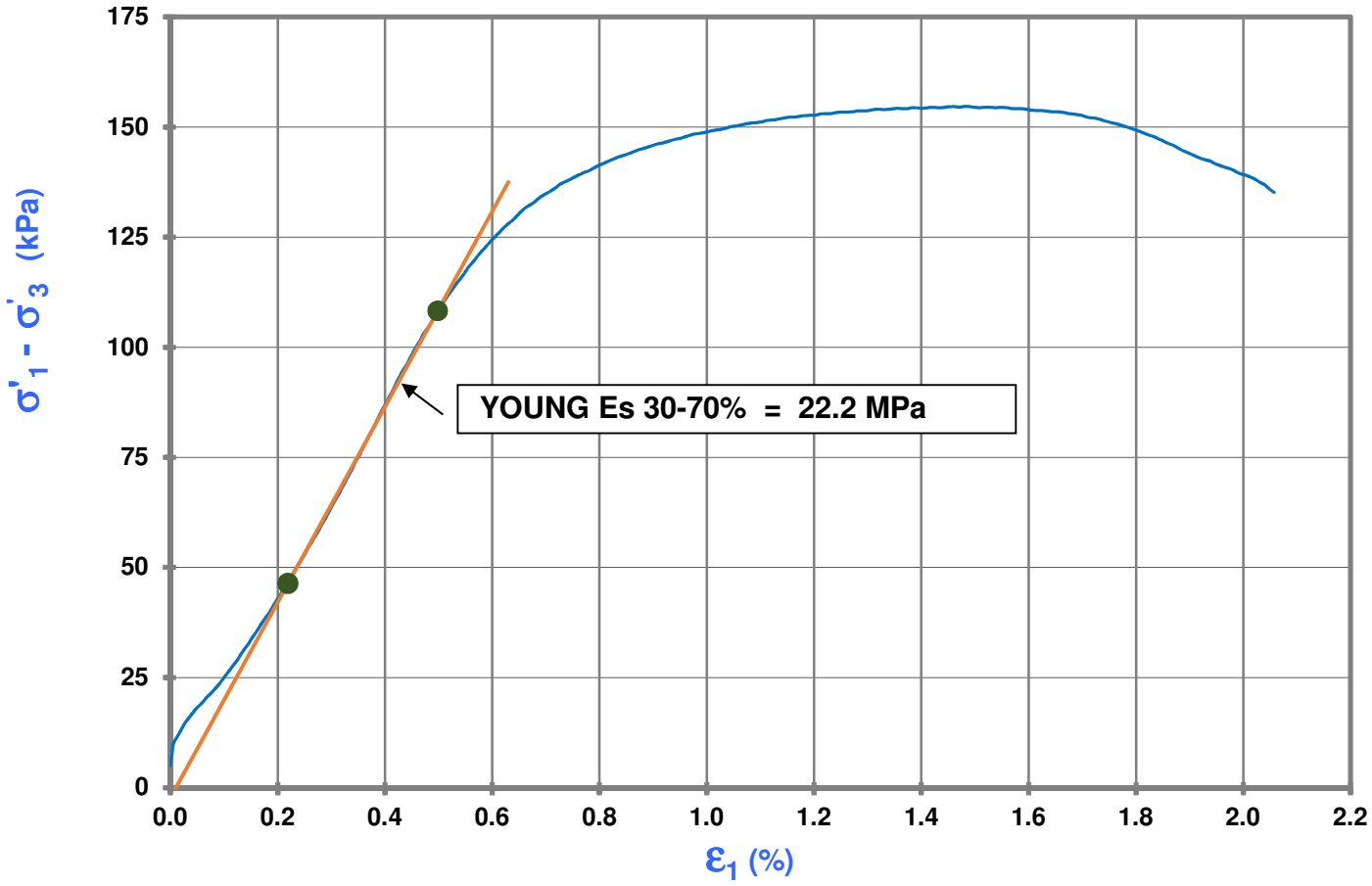
MIX DESIGN # : 2
CURING TYPE : UNDER WATER AT 20 °C
TEST NR : UU - 02

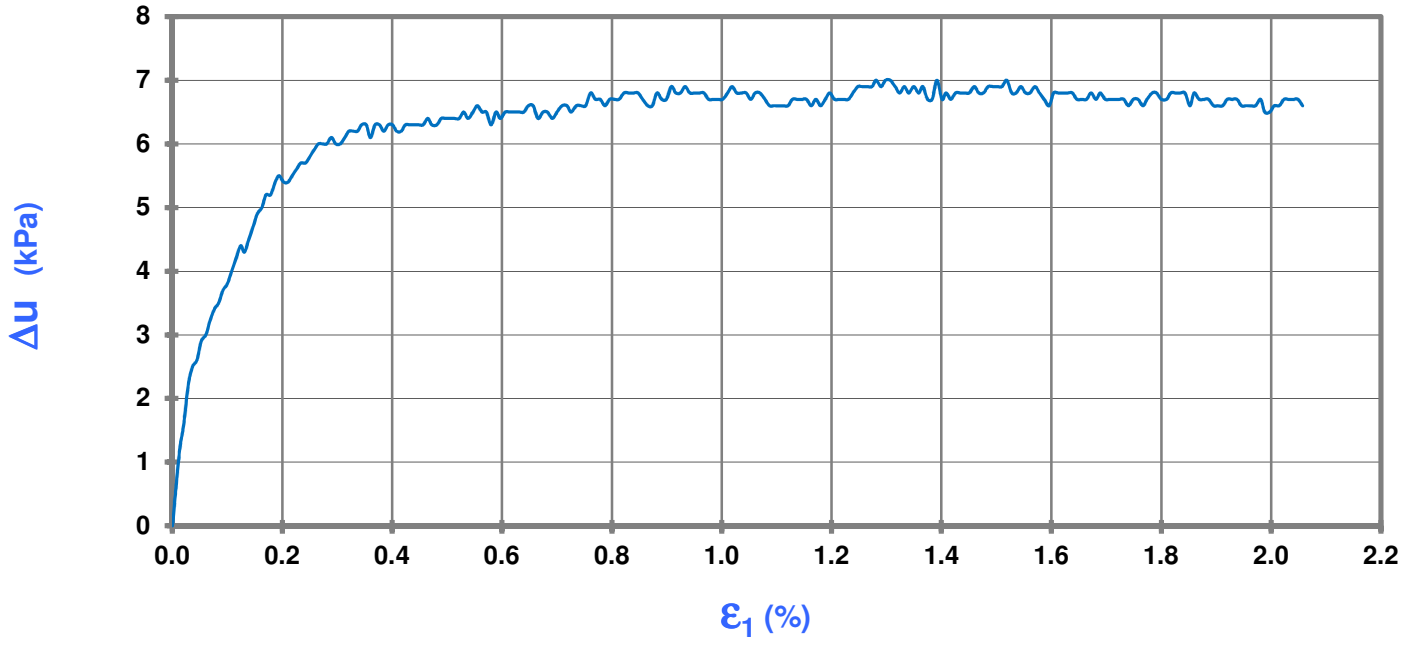


SNC·LAVALIN

UNCONSOLIDATED - UNDRAINED SHEAR

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 3
PROJECT	: AMARUQ	**CURING TYPE**	: UNDER WATER AT 20 ℃
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr**	: UU - 03





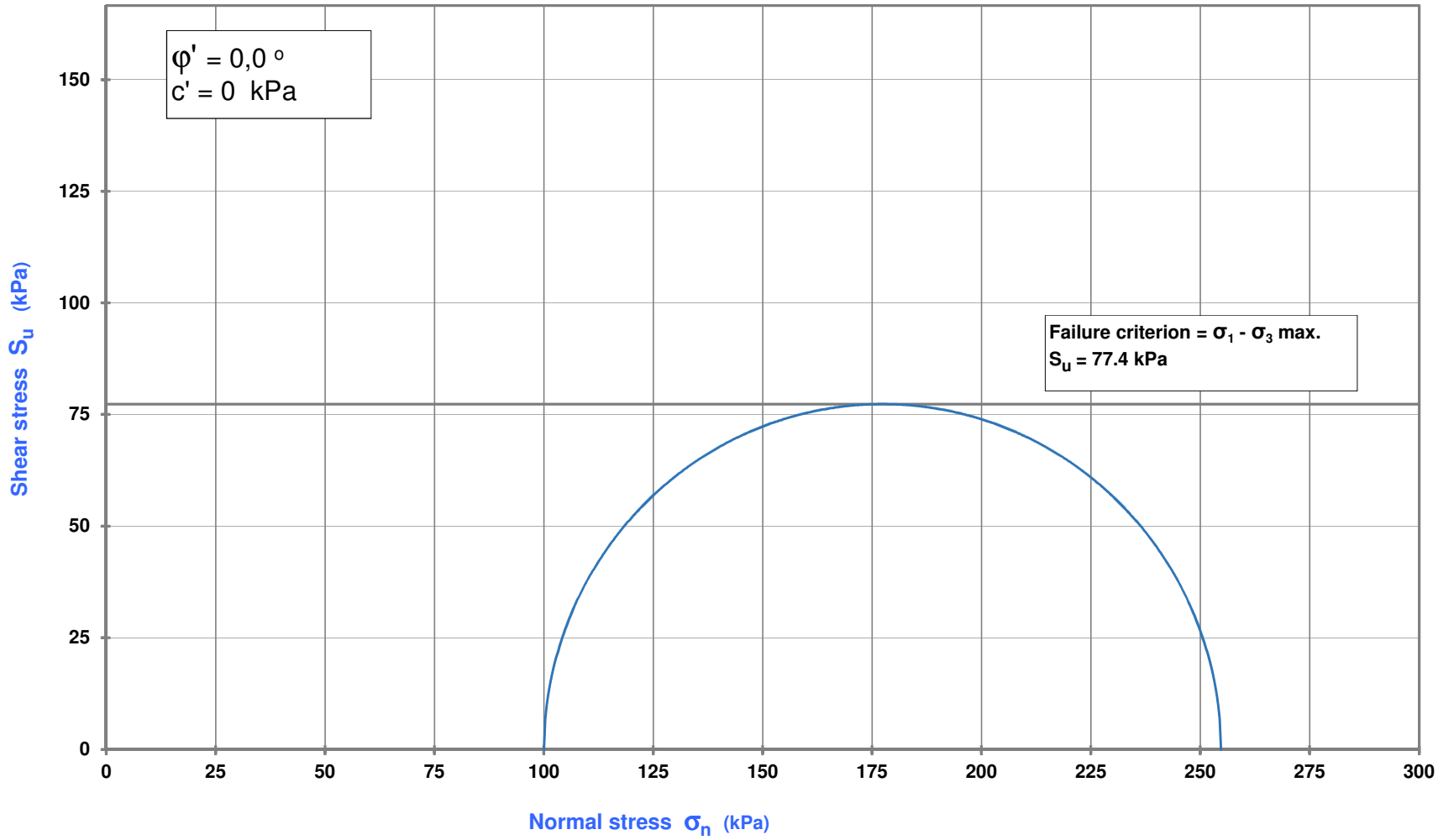
SNC·LAVALIN

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST UU + u

SYNTHESIS - PRESENTATION OF MOHR-COULOMB'S IN TOTAL STRESS

CLIENT : SNC-Lavalin inc.
PROJECT : AMARUQ
LOCATION : NUNAVUT
FILE : 651298

MIX DESIGN # : 3
CURING TYPE : UNDER WATER AT 20 °C
TEST NR : UU - 03



SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 1
PROJECT	: AMARUQ	**CURING TYPE**	: UNDER WATER AT 20 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 01

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	101.66	mm
Length	Le	194.34	mm
Cross-sectional area	Ae	81.17	cm^2
Total volume	Ve	1577.4	cm^3
Ratio L / D	Le / De	1.912	(1/1)
Total wet mass	Mh	2042.53	g
Total dry mass	Ms	734.24	g
Water volume	Vw	1312.2	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	268.3	cm^3
Degree of saturation	S	100.2	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	194.34	mm
Diameter	Do	101.66	mm
Measured Ovality			%

Cell nr : GE-208

Rate of axial strain :

WATER CONTENT

	AUXILIARY	TOTAL
Mass tare + moist specimen		2420.33
Mass tare + dry specimen		1112.52
Tare no.		22
Mass of tare		378.28
Water content (%)		178.12

MEMBRANE OF LATEX

Dm : 0.30 mm

Cm : 310.00 mm

Lm : 197.55 mm

Correction.: N

E : Homogeneous elastic

H : Horizontals creasings

V : Verticals creasings

P : Plane of failure

N : No correction

CONDITIONS OF DRAINAGE

Loading: N

Dissipation: N

Shearing: N

H : Top

B : Base

R : Radial

N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane

σ_r : radial correction of membrane

σ_α : correction for plan of failure

k : 1.04E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	Trimming	Initial		Dissipation	Saturation	
			Line		1		36	25	
Volume of specimen	Vx	(cm^3)		1577.4	1577.4		1568.0	1573.5	
Volume of water	Vw	(cm^3)		1312.2	1312.2		1312.3	1316.8	
Volume of voids	Vv	(cm^3)		1309.2	1309.2		1299.7	1305.2	
Water content	W	(%)		178.18	178.18		178.20	178.81	
Dry mass density	ρ_s	(kg/m^3)		465	465		468	467	
Void ratio	e	(1/1)		4.880	4.880		4.844	4.865	
Porosity	n	(1/1)		0.830	0.830		0.829	0.829	
Degree of saturation	S	(%)		100.2	100.2		101.0	100.9	
Units strains	ε_v	(%)		0.00	0.00		0.60	0.25	
since the trimming	ε_1	(%)		0.00	0.00		0.18	0.07	
Effective stresses	σ'_3	(kPa)			5		80	5	
	σ'_1	(kPa)			10		85	10	
Pore pressure parameter	B	(1/1)						0.940	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	36
KC	Permeability constant head - method A	37	46

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST

2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2017-11-22 Date of test : 2017-12-19 (27 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-01-11

Verified by: Yohan Jalbert, ing. Date:

SNC•LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 2
PROJECT	: AMARUQ	**CURING TYPE**	: UNDER WATER AT 20 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 02

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	101.60	mm
Length	Le	191.90	mm
Cross-sectional area	Ae	81.07	cm^2
Total volume	Ve	1555.8	cm^3
Ratio L / D	Le / De	1.889	(1/1)
Total wet mass	Mh	1953.40	g
Total dry mass	Ms	615.38	g
Water volume	Vw	1342.0	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	224.9	cm^3
Degree of saturation	S	100.8	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	191.90	mm
Diameter	Do	101.60	mm
Measured Ovality			%

Cell nr : GE-002

Rate of axial strain :

WATER CONTENT

Mass tare + moist specimen		2338.38
Mass tare + dry specimen		1001.58
Tare no.		N-71
Mass of tare		386.20
Water content (%)		217.23

MEMBRANE OF LATEX

Dm : 0.30 mm

Cm : 310.00 mm

Lm : 195.01 mm

Correction.: N

E : Homogeneous elastic

H : Horizontals creasings

V : Verticals creasings

P : Plane of failure

N : No correction

CONDITIONS OF DRAINAGE

Loading: N

Dissipation: N

Shearing: N

H : Top

B : Base

R : Radial

N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane

σ_r : radial correction of membrane

σ_α : correction for plan of failure

k : 2.55E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	Trimming	Initial		Dissipation	Saturation	
			Line		1		36	25	
Volume of specimen	Vx	(cm^3)		1555.8	1555.8		1542.7	1549.6	
Volume of water	Vw	(cm^3)		1342.0	1342.0		1339.5	1345.9	
Volume of voids	Vv	(cm^3)		1330.9	1330.9		1317.9	1324.7	
Water content	W	(%)		217.43	217.43		217.02	218.06	
Dry mass density	ρ_s	(kg/m^3)		396	396		399	397	
Void ratio	e	(1/1)		5.919	5.919		5.861	5.891	
Porosity	n	(1/1)		0.855	0.855		0.854	0.855	
Degree of saturation	S	(%)		100.8	100.8		101.6	101.6	
Units strains	ε_v	(%)		0.00	0.00		0.84	0.40	
since the trimming	ε_1	(%)		0.00	0.00		0.23	0.07	
Effective stresses	σ'_3	(kPa)			5		80	5	
	σ'_1	(kPa)			10		85	10	
Pore pressure parameter	B	(1/1)						0.980	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	36
KC	Permeability constant head - method A	37	46

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST

2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2017-11-22 Date of test : 2017-12-19 (27 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-01-11

Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 3
PROJECT	: AMARUQ	**CURING TYPE**	: UNDER WATER AT 20 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 03

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	101.78	mm
Length	Le	193.64	mm
Cross-sectional area	Ae	81.36	cm^2
Total volume	Ve	1575.5	cm^3
Ratio L / D	Le / De	1.903	(1/1)
Total wet mass	Mh	1898.25	g
Total dry mass	Ms	501.46	g
Water volume	Vw	1401.0	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	183.2	cm^3
Degree of saturation	S	100.6	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	193.64	mm
Diameter	Do	101.78	mm
Measured Ovality			%

Cell nr : GE-002

Rate of axial strain :

WATER CONTENT

	AUXILIARY	TOTAL
Mass tare + moist specimen		2322.07
Mass tare + dry specimen		928.59
Tare no.		N-20
Mass of tare		427.13
Water content (%)		277.88

MEMBRANE OF LATEX

Dm : 0.30 mm

Cm : 310.00 mm

Lm : 196.95 mm

Correction.: N

E : Homogeneous elastic

H : Horizontals creasings

V : Verticals creasings

P : Plane of failure

N : No correction

CONDITIONS OF DRAINAGE

Loading: N

Dissipation: N

Shearing: N

H : Top

B : Base

R : Radial

N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane

σ_r : radial correction of membrane

σ_α : correction for plan of failure

k : 5.22E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	**Trimming**	**Initial**		**Dissipation**	**Saturation**	
			Line		1		36	25	
Volume of specimen	Vx	(cm^3)		1575.5	1575.5		1559.2	1570.8	
Volume of water	Vw	(cm^3)		1401.0	1401.0		1396.6	1406.5	
Volume of voids	Vv	(cm^3)		1392.2	1392.2		1375.9	1387.5	
Water content	W	(%)		278.54	278.54		277.67	279.64	
Dry mass density	ρ_s	(kg/m^3)		318	318		322	319	
Void ratio	e	(1/1)		7.598	7.598		7.509	7.573	
Porosity	n	(1/1)		0.884	0.884		0.882	0.883	
Degree of saturation	S	(%)		100.6	100.6		101.5	101.4	
Units strains	ε_v	(%)		0.00	0.00		1.04	0.30	
since the trimming	ε_1	(%)		0.00	0.00		0.28	0.03	
Effective stresses	σ'_3	(kPa)			5		80	5	
	σ'_1	(kPa)			10		85	10	
Pore pressure parameter	B	(1/1)						0.972	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	36
KC	Permeability constant head - method A	37	43

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST

2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2017-11-22 Date of test : 2017-12-20 (28 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-01-11

Verified by: Yohan Jalbert, ing. Date:

Appendix 2
Phase II Laboratory Test Results

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -04**

Initial characteristics

Diameter	D_O	mm	49.93
Length	L_O	mm	86.78
Cross-sectional area	A_0	cm^2	19.58
Total volume	V_T	cm^3	169.92
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.738
Total wet mass	Mh	g	216.88
Total dry mass	Ms	g	76.89
Water volume	V_w	cm^3	140.41
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.10
Degree of saturation	S_R	(%)	99.0

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

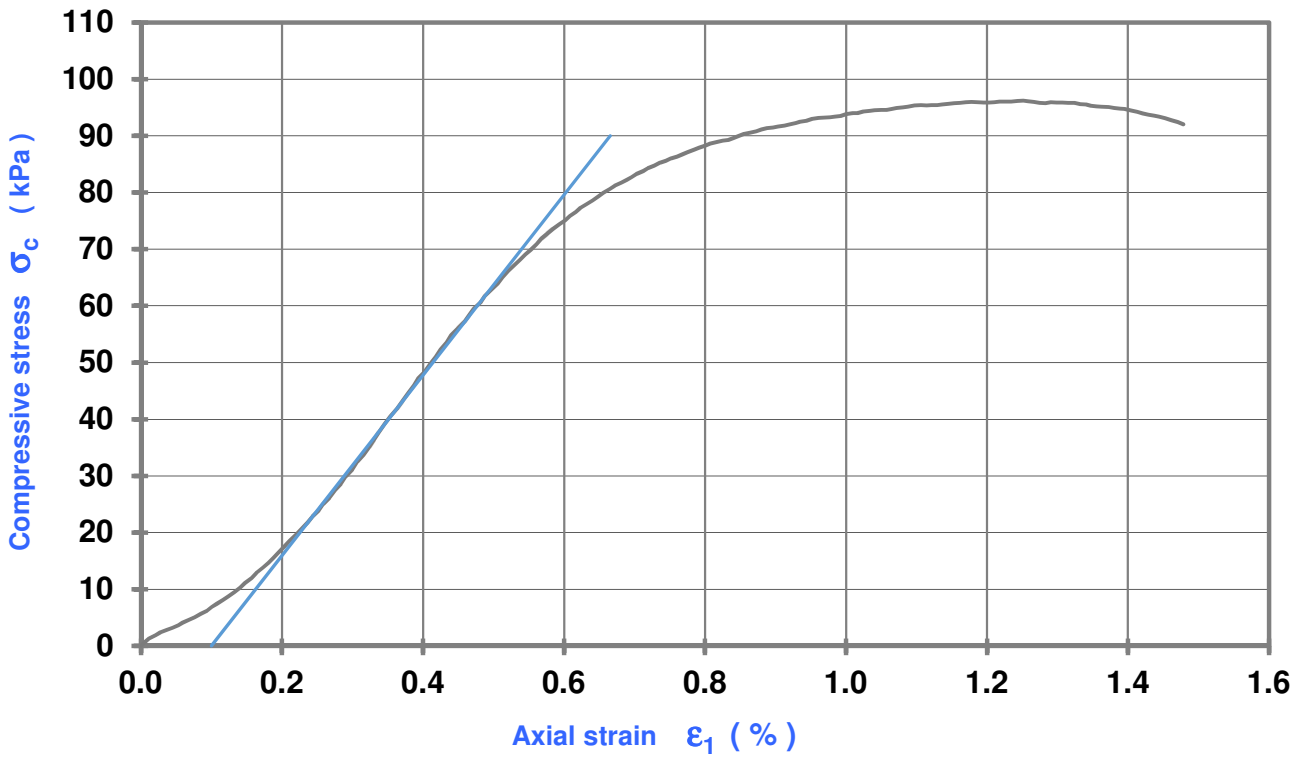
	Auxiliary	Total
Total wet mass (g)		230.23
Total dry mass (g)		90.24
Container nr		1
Container mass (g)		13.35
Water content (%)		**182.07**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	96.2
Axial strain	ε_1	(%)	1.25
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.10
Axial strain (%)	1.15		0.30
E_u (MPa)	8.4		16.0



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-19 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-21
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -05**

Initial characteristics

Diameter	D_O	mm	49.98
Length	L_O	mm	90.35
Cross-sectional area	A_0	cm^2	19.62
Total volume	V_T	cm^3	177.24
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.808
Total wet mass	Mh	g	226.01
Total dry mass	Ms	g	80.72
Water volume	V_w	cm^3	145.73
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.49
Degree of saturation	S_R	(%)	98.6

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.5

Water content

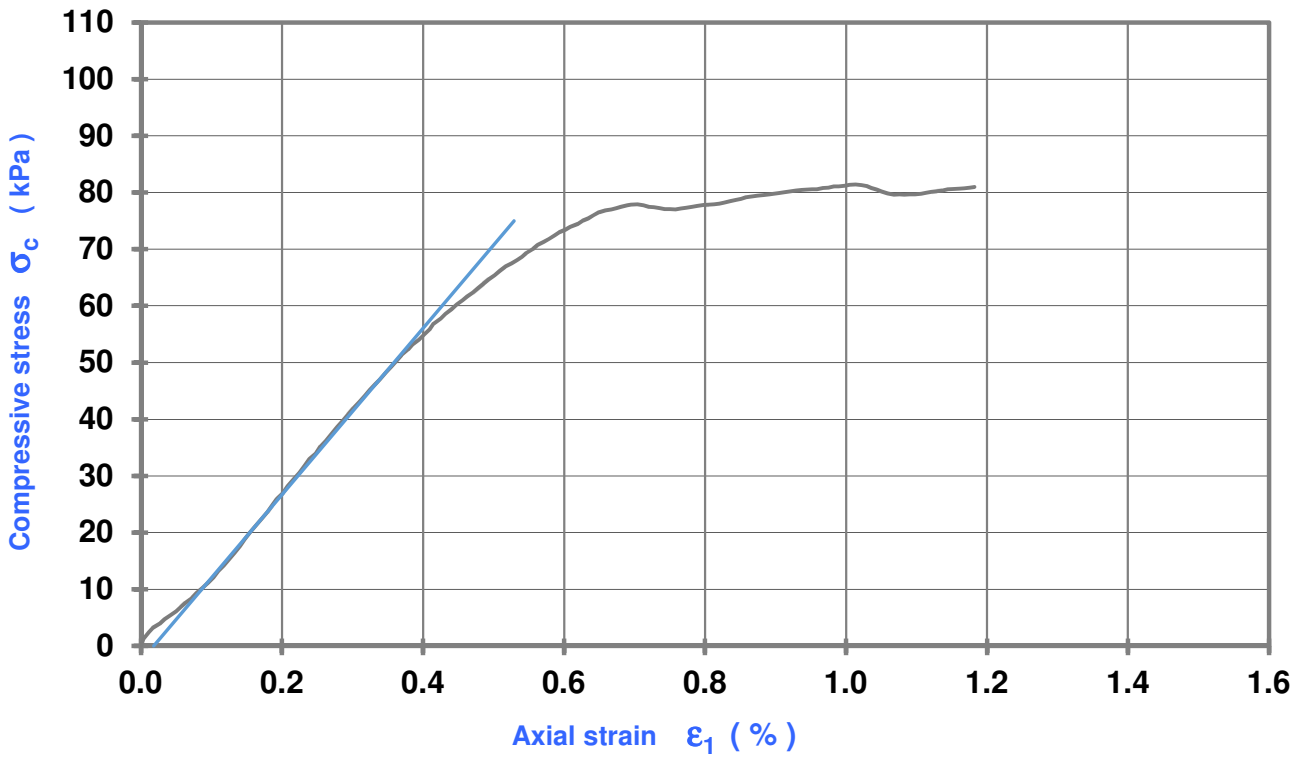
	Auxiliary	Total
Total wet mass (g)		239.45
Total dry mass (g)		94.16
Container nr		49
Container mass (g)		13.44
Water content (%)		**179.99**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	81.4
Axial strain	ε_1	(%)	1.01
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.02
Axial strain (%)	1.00		0.28
E_u (MPa)	8.2		14.9



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-19 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-21
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -06**

Initial characteristics

Diameter	D_O	mm	50.19
Length	L_O	mm	90.40
Cross-sectional area	A_0	cm^2	19.78
Total volume	V_T	cm^3	178.83
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.801
Total wet mass	Mh	g	228.94
Total dry mass	Ms	g	81.18
Water volume	V_w	cm^3	148.20
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.66
Degree of saturation	S_R	(%)	99.4

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.6
Total dry	ρ_d		4.5

Water content

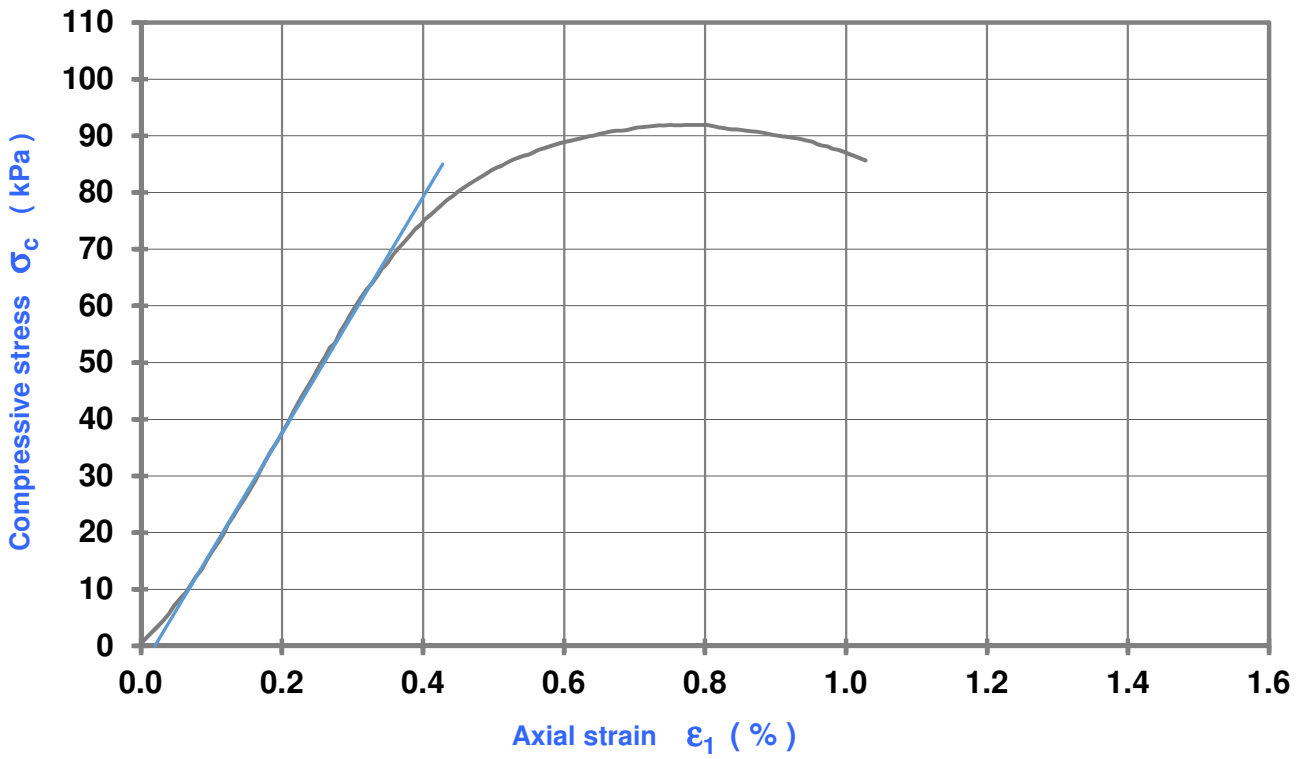
	Auxiliary	Total
Total wet mass (g)		242.45
Total dry mass (g)		94.69
Container nr		48
Container mass (g)		13.51
Water content (%)		**182.02**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	91.9
Axial strain	ε_1	(%)	0.77
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.02
Axial strain (%)	0.75		0.23
E_u (MPa)	12.2		20.0



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-19 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-21
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -01**

Initial characteristics

Diameter	D_O	mm	50.27
Length	L_O	mm	92.07
Cross-sectional area	A_0	cm^2	19.85
Total volume	V_T	cm^3	182.76
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.831
Total wet mass	Mh	g	231.76
Total dry mass	Ms	g	80.71
Water volume	V_w	cm^3	151.50
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.49
Degree of saturation	S_R	(%)	98.8

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.4
Total dry	ρ_d		4.3

Water content

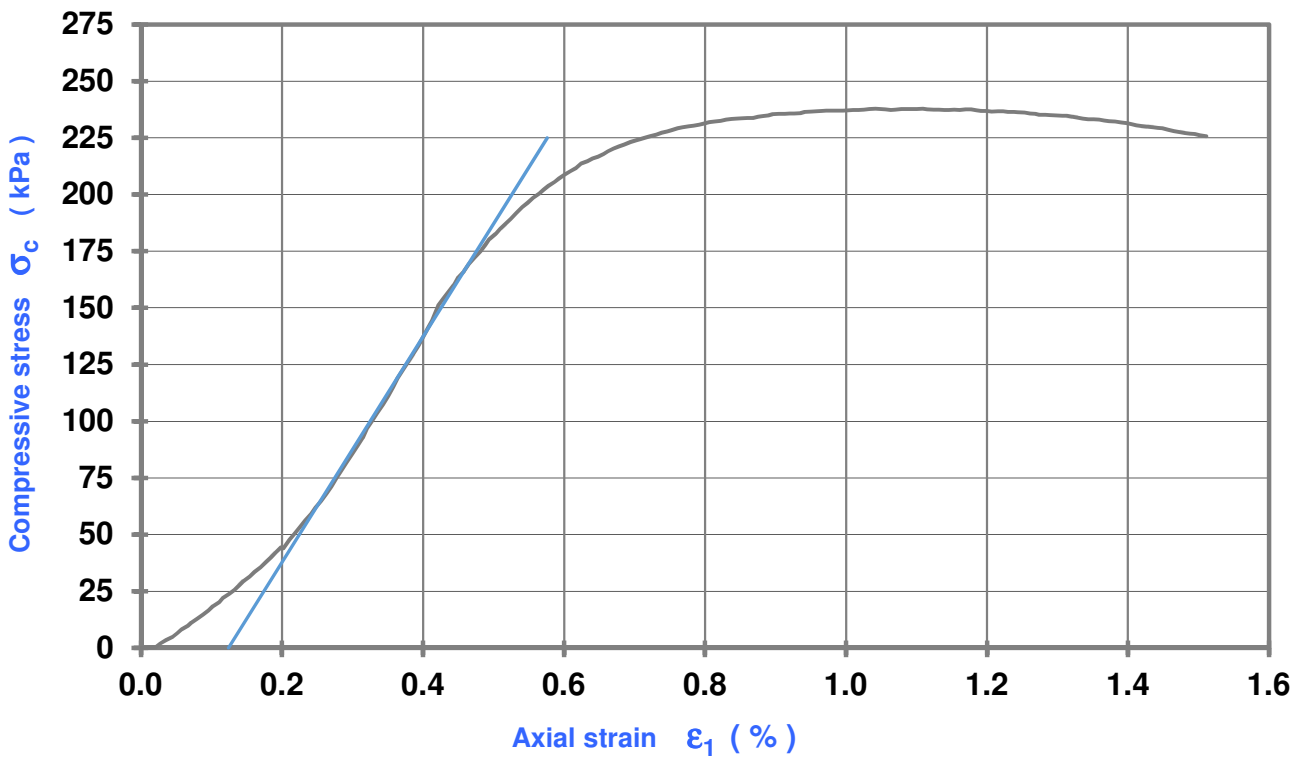
	Auxiliary	Total
Total wet mass (g)		247.25
Total dry mass (g)		96.20
Container nr		97
Container mass (g)		15.49
Water content (%)		**187.15**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	237.7
Axial strain	ε_1	(%)	1.04
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.12
Axial strain (%)	0.92		0.24
E_u (MPa)	25.9		49.6



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-19 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-21
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -02**

Initial characteristics

Diameter	D_O	mm	50.30
Length	L_O	mm	89.29
Cross-sectional area	A_0	cm^2	19.87
Total volume	V_T	cm^3	177.43
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.775
Total wet mass	Mh	g	225.27
Total dry mass	Ms	g	78.36
Water volume	V_w	cm^3	147.35
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.63
Degree of saturation	S_R	(%)	99.0

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.3

Water content

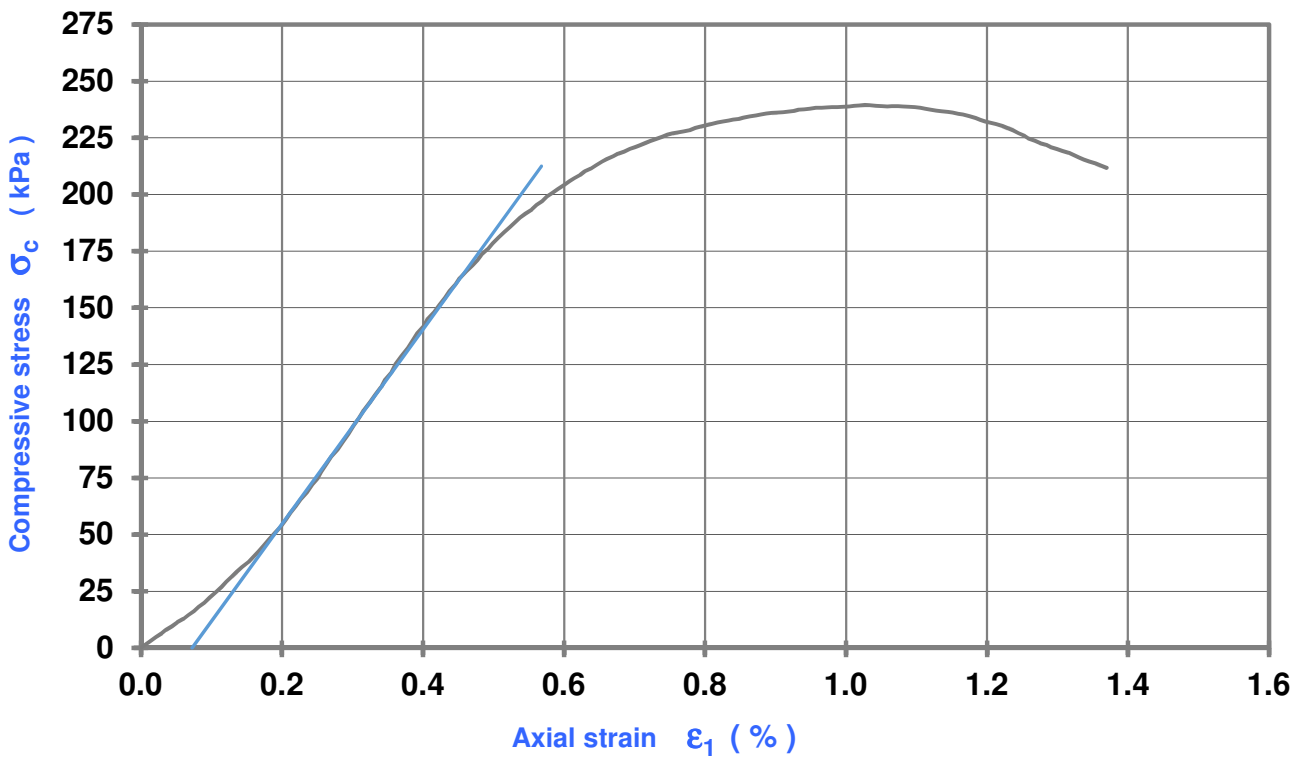
	Auxiliary	Total
Total wet mass (g)		240.87
Total dry mass (g)		93.96
Container nr		84
Container mass (g)		15.60
Water content (%)		**187.48**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	239.5
Axial strain	ε_1	(%)	1.03
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.07
Axial strain (%)	0.96		0.28
E_u (MPa)	25.1		43.0



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-19 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-21
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -03**

Initial characteristics

Diameter	D_O	mm	50.20
Length	L_O	mm	90.23
Cross-sectional area	A_0	cm^2	19.79
Total volume	V_T	cm^3	178.59
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.797
Total wet mass	Mh	g	227.19
Total dry mass	Ms	g	79.45
Water volume	V_w	cm^3	148.18
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.03
Degree of saturation	S_R	(%)	99.1

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

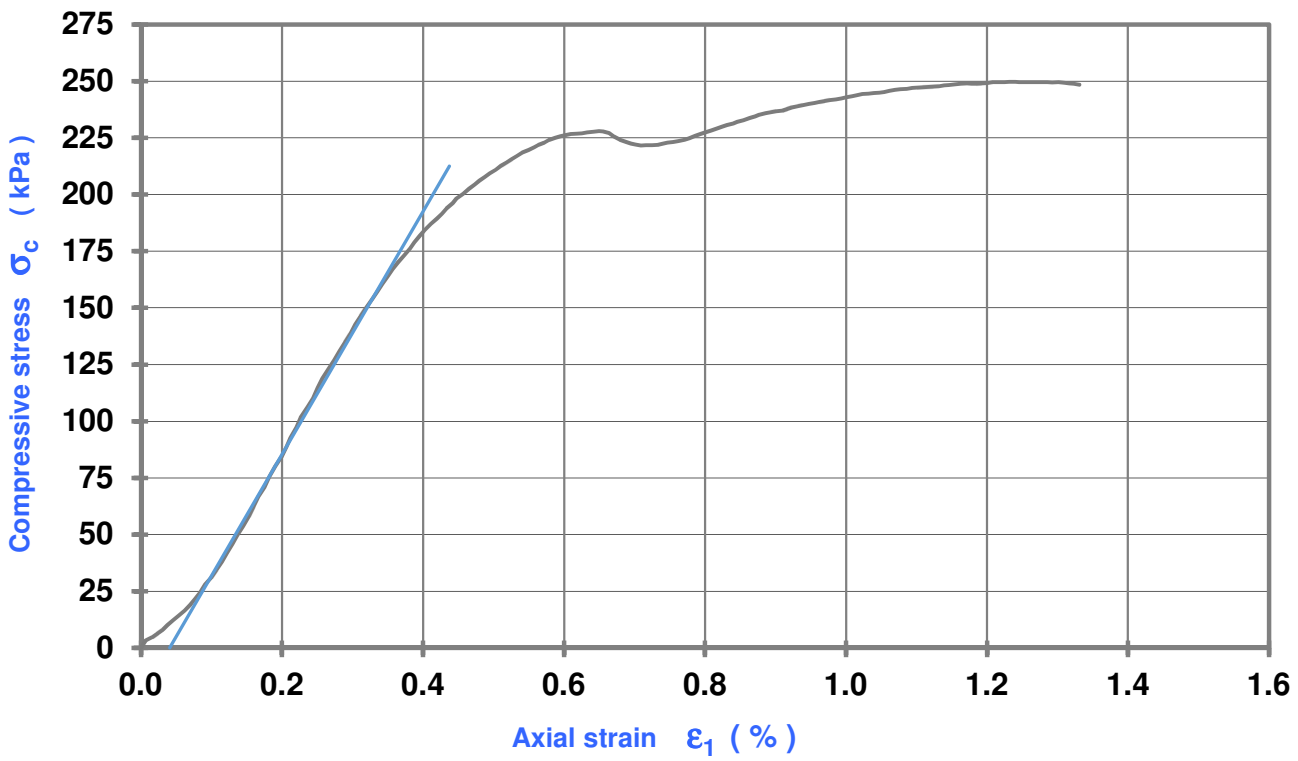
	Auxiliary	Total
Total wet mass (g)		240.81
Total dry mass (g)		93.07
Container nr		20
Container mass (g)		13.62
Water content (%)		**185.95**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	249.8
Axial strain	ε_1	(%)	1.24
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.04
Axial strain (%)	1.20		0.23
E_u (MPa)	20.8		54.4



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-19 (7 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-21
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -09**

Initial characteristics

Diameter	D_O	mm	50.12
Length	L_O	mm	88.22
Cross-sectional area	A_0	cm^2	19.73
Total volume	V_T	cm^3	174.04
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.760
Total wet mass	Mh	g	221.94
Total dry mass	Ms	g	78.44
Water volume	V_w	cm^3	143.93
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.66
Degree of saturation	S_R	(%)	99.0

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

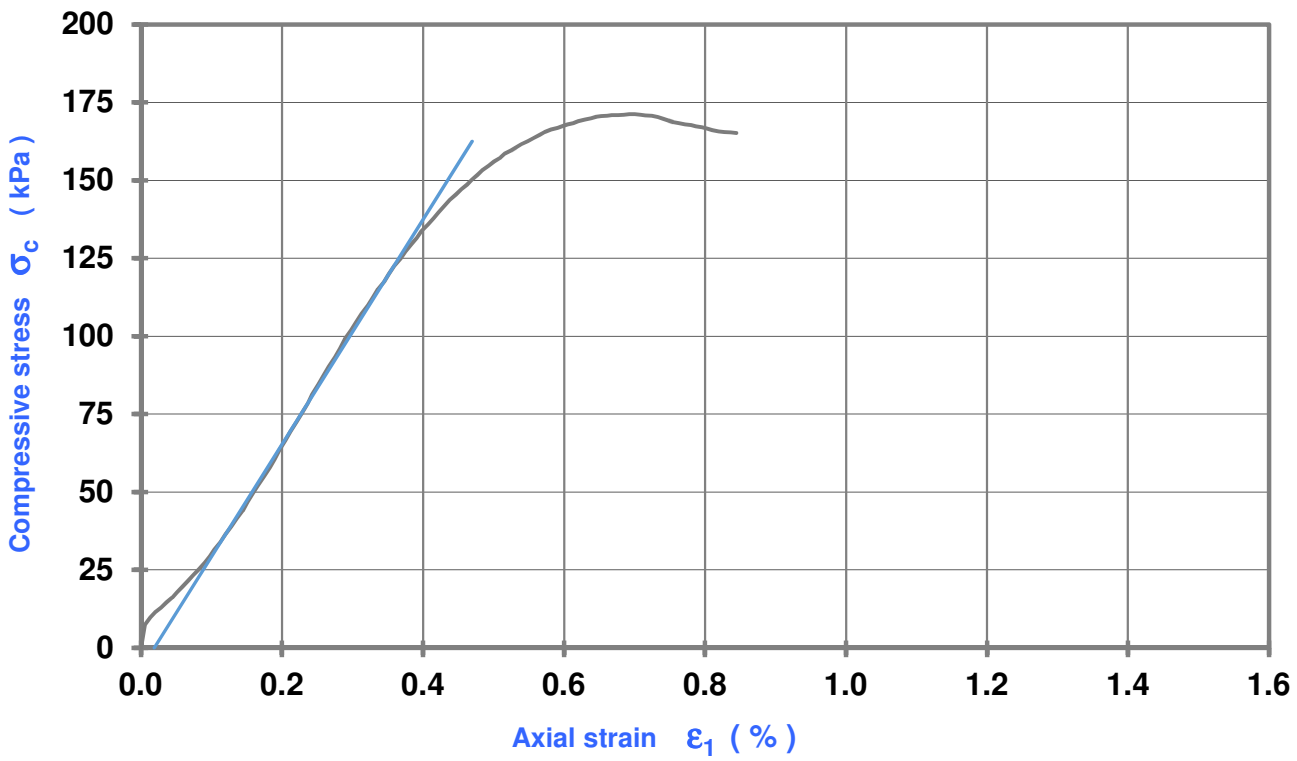
	Auxiliary	Total
Total wet mass (g)		235.31
Total dry mass (g)		91.81
Container nr		ML-1
Container mass (g)		13.37
Water content (%)		**182.94**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	171.2
Axial strain	ε_1	(%)	0.70
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.02
Axial strain (%)	0.68		0.24
E_u (MPa)	25.1		36.5



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-26 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-28
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -10**

Initial characteristics

Diameter	D_O	mm	50.09
Length	L_O	mm	87.77
Cross-sectional area	A_0	cm^2	19.71
Total volume	V_T	cm^3	172.97
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.752
Total wet mass	Mh	g	221.94
Total dry mass	Ms	g	78.22
Water volume	V_w	cm^3	144.15
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.58
Degree of saturation	S_R	(%)	99.8

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.6
Total dry	ρ_d		4.4

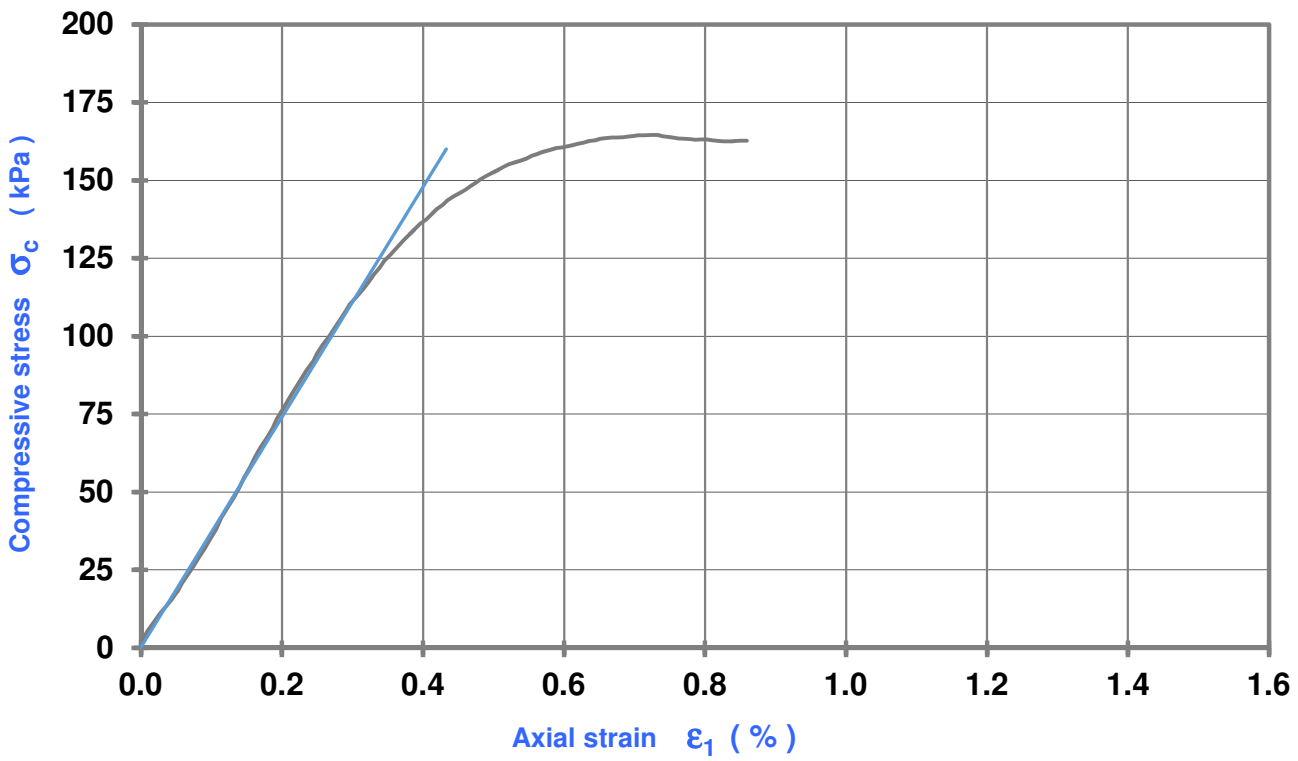
Water content	Auxiliary	Total
Total wet mass (g)		235.38
Total dry mass (g)		91.66
Container nr		49
Container mass (g)		13.44
Water content (%)		**183.74**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	164.6
Axial strain	ε_1	(%)	0.72
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.00
Axial strain (%)	0.72		0.23
E_u (MPa)	22.8		38.0



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-26 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-28
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -07**

Initial characteristics

Diameter	D_O	mm	50.41
Length	L_O	mm	94.28
Cross-sectional area	A_0	cm^2	19.96
Total volume	V_T	cm^3	188.17
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.870
Total wet mass	Mh	g	239.15
Total dry mass	Ms	g	83.44
Water volume	V_w	cm^3	156.18
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	30.49
Degree of saturation	S_R	(%)	99.0

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.3

Water content

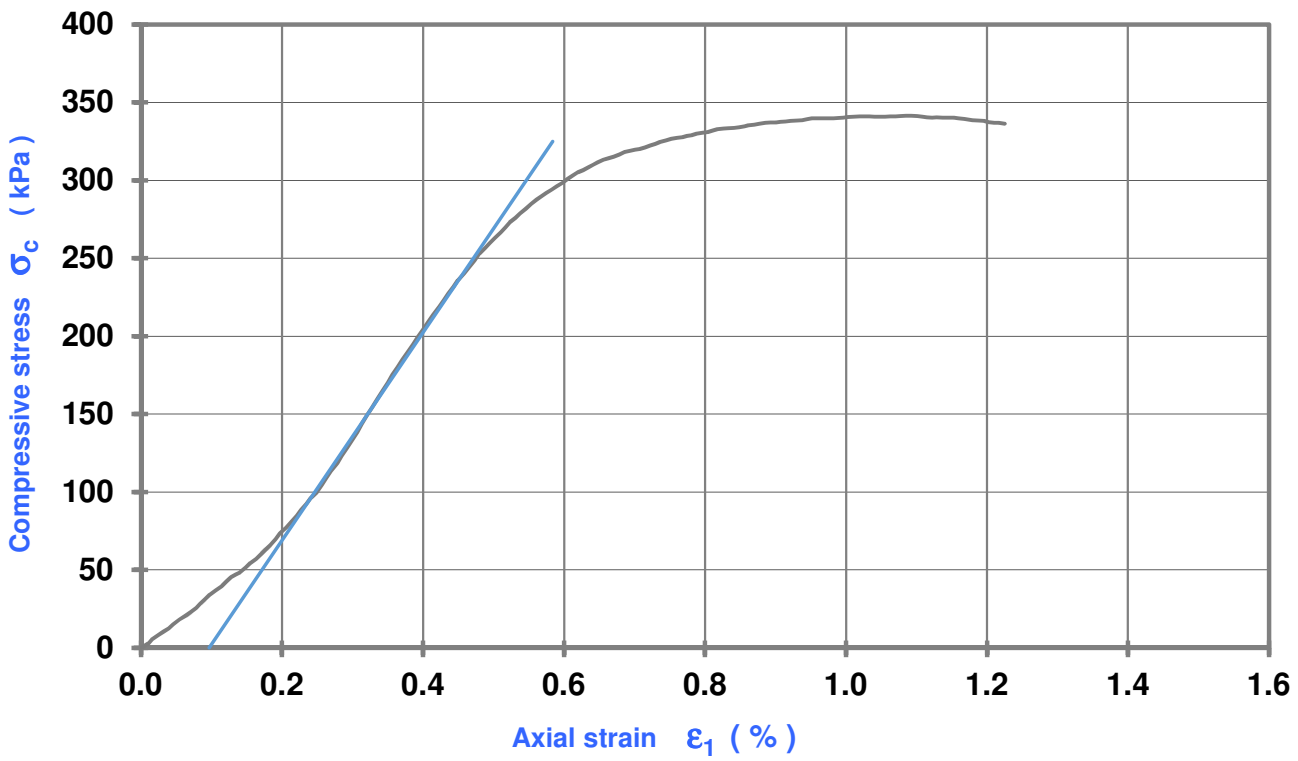
	Auxiliary	Total
Total wet mass (g)		254.63
Total dry mass (g)		98.92
Container nr		97
Container mass (g)		15.48
Water content (%)		**186.61**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	341.4
Axial strain	ε_1	(%)	1.09
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.10
Axial strain (%)	0.99		0.26
E_u (MPa)	34.6		67.7



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-26 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-28
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -08**

Initial characteristics

Diameter	D_O	mm	50.46
Length	L_O	mm	91.52
Cross-sectional area	A_0	cm^2	20.00
Total volume	V_T	cm^3	183.01
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.814
Total wet mass	Mh	g	231.73
Total dry mass	Ms	g	80.74
Water volume	V_w	cm^3	151.44
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.50
Degree of saturation	S_R	(%)	98.7

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.4
Total dry	ρ_d		4.3

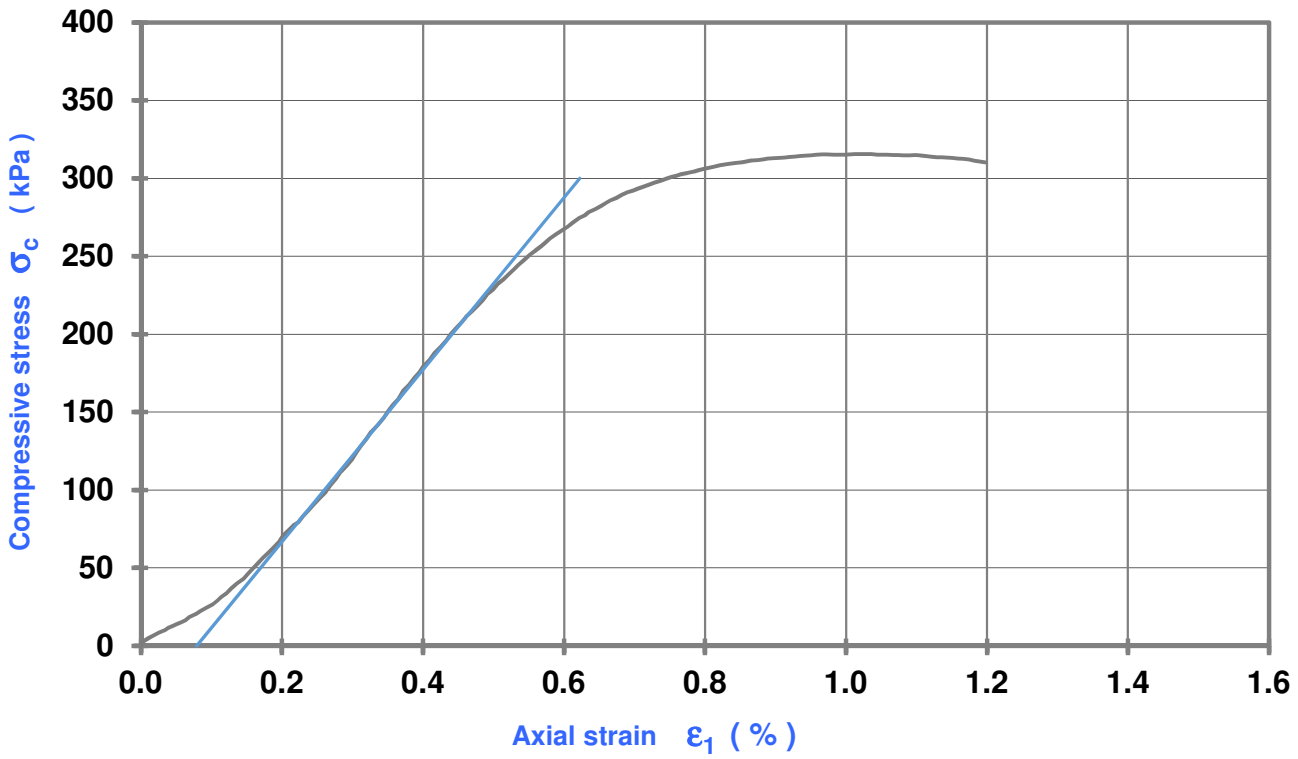
Water content	Auxiliary	Total
Total wet mass (g)		245.25
Total dry mass (g)		94.26
Container nr		48
Container mass (g)		13.52
Water content (%)		**187.01**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	315.6
Axial strain	ε_1	(%)	1.03
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.08
Axial strain (%)	0.95		0.29
E_u (MPa)	33.3		55.4



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-02-26 (14 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-02-28
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -14**

Initial characteristics

Diameter	D_O	mm	50.12
Length	L_O	mm	86.92
Cross-sectional area	A_0	cm^2	19.73
Total volume	V_T	cm^3	171.51
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.734
Total wet mass	Mh	g	219.89
Total dry mass	Ms	g	77.91
Water volume	V_w	cm^3	142.41
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.47
Degree of saturation	S_R	(%)	99.6

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.6
Total dry	ρ_d		4.5

Water content

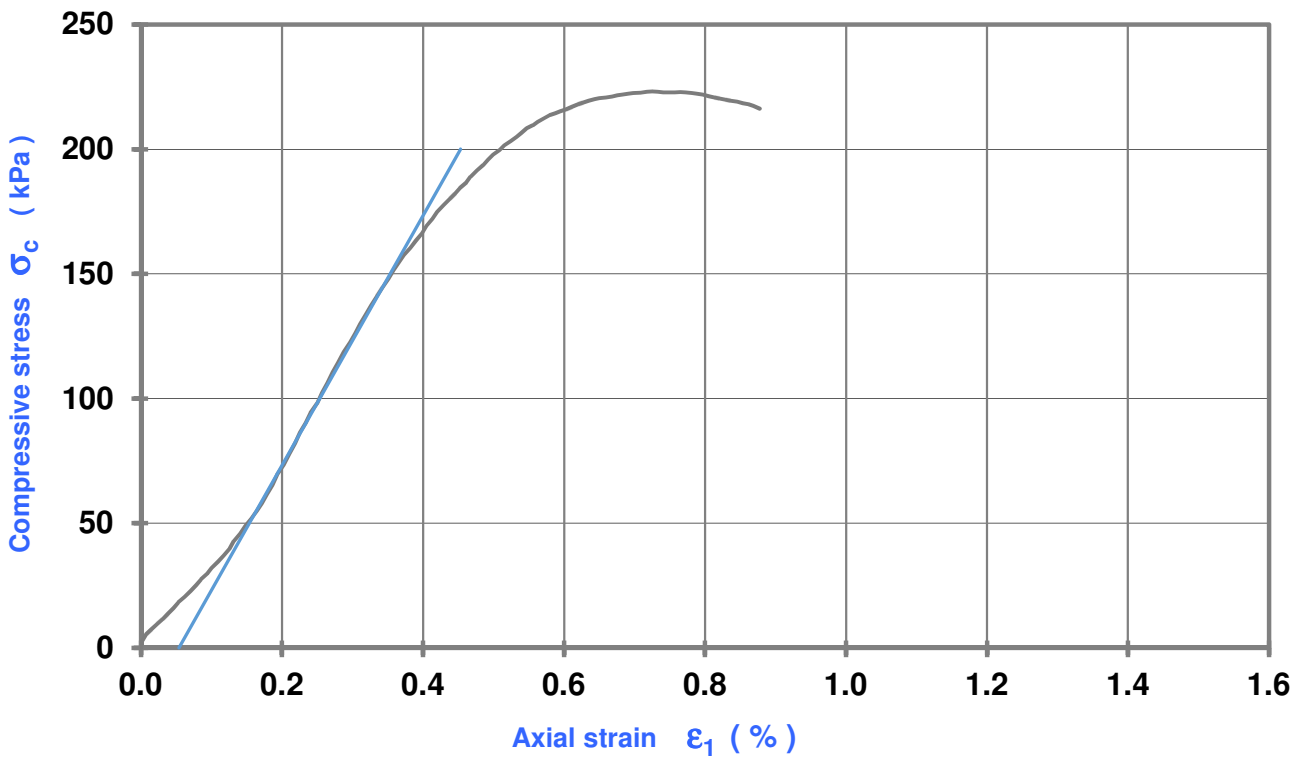
	Auxiliary	Total
Total wet mass (g)		233.50
Total dry mass (g)		91.52
Container nr		20
Container mass (g)		13.61
Water content (%)		**182.24**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	223.2
Axial strain	ε_1	(%)	0.73
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.05
Axial strain (%)	0.67		0.23
E_u (MPa)	33.3		50.6



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-03-12 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-03-14
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -15**

Initial characteristics

Diameter	D_O	mm	50.18
Length	L_O	mm	88.52
Cross-sectional area	A_0	cm^2	19.78
Total volume	V_T	cm^3	175.08
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.764
Total wet mass	Mh	g	224.00
Total dry mass	Ms	g	79.26
Water volume	V_w	cm^3	145.18
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.96
Degree of saturation	S_R	(%)	99.4

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

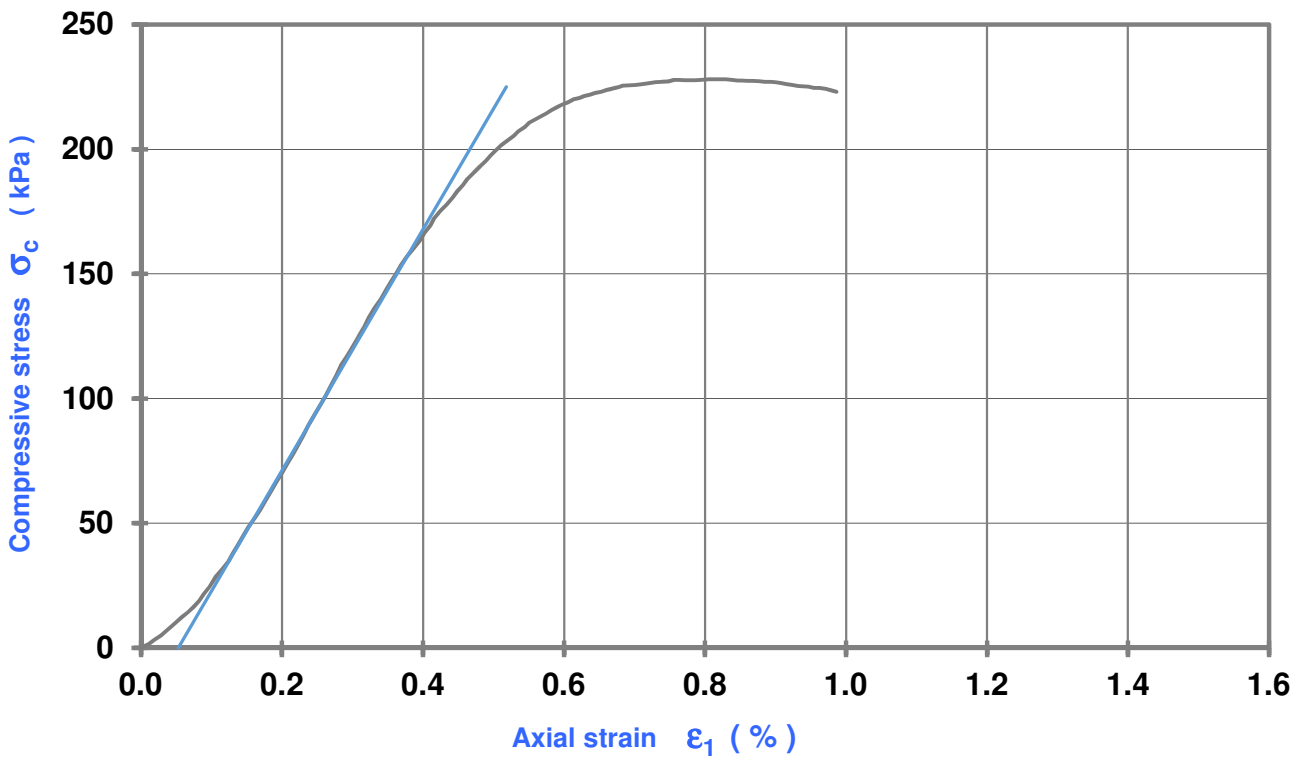
	Auxiliary	Total
Total wet mass (g)		237.37
Total dry mass (g)		92.63
Container nr		89
Container mass (g)		13.37
Water content (%)		**182.61**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	228.1
Axial strain	ε_1	(%)	0.83
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.05
Axial strain (%)	0.78		0.24
E_u (MPa)	29.4		48.7



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-03-12 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-03-14
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 2,6 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -16**

Initial characteristics

Diameter	D_O	mm	50.27
Length	L_O	mm	88.16
Cross-sectional area	A_0	cm^2	19.85
Total volume	V_T	cm^3	175.00
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.754
Total wet mass	Mh	g	223.64
Total dry mass	Ms	g	79.29
Water volume	V_w	cm^3	144.78
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.97
Degree of saturation	S_R	(%)	99.2

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

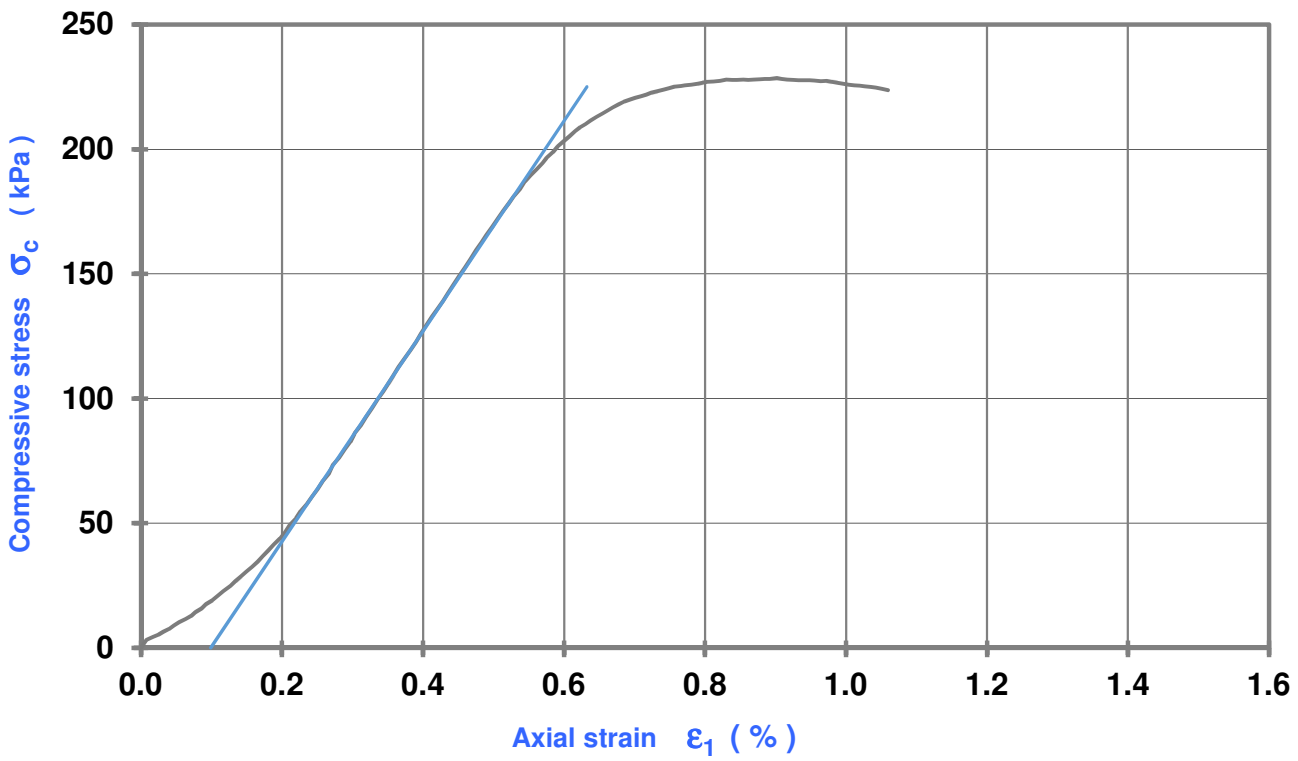
	Auxiliary	Total
Total wet mass (g)		237.32
Total dry mass (g)		92.97
Container nr		88
Container mass (g)		13.68
Water content (%)		**182.05**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	228.5
Axial strain	ε_1	(%)	0.90
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.10
Axial strain (%)	0.80		0.28
E_u (MPa)	28.5		42.2



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-03-12 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-03-14
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -11**

Initial characteristics

Diameter	D_O	mm	50.44
Length	L_O	mm	92.25
Cross-sectional area	A_0	cm^2	19.98
Total volume	V_T	cm^3	184.31
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.829
Total wet mass	Mh	g	235.07
Total dry mass	Ms	g	80.07
Water volume	V_w	cm^3	155.47
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.26
Degree of saturation	S_R	(%)	100.3

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.3

Water content

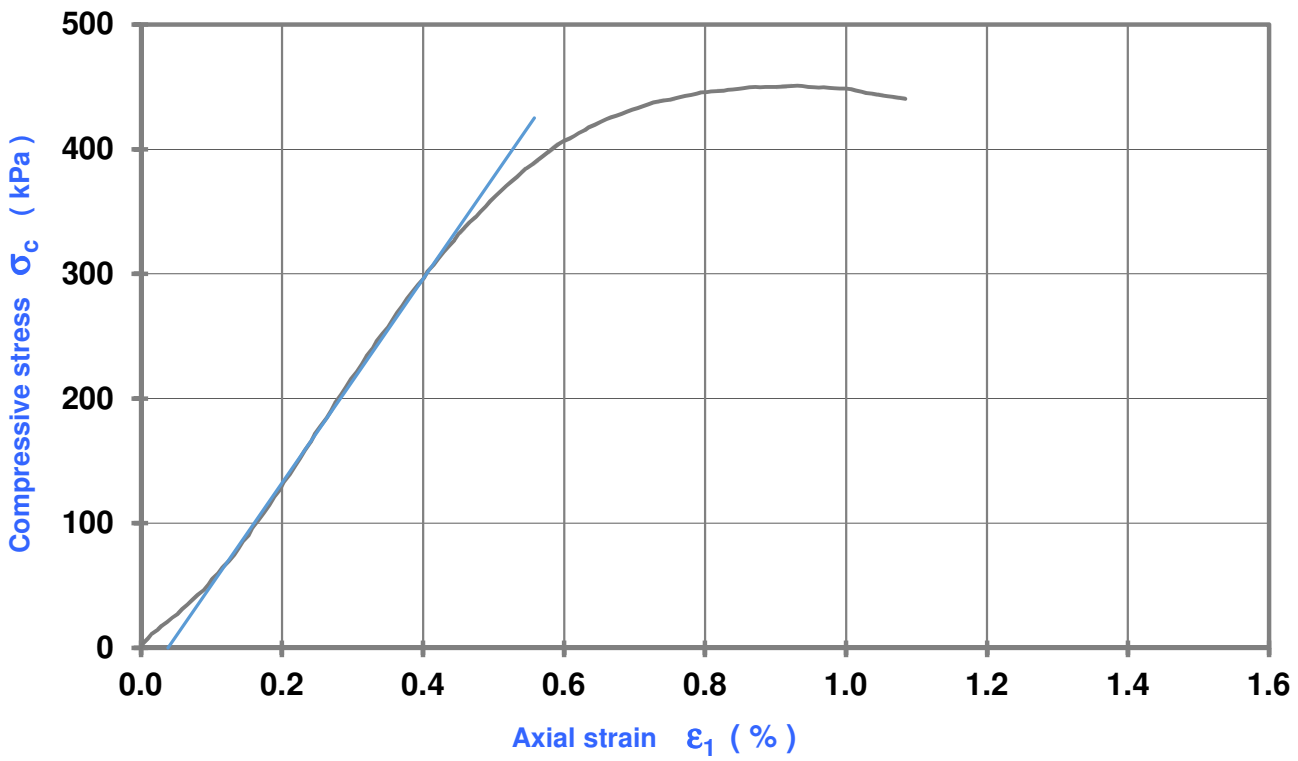
	Auxiliary	Total
Total wet mass (g)		250.75
Total dry mass (g)		95.75
Container nr		7
Container mass (g)		15.68
Water content (%)		**193.58**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	451.0
Axial strain	ε_1	(%)	0.93
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.04
Axial strain (%)	0.89		0.28
E_u (MPa)	50.5		82.7



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-03-12 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-03-14
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -12**

Initial characteristics

Diameter	D_O	mm	50.31
Length	L_O	mm	90.46
Cross-sectional area	A_0	cm^2	19.88
Total volume	V_T	cm^3	179.79
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.798
Total wet mass	Mh	g	229.63
Total dry mass	Ms	g	80.71
Water volume	V_w	cm^3	149.37
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	29.49
Degree of saturation	S_R	(%)	99.4

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

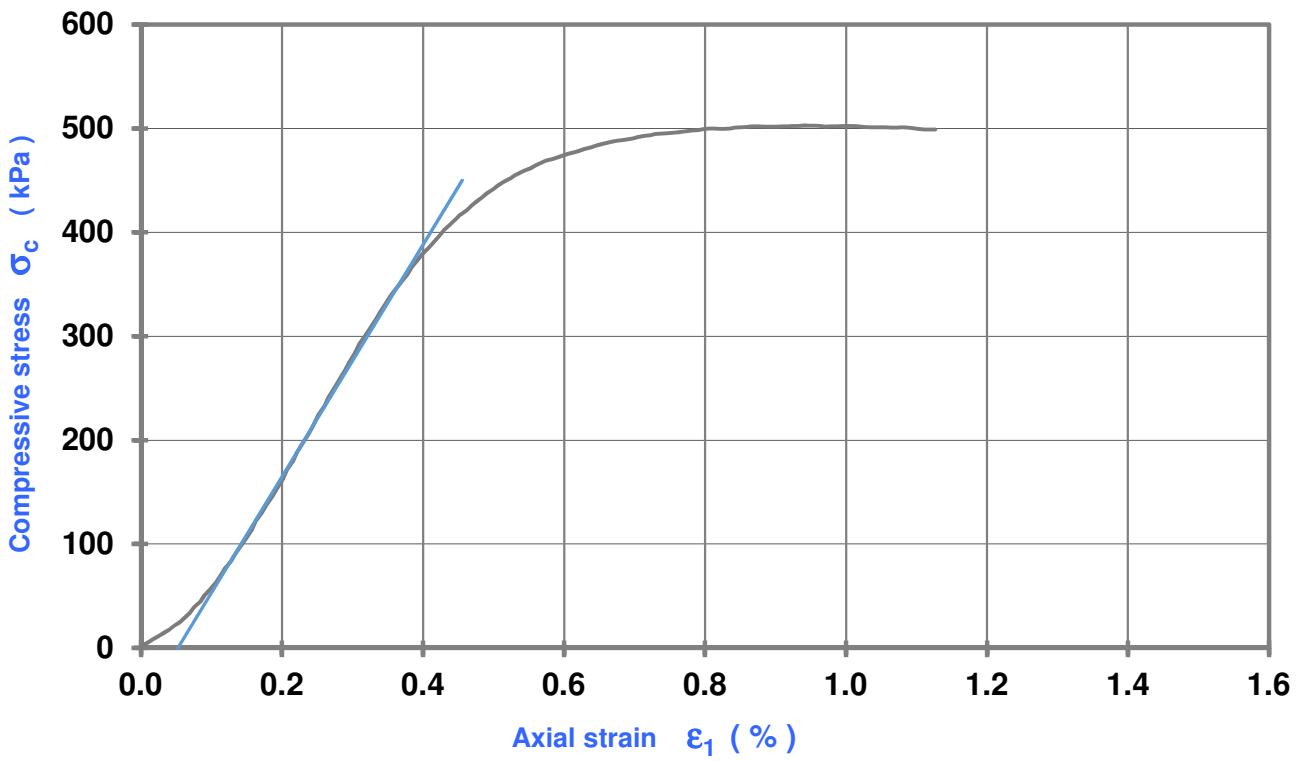
	Auxiliary	Total
Total wet mass (g)		245.10
Total dry mass (g)		96.18
Container nr		97
Container mass (g)		15.47
Water content (%)		**184.51**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	502.8
Axial strain	ε_1	(%)	0.94
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.05
Axial strain (%)	0.89		0.23
E_u (MPa)	56.6		112.6



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-03-12 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-03-14
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

TRIAXIAL COMPRESSION TEST UCS

CLIENT	: SNC-Lavalin	**MIX DESIGN # :**	**22**
PROJECT	: PHASE II - -AMARUQ	**CURING TYPE :**	**UNDER WATER AT 20 °c**
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST nr :**	**UCS -13**

Initial characteristics

Diameter	D_O	mm	50.33
Length	L_O	mm	88.33
Cross-sectional area	A_0	cm^2	19.90
Total volume	V_T	cm^3	175.75
Ratio Length / Diameter	L_0 / D_0	(1 / 1)	1.755
Total wet mass	Mh	g	223.73
Total dry mass	Ms	g	78.16
Water volume	V_w	cm^3	146.01
Specific gravity (est.)	G_S	(1 / 1)	2.745
Solids volume	V_s	cm^3	28.56
Degree of saturation	S_R	(%)	99.2

Molded Specimen Unit Weight

Total moist	ρ_w	kN/m^3	12.5
Total dry	ρ_d		4.4

Water content

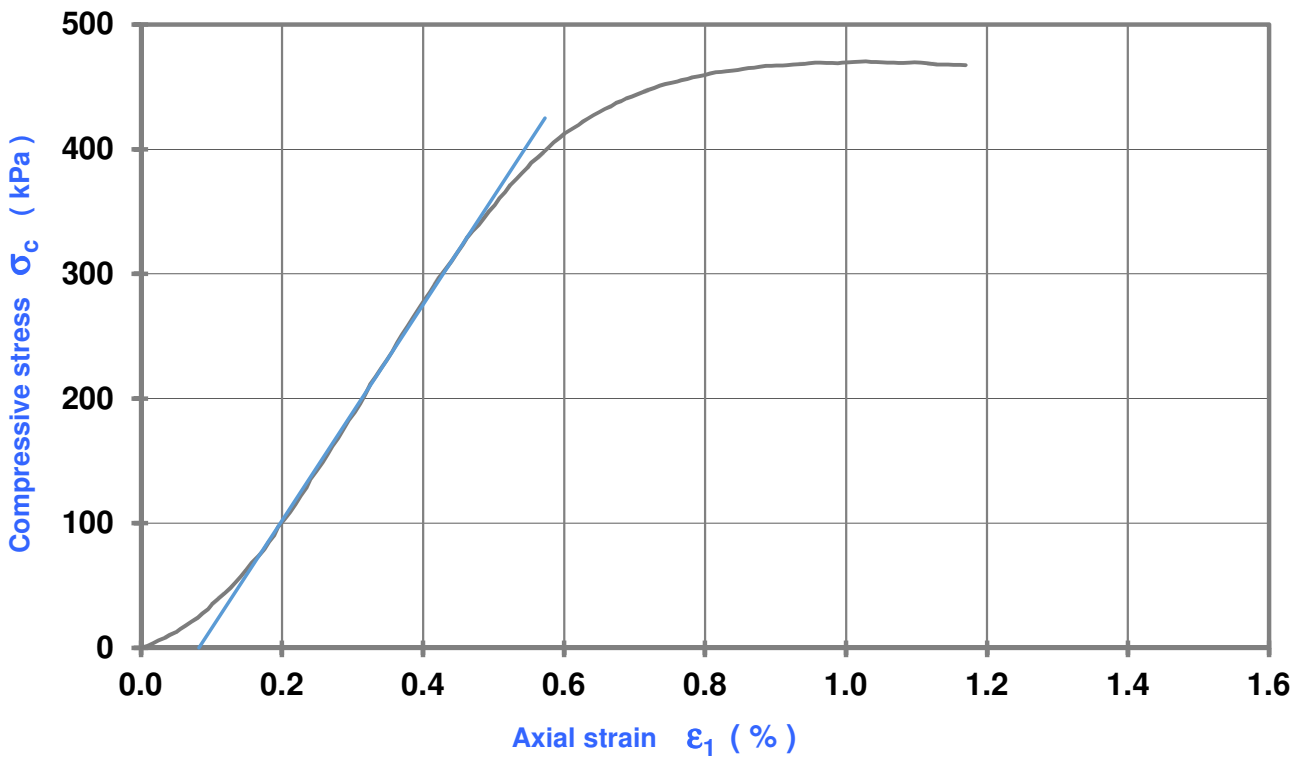
	Auxiliary	Total
Total wet mass (g)		239.32
Total dry mass (g)		93.75
Container nr		84
Container mass (g)		15.59
Water content (%)		**186.25**

TEST CONDITION

Compression rate	mm/min	0.081	%/min	0.09

MAIN RESULTS AT FAILURE

Compressive stress	σ_c	kPa	470.4
Axial strain	ε_1	(%)	1.03
Secant modulus at :	σ_c		$\sigma_c / 2$
Initail correction	$\Delta L / L_O$	(%)	0.08
Axial strain (%)	0.95		0.28
E_u (MPa)	49.7		86.5



Remarks : **Date of batching : 2018-02-12** **Date of test : 2018-03-12 (28 days curing)**
The specimen expelled water during compression (draining property)
Prepared by : Richard Courchesne (100736) Date: 2018-03-14
Verfied by : Yohan Jalbert, ing. Date:

DESIGNATION : Unconfined Compressive Strength ASTM D2166/D2166M - 16

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 22
PROJECT	: AMARUQ - PHASE II	**CURING TYPE**	: UNDER WATER AT 20 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 1

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	50.35	mm
Length	Le	90.46	mm
Cross-sectional area	Ae	19.91	cm^2
Total volume	Ve	180.1	cm^3
Ratio L / D	Le / De		(1/1)
Total wet mass	Mh	229.33	g
Total dry mass	Ms	80.69	g
Water volume	Vw	149.1	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	29.5	cm^3
Degree of saturation	S	99.0	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	90.46	mm
Diameter	Do	50.35	mm
Measured Ovality			%

Cell nr : GE-189

Rate of axial strain :

WATER CONTENT

Mass tare + moist specimen	246.73
Mass tare + dry specimen	96.56
Tare no.	W-4
Mass of tare	15.87
Water content (%)	186.11

MEMBRANE OF LATEX

Dm :	0.30	mm
Cm :	153.00	mm
Lm :	92.26	mm

Correction.: N

E : Homogeneous elastic
H : Horizontals creasings
V : Verticals creasings
P : Plane of failure
N : No correction

AUXILIARY

TOTAL

CONDITIONS OF DRAINAGE

Loading: N
Dissipation: HB
Shearing:

H : Top
B : Base
R : Radial
N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane
σ_r : radial correction of membrane
σ_α : correction for plan of failure

k : 2.14E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	Trimming	Initial		Dissipation	Saturation	
			Line		1		35	25	
Volume of specimen	Vx	(cm^3)		180.1	180.1		177.1	178.6	
Volume of water	Vw	(cm^3)		149.1	149.1		150.3	151.4	
Volume of voids	Vv	(cm^3)		150.7	150.7		147.7	149.1	
Water content	W	(%)		184.21	184.21		185.69	187.05	
Dry mass density	ρ_s	(kg/m^3)		448	448		456	452	
Void ratio	e	(1/1)		5.110	5.110		5.008	5.058	
Porosity	n	(1/1)		0.836	0.836		0.834	0.835	
Degree of saturation	S	(%)		99.0	99.0		101.8	101.5	
Units strains	ε_v	(%)		0.00	0.00		1.68	0.84	
since the trimming	ε_1	(%)		0.00	0.00		0.21	0.06	
Effective stresses	σ'_3	(kPa)			5		85	5	
	σ'_1	(kPa)			10		91	10	
Pore pressure parameter	B	(1/1)						0.940	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	35
KC	Permeability constant head - method A	36	45

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST
2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2018-02-12 Date of test : 2018-03-14 (30 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-03-20
Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 22
PROJECT	: AMARUQ - PHASE II	**CURING TYPE**	: UNDER WATER AT 2.6 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 02

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	50.21	mm
Length	Le	85.09	mm
Cross-sectional area	Ae	19.80	cm^2
Total volume	Ve	168.5	cm^3
Ratio L / D	Le / De		(1/1)
Total wet mass	Mh	215.79	g
Total dry mass	Ms	76.30	g
Water volume	Vw	139.9	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	27.9	cm^3
Degree of saturation	S	99.5	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	85.09	mm
Diameter	Do	50.21	mm
Measured Ovality			%

Cell nr : GE-190

Rate of axial strain :

WATER CONTENT

Mass tare + moist specimen	229.90
Mass tare + dry specimen	89.66
Tare no.	ML-1
Mass of tare	13.36
Water content (%)	183.80

MEMBRANE OF LATEX

Dm :	0.30	mm
Cm :	153.00	mm
Lm :	86.66	mm
Correction.:	N	

E : Homogeneous elastic
H : Horizontals creasings
V : Verticals creasings
P : Plane of failure
N : No correction

AUXILIARY

TOTAL

CONDITIONS OF DRAINAGE

Loading: N
Dissipation: HB
Shearing:

H : Top
B : Base
R : Radial
N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane
σ_r : radial correction of membrane
σ_α : correction for plan of failure

k : 5.20E-06 cm/s
C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	Trimming	Initial		Dissipation	Saturation	
			Line		1		35	25	
Volume of specimen	Vx	(cm^3)		168.5	168.5		166.4	167.9	
Volume of water	Vw	(cm^3)		139.9	139.9		141.2	142.7	
Volume of voids	Vv	(cm^3)		140.6	140.6		138.5	140.0	
Water content	W	(%)		182.82	182.82		184.52	186.48	
Dry mass density	ρ_s	(kg/m^3)		453	453		458	454	
Void ratio	e	(1/1)		5.044	5.044		4.969	5.022	
Porosity	n	(1/1)		0.835	0.835		0.832	0.834	
Degree of saturation	S	(%)		99.5	99.5		101.9	101.9	
Units strains	ε_v	(%)		0.00	0.00		1.24	0.37	
since the trimming	ε_1	(%)		0.00	0.00		0.44	0.09	
Effective stresses	σ'_3	(kPa)			5		85	5	
	σ'_1	(kPa)			10		91	10	
Pore pressure parameter	B	(1/1)						0.966	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	35
KC	Permeability constant head - method A	36	45

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST
2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2018-02-12 Date of test : 2018-03-14 (30 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-03-20
Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 22
PROJECT	: AMARUQ - PHASE II	**CURING TYPE**	: UNDER WATER AT 20 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 03

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	50.38	mm
Length	Le	89.74	mm
Cross-sectional area	Ae	19.93	cm^2
Total volume	Ve	178.9	cm^3
Ratio L / D	Le / De		(1/1)
Total wet mass	Mh	227.74	g
Total dry mass	Ms	79.94	g
Water volume	Vw	148.2	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	29.2	cm^3
Degree of saturation	S	99.1	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	89.74	mm
Diameter	Do	50.38	mm
Measured Ovality			%

Cell nr : GE-189

Rate of axial strain :

WATER CONTENT

Mass tare + moist specimen		242.72
Mass tare + dry specimen		93.58
Tare no.		20
Mass of tare		13.64
Water content (%)		186.56

MEMBRANE OF LATEX

Dm :	0.30	mm
Cm :	153.00	mm
Lm :	91.54	mm
Correction.:	N	

E : Homogeneous elastic
H : Horizontals creasings
V : Verticals creasings
P : Plane of failure
N : No correction

CONDITIONS OF DRAINAGE

Loading:	N
Dissipation:	HB
Shearing:	

H : Top
B : Base
R : Radial
N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane
σ_r : radial correction of membrane
σ_α : correction for plan of failure

k : 5.37E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	**Trimming**	**Initial**		**Dissipation**	**Saturation**	
			Line		1		35	25	
Volume of specimen	Vx	(cm^3)		178.9	178.9		176.8	178.2	
Volume of water	Vw	(cm^3)		148.2	148.2		150.0	151.1	
Volume of voids	Vv	(cm^3)		149.7	149.7		147.6	148.9	
Water content	W	(%)		184.89	184.89		187.13	188.51	
Dry mass density	ρ_s	(kg/m^3)		447	447		452	449	
Void ratio	e	(1/1)		5.124	5.124		5.052	5.099	
Porosity	n	(1/1)		0.837	0.837		0.835	0.836	
Degree of saturation	S	(%)		99.1	99.1		101.7	101.5	
Units strains	ε_v	(%)		0.00	0.00		1.19	0.40	
since the trimming	ε_1	(%)		0.00	0.00		0.27	0.07	
Effective stresses	σ'_3	(kPa)			5		85	5	
	σ'_1	(kPa)			10		91	10	
Pore pressure parameter	B	(1/1)						0.928	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	35
KC	Permeability constant head - method A	36	45

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST
2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2018-02-12 Date of test : 2018-03-15 (31 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-03-20
Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 22
PROJECT	: AMARUQ - PHASE II	**CURING TYPE**	: UNDER WATER AT 2.6 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 04

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	50.30	mm
Length	Le	86.74	mm
Cross-sectional area	Ae	19.87	cm^2
Total volume	Ve	172.4	cm^3
Ratio L / D	Le / De		(1/1)
Total wet mass	Mh	221.07	g
Total dry mass	Ms	78.98	g
Water volume	Vw	142.5	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	28.9	cm^3
Degree of saturation	S	99.3	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	86.74	mm
Diameter	Do	50.30	mm
Measured Ovality			%

Cell nr : GE-189

Rate of axial strain :

WATER CONTENT

Mass tare + moist specimen	237.27
Mass tare + dry specimen	94.47
Tare no.	97
Mass of tare	15.49
Water content (%)	180.81

MEMBRANE OF LATEX

Dm :	0.30	mm
Cm :	153.00	mm
Lm :	88.42	mm

Correction.: N

E : Homogeneous elastic
H : Horizontals creasings
V : Verticals creasings
P : Plane of failure
N : No correction

AUXILIARY

TOTAL

CONDITIONS OF DRAINAGE

Loading: N
Dissipation: HB
Shearing:

H : Top
B : Base
R : Radial
N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane
σ_r : radial correction of membrane
σ_α : correction for plan of failure

k : 6.64E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	Trimming	Initial		Dissipation	Saturation	
			Line		1		35	25	
Volume of specimen	Vx	(cm^3)		172.4	172.4		169.9	171.1	
Volume of water	Vw	(cm^3)		142.5	142.5		143.1	144.3	
Volume of voids	Vv	(cm^3)		143.5	143.5		141.0	142.2	
Water content	W	(%)		179.91	179.91		180.66	182.18	
Dry mass density	ρ_s	(kg/m^3)		458	458		465	462	
Void ratio	e	(1/1)		4.973	4.973		4.886	4.928	
Porosity	n	(1/1)		0.833	0.833		0.830	0.831	
Degree of saturation	S	(%)		99.3	99.3		101.5	101.5	
Units strains	ε_v	(%)		0.00	0.00		1.47	0.76	
since the trimming	ε_1	(%)		0.00	0.00		0.28	0.08	
Effective stresses	σ'_3	(kPa)			5		85	5	
	σ'_1	(kPa)			10		91	10	
Pore pressure parameter	B	(1/1)						0.966	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	35
KC	Permeability constant head - method A	36	45

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST
2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2018-02-12 Date of test : 2018-03-19 (35 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-03-21
Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 22
PROJECT	: AMARUQ - PHASE II	**CURING TYPE**	: UNDER WATER AT 20 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 05

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	50.40	mm
Length	Le	87.89	mm
Cross-sectional area	Ae	19.95	cm^2
Total volume	Ve	175.4	cm^3
Ratio L / D	Le / De		(1/1)
Total wet mass	Mh	223.94	g
Total dry mass	Ms	79.06	g
Water volume	Vw	145.3	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	28.9	cm^3
Degree of saturation	S	99.2	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	87.89	mm
Diameter	Do	50.40	mm
Measured Ovality			%

Cell nr : GE-189

Rate of axial strain :

WATER CONTENT

Mass tare + moist specimen	240.84
Mass tare + dry specimen	94.65
Tare no.	84
Mass of tare	15.59
Water content (%)	184.91

MEMBRANE OF LATEX

Dm :	0.30	mm
Cm :	153.00	mm
Lm :	89.68	mm

Correction.: N

E : Homogeneous elastic
H : Horizontals creasings
V : Verticals creasings
P : Plane of failure
N : No correction

CONDITIONS OF DRAINAGE

Loading: N
Dissipation: HB
Shearing:

H : Top
B : Base
R : Radial
N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane
σ_r : radial correction of membrane
σ_α : correction for plan of failure

k : 2.89E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	**Trimming**	**Initial**		**Dissipation**	**Saturation**	
			Line		1		35	25	
Volume of specimen	Vx	(cm^3)		175.4	175.4		173.7	174.4	
Volume of water	Vw	(cm^3)		145.3	145.3		147.0	148.0	
Volume of voids	Vv	(cm^3)		146.5	146.5		144.8	145.6	
Water content	W	(%)		183.25	183.25		185.40	186.66	
Dry mass density	ρ_s	(kg/m^3)		451	451		455	453	
Void ratio	e	(1/1)		5.070	5.070		5.011	5.039	
Porosity	n	(1/1)		0.835	0.835		0.834	0.834	
Degree of saturation	S	(%)		99.2	99.2		101.6	101.7	
Units strains	ε_v	(%)		0.00	0.00		0.98	0.52	
since the trimming	ε_1	(%)		0.00	0.00		0.25	0.08	
Effective stresses	σ'_3	(kPa)			5		85	5	
	σ'_1	(kPa)			10		91	10	
Pore pressure parameter	B	(1/1)						0.909	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	35
KC	Permeability constant head - method A	36	45

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST
2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2018-02-12 Date of test : 2018-03-16 (32 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-03-20
Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

SYNTHESIS REPORT - TRIAXIAL PERMEABILITY

CLIENT	: SNC-Lavalin inc.	**MIX DESIGN #**	: 22
PROJECT	: AMARUQ - PHASE II	**CURING TYPE**	: UNDER WATER AT 2.6 °C
LOCATION	: NUNAVUT		
FILE	: 651298	**TEST Nr**	: SK - 06

INITIAL MOUNTING SPECIMEN PROPERTIES

Diameter	De	50.30	mm
Length	Le	82.09	mm
Cross-sectional area	Ae	19.87	cm^2
Total volume	Ve	163.1	cm^3
Ratio L / D	Le / De		(1/1)
Total wet mass	Mh	209.11	g
Total dry mass	Ms	74.09	g
Water volume	Vw	135.4	cm^3
Specific gravity (est.)	Gs	2.745	
Solids volume	Vs	27.1	cm^3
Degree of saturation	S	99.6	%

DIMENSIONS OF TRIMMED SPECIMEN

Length	Lo	82.09	mm
Diameter	Do	50.30	mm
Measured Ovality			%

Cell nr : GE-190

Rate of axial strain :

WATER CONTENT

	AUXILIARY	TOTAL
Mass tare + moist specimen		223.27
Mass tare + dry specimen		87.47
Tare no.		89
Mass of tare		13.38
Water content (%)		183.29

MEMBRANE OF LATEX

Dm : 0.30 mm

Cm : 153.00 mm

Lm : 83.67 mm

Correction.: N

E : Homogeneous elastic

H : Horizontals creasings

V : Verticals creasings

P : Plane of failure

N : No correction

CONDITIONS OF DRAINAGE

Loading: N

Dissipation: HB

Shearing:

H : Top

B : Base

R : Radial

N : Undrained

Note: Without drains

MAIN RESULTS AT FAILURE

	Failure	Final
Line		
$\sigma_1-\sigma_3$		
σ'_1/σ'_3		
σ'_3		
ΔU_b		
A		
ε_1		
ε_v		

Failure criterion : $\sigma_1-\sigma_3$ max

CORRECTIONS OF MEMBRANE

σ_a		
σ_r		
σ_α		

σ_a : axial correction of membrane

σ_r : radial correction of membrane

σ_α : correction for plan of failure

k : 8.01E-06 cm/s

C_v :

PHYSICALS AND MECHANICALS CHARACTERISTICS IN END STEP

			Code	IO	IN	CI	DU	SP	ZD
			Step	**Trimming**	**Initial**		**Dissipation**	**Saturation**	
			Line		1		35	25	
Volume of specimen	Vx	(cm^3)		163.1	163.1		160.4	162.1	
Volume of water	Vw	(cm^3)		135.4	135.4		135.7	137.3	
Volume of voids	Vv	(cm^3)		136.0	136.0		133.4	135.0	
Water content	W	(%)		182.24	182.24		182.64	184.79	
Dry mass density	ρ_s	(kg/m^3)		454	454		462	457	
Void ratio	e	(1/1)		5.024	5.024		4.926	4.987	
Porosity	n	(1/1)		0.834	0.834		0.831	0.833	
Degree of saturation	S	(%)		99.6	99.6		101.8	101.7	
Units strains	ε_v	(%)		0.00	0.00		1.64	0.62	
since the trimming	ε_1	(%)		0.00	0.00		0.34	0.07	
Effective stresses	σ'_3	(kPa)			5		85	5	
	σ'_1	(kPa)			10		91	10	
Pore pressure parameter	B	(1/1)						0.974	

SEQUENCE OF TEST

CODES	STEPS	Start line	End line
IN	Initial transition	0	1
SP	Back pressure saturation	2	25
CI	Isotropic loading	26	27
DU	Dissipation of excess pore pressure	28	35
KC	Permeability constant head - method A	36	45

REMARKS : 1 - SATURATION BY BACK PRESSURE, ISOTROPIC CONSOLIDATION AND PERMEABILITY TEST

2 - DESIGNATION : ASTM D2435M-11, ASTM D5084-16a

3 - Date of batching : 2018-02-12 Date of test : 2018-03-16 (32 days curing)

Prepared by: Richard Courchesne (100736) Date: 2018-03-20

Verified by: Yohan Jalbert, ing. Date:

SNC·LAVALIN

Appendix 3
Additives – Product Description

ARBO® SO1 P

Wood type	Northern Softwood
Manufacturing Process	Ammonium Sulfite
Production Site	Temiscaming, Quebec, Canada
CAS Number (generic)	68131-31-7
CAS Number (specific)	8061-51-6

Specifications

CHARACTERISTIC	Analysis Method	UNIT	RANGE(1)
Appearance			Brown powder
Bulk Density	WI-RES-S042	g/cc	0.32 - 0.55
Solids (w/w)	WI-LIG-L007	%	93 - 97

(1) on product as is

Typical Data

CHARACTERISTIC	Analysis Method	UNIT	TYPICAL VALUE (2)
Mineral ashes	WI-LIG-050	%	22.7
Sodium	ICP-MS,MA-500-Mét.1.2R	%	7
Total Sulfur	ICP-MS,MA-500-Mét.1.2R	%	6.7
Reducing Matters	WI-DIV-L054	%	< 3

(2) on 100% solids basis

Description and Applications

ARBO® SO1 is a low sugar, modified sodium lignosulfonate spray dried powder

ARBO® SO1 is widely used as a dispersing agent for agrochemicals and concrete admixtures and binding agent for carbon black production

Packaging

25 Kg bags (1 MT per pallet, stretch wrapped), or 900 Kg Bulk Bags

Disclaimer

Tembec Lignosulfonates - Technical Service and Development

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Temiscaming, Quebec, Canada
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shanna.milne@tembec.com

Construction

Sika® P-300N

High-Range Water Reducing Admixture

Description

Sika® P-300N is a normal setting, high range water reducing, super-plasticizing powdered admixture for concrete.

Where to Use

- As a super-plasticizer, Sika® P-300N may be added with the normal amount of water to produce flowing concrete.
- When used as a high range water reducer, Sika® P-300N will reduce water requirements by 25 - 40%, increasing concrete compressive strengths at all ages. Alternatively, it can be used to achieve a combination of these characteristics.

Advantages

- Jobsite control of slump without the addition of water.
- Higher, early and ultimate strengths.
- Improved workability with no loss in strength.
- Improved cohesiveness and reduced segregation.
- Higher strengths may be achieved more economically.
- Lower permeability and greater durability.
- Easier concrete placement in difficult to access and heavily reinforced areas.
- Reduces shrinkage and creep.
- Yields higher modulus of rupture.

Standards

Sika® P-300N conforms to ASTM C494, Type F.

Typical Data

Packaging	15 kg (33 lb) bag
Colour and Form	Brown powder
Shelf Life and Storage	2 years when stored in original unopened bag in dry warehouse conditions. Protect from direct sunlight.

How to Use

Dosage

Sika® P-300N is normally added to the concrete at a rate of 150 - 500 g/100 kg weight of cementitious material. Performance assurance testing should be conducted to determine the optimum dosage.

Dosage rates outside the recommended range may be used where specialized materials such as microsilica are specified, extreme ambient conditions are encountered or unusual project conditions require special consideration. In this case, please contact your Sika Canada Technical Sales Representative for further information.

Mixing

Sika® P-300N should be dispensed separately from the other admixtures, preferably after all of the materials have been charged into the mixer.

Clean Up

Use personal protective equipment (chemical resistant goggles/gloves/clothing). Without direct contact, remove spilled or excess product and place in suitable sealed container. Dispose of excess product and container in accordance with applicable environmental regulations.

Health and Safety Information

For information and advice on the safe handling, storage and disposal of chemical products, users should refer to the **most recent Material Safety Data Sheet** containing physical, ecological, toxicological and other safety-related data.

KEEP OUT OF REACH OF CHILDREN
FOR INDUSTRIAL USE ONLY

Sika Canada Inc.
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Other locations
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Edmonton
Vancouver

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www.sika.ca

An ISO 9001 certified company
Pointe-Claire: ISO 14001 certified EMS

Appendix G

Thermistor string readings along WTD

Appendix G

Thermistor readings in the WTD area

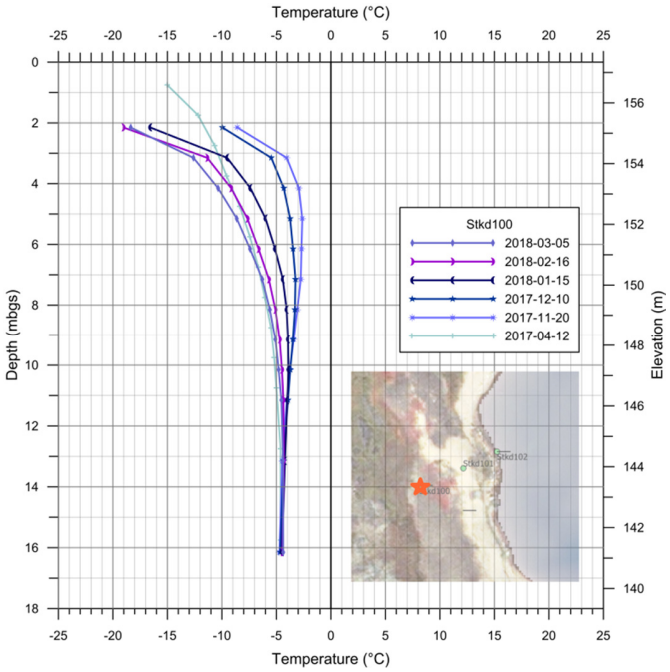

Figure G-1: Readings on temporary thermistor string Stkd100

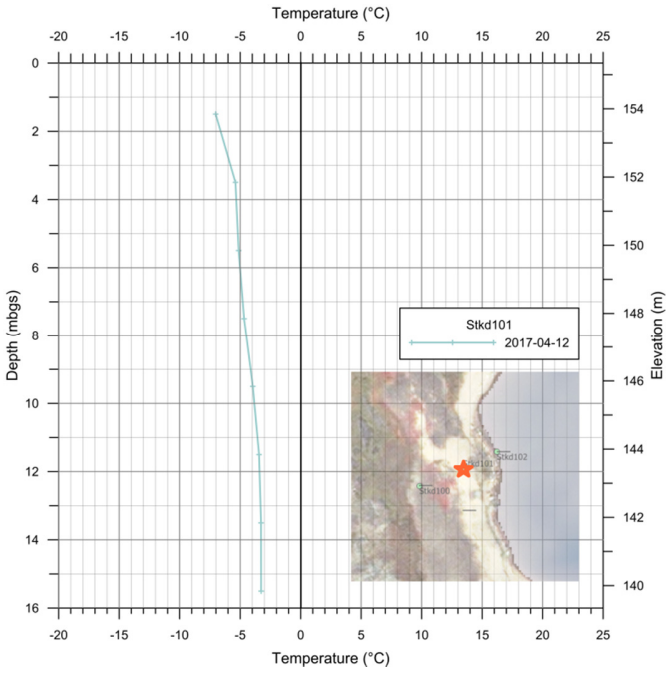

Figure G-2: Reading on temporary thermistor string Stkd101

Appendix G

Thermistor readings in the WTD area

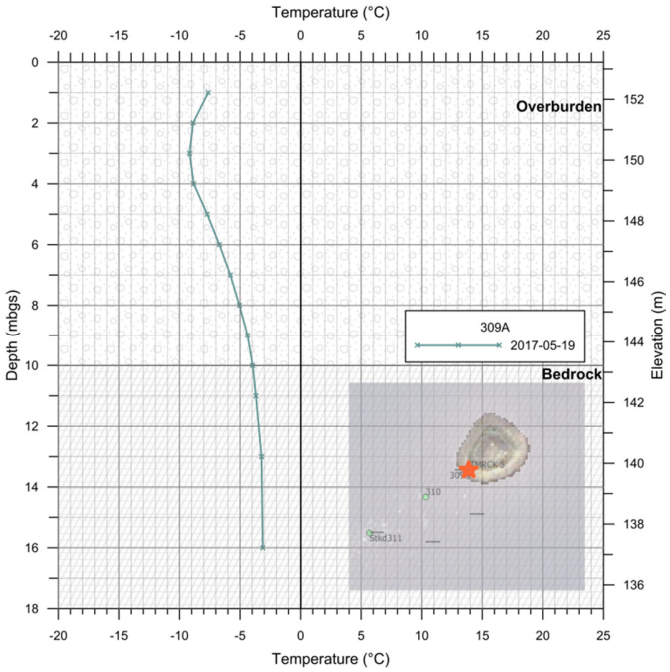

Figure G-3: Reading on temporary thermistor string 309A

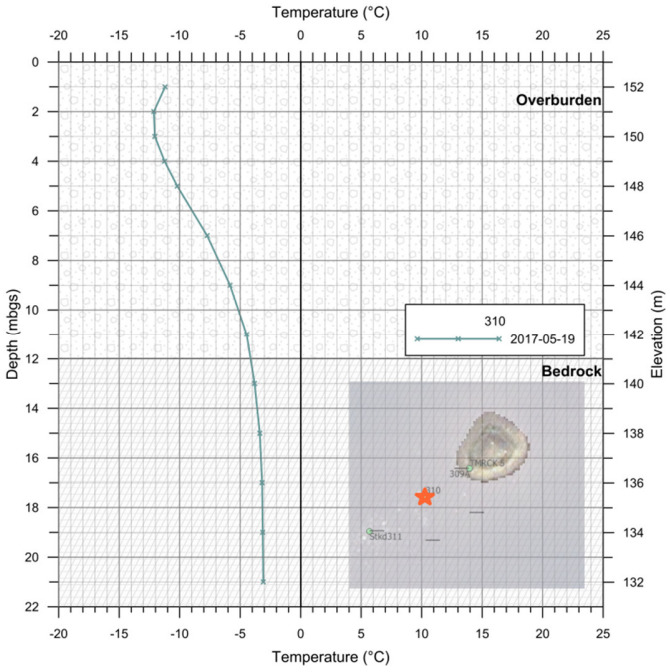

Figure G-4: Reading on temporary thermistor string 310

Appendix G

Thermistor readings in the WTD area

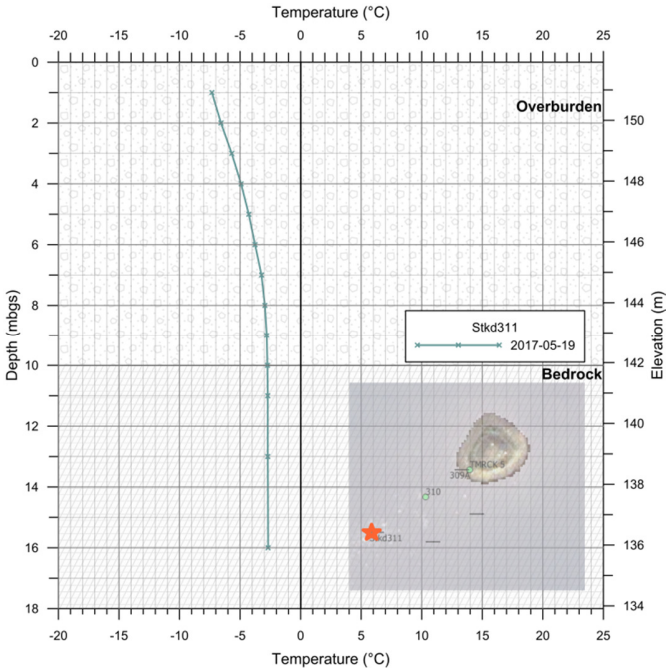

Figure G-5: Reading on temporary thermistor string Stkd311

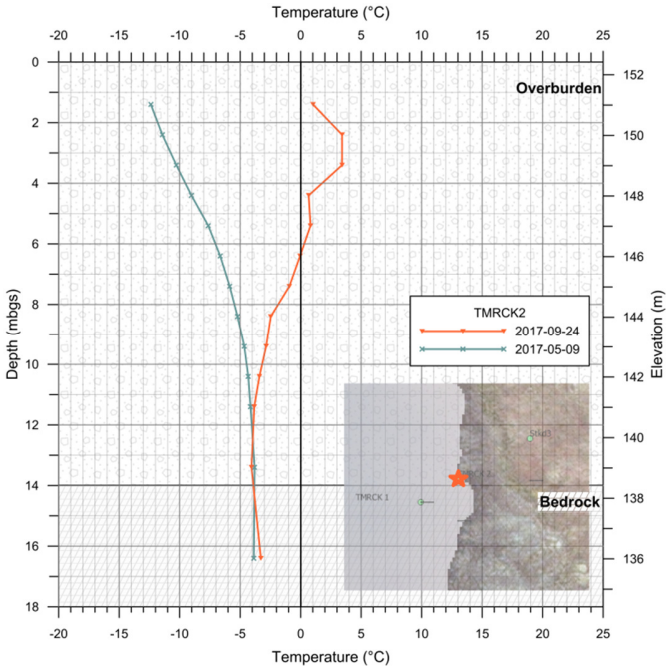

Figure G-6: Readings on temporary thermistor string TMRCK2

Appendix G

Thermistor readings in the WTD area

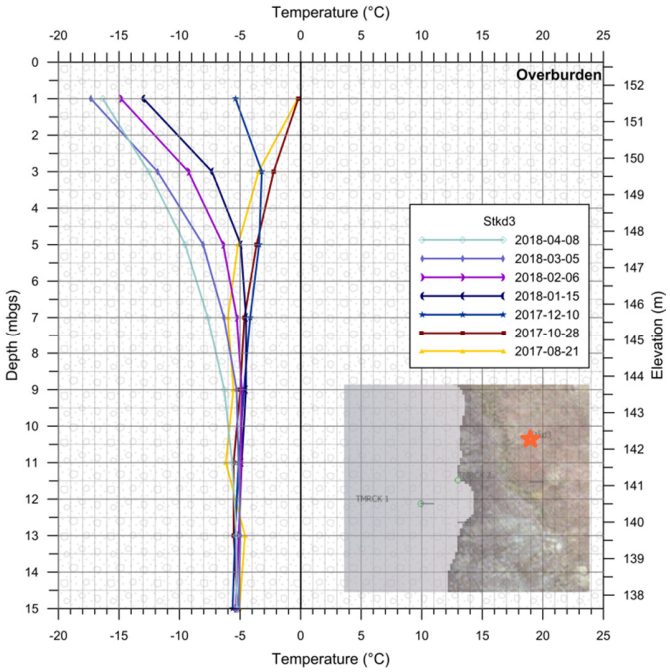

Figure G-7: Readings on temporary thermistor string Stkd3

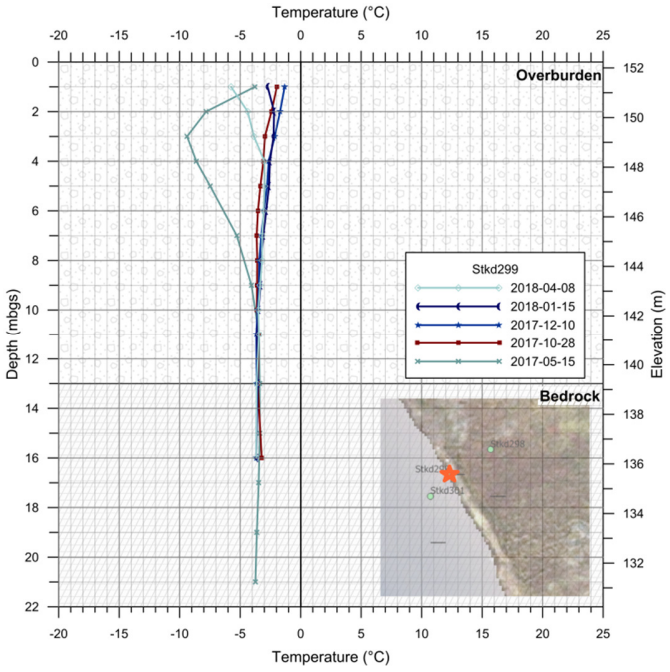

Figure G-8: Readings on temporary thermistor string Stkd299

Appendix G

Thermistor readings in the WTD area

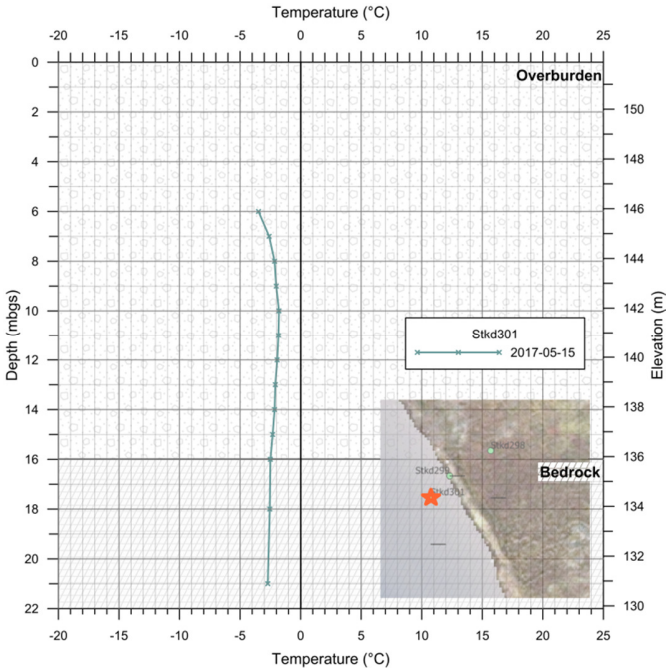

Figure G-9: Reading on temporary thermistor string Stkd301

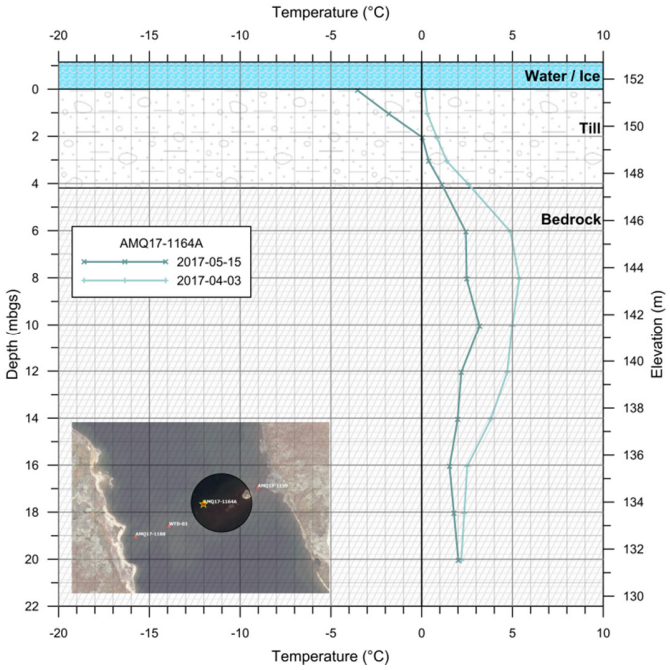

Figure G-10: Readings on permanent thermistor string AMQ17-1164A

Appendix G

Thermistor readings in the WTD area

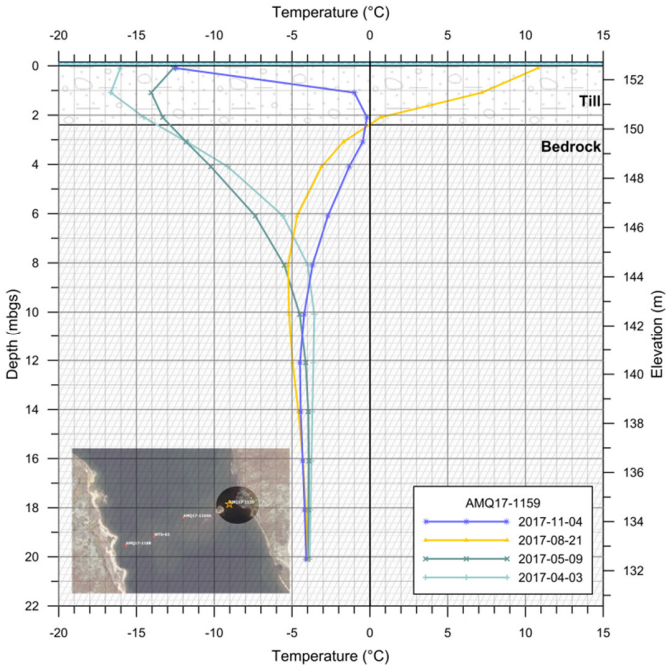

Figure G-11: Readings on permanent thermistor string AMQ17-1159

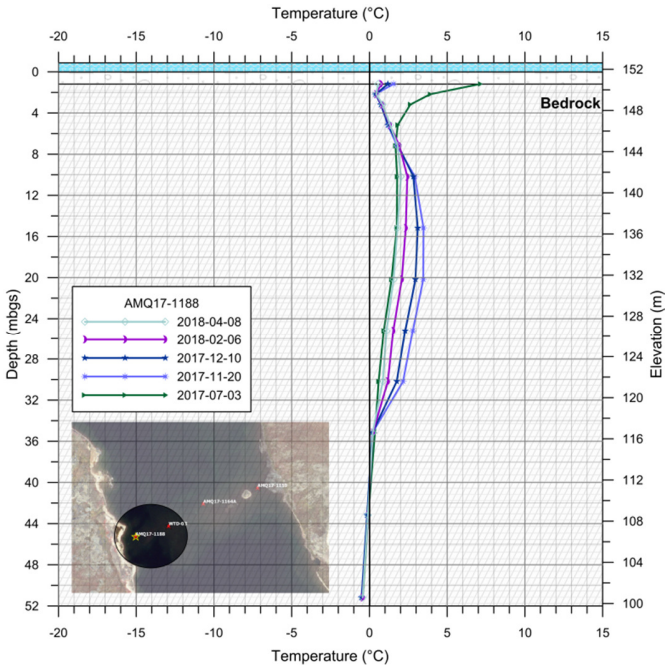

Figure G-12: Readings on permanent thermistor string AMQ17-1188

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