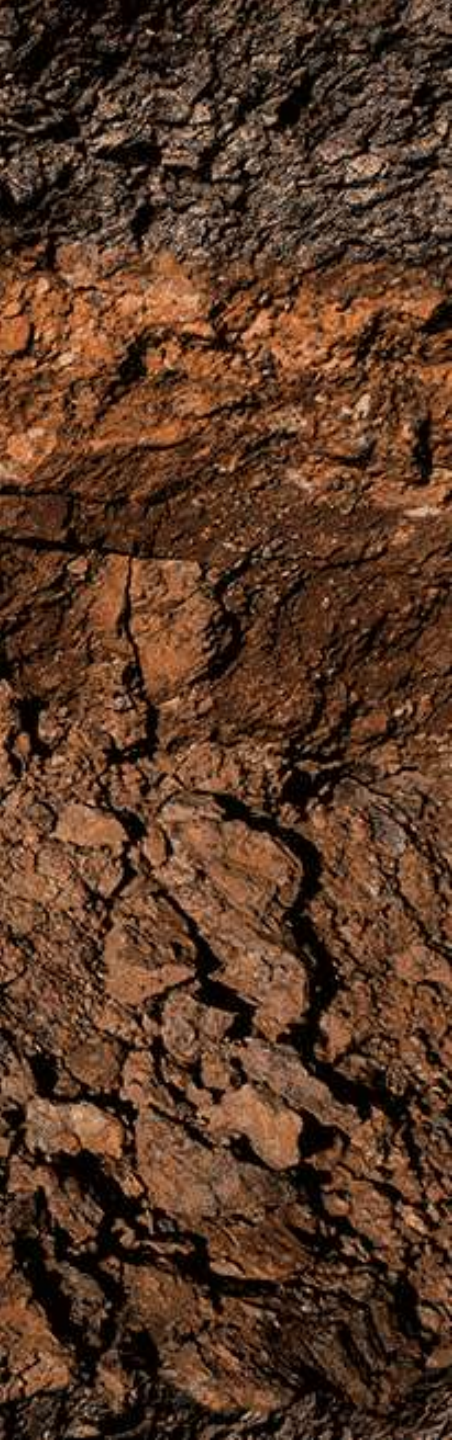


Douglas
FOUNDATION SOLUTIONS

Commercial Soil Stabilization

Austin, Texas & Surrounding Areas

www.douglasfoundationrepair.com

Soil Stabilization

New Construction | Existing Buildings

Douglas Foundation Solutions offers soil stabilization services to commercial & infrastructure clients throughout Austin, Texas and the surrounding area.

- Commercial & industrial buildings
- Warehouses
- Parking lots
- Roads
- Walkways

Proven Soil Stabilization Technology

- Douglas foundations injects an advanced AGSS-ICS ionic stabilizer designed for swelling clay soils that changes the nature of the soil itself to permanently solve the problem of swelling and contracting soils by as much as 88% to protect the structures above.

Table 1. Swell Test Summary from Construction

West Side of Stadium			East Side of Stadium		
Sample No.	Depth Below Finished Subgrade (ft)	Swell Potential (%)	Sample No.	Depth Below Finished Subgrade (ft)	Swell Potential (%)
GI16297	8	0.0	GI16384	8	1
GI16298	8	0.9	GI16385	8	0
GI16299	8	0.8	GI16386	8	0
GI16318	6	0.0	GI16402	5	0.1
GI16319	6	0.7	GI16403	5	0.7
GI16320	6	0.0	GI16404	5	0.5
GI16330	5	0.0	112116A	3	0.7
GI16331	5	0.5	112116B	3	0.9
GI16332	5	0.0	112116c	3	1
GI16342	4	0.4	GI16409	1	1
GI16343	4	1.6	GI16410	1	0.5
GI16343*	4	0.7	GI16411	1	1
GI16344	4	0.3	GI16421	0	0.2
GI16349	3	0.7	GI16422	0	0.2
GI16350	3	1.8	GI16423	0	1.7
GI16350*	3	1.0	GI16423*	0	0
GI16351	3	0.0			
GI16360	0	0.4			
GI16361	0	0.1			
GI16362	0	0.6			

Average Treated Swell = 0.45%

Untreated Swell Varied between 2% - 10%

*Retested about 3 weeks after sampling

The nuclear moisture/density tests performed during construction met the moisture and compaction specification outlined in STRATA's geotechnical plan sheets for the project titled "Campbell County Athletic Play Fields, Campbell County Athletic High School South Campus, Gillette, Wyoming" dated May 26, 2016.

Three of the swell tests performed during construction had swell potentials greater than 1 percent. Portions of the samples were maintained in STRATA's laboratory. Portions of the 3 samples that exceeded 1 percent were tested again approximately 3 weeks after treatment to allow the chemical more time to react with the clay. Each of the 3 retest results were less than 1 percent swell. The swell tests that were done during the treatment of the soil met project specifications.

Using the retest values, the average swell potential is about 0.5 percent. If 0.5 percent swell were to be realized over the 8-foot treated zone, due to an increase in the moisture content, the resulting movement at the ground surface would be about ½-inch.

Proven Results

- AGSS-ICS soil stabilization has proven effective with long-lasting benefits in project after project, study after study.
  - Dramatic reduction in swell
  - Increased strength
  - Reduced moisture migration

AGSS-ICS Technology

- AGSS-ICS is an ionic chemical stabilizer that is used to treat swelling clays.
- AGSS-ICS has been proven to reduce or eliminate the natural swell potential of expansive clays by effecting permanent molecular changes in the clay particle through the process of isomorphic substitution and cation exchange.
- AGSS-ICS reduces the soil suction of the swelling clays as well as increases the strength.

Cost Benefits of AGSS-ICS

- New construction: treatment of native clay soils using AGSS-ICS for new road subgrades and building pads is:
  - **Up to 5 times less expensive than the export/import of select fill**
  - **Up to 3 times more cost-effective per cubic yard than lime treatment**
- No need to spend the time and money to haul off hundreds or thousands of loads and replace with purchased fill soil
- AGSS-ICS treated clays are irreversible and will not solution with time. Lime treatment can solution with time and require retreatment.

Applications and Benefits of AGSS-ICS

- Remediation of existing road subgrades and structures containing expansive clay soils
- No “bathtub effect”
- Improves soil compaction and overall strength
- Performs well in high sulphate soils and does not react with sulphates to cause sulphate heave
- Safe for the environment (risk assessment study available)
- Can be applied either as a mixing operation or as an injection

ACSS-ICS Comparison to Alternatives

	AGSS-ICS	Select Fill	Lime Treatment
Permanent molecular treatment	yes	no	no
Can be used on existing structures	yes	no	no
Expense	$	$$$	$$
Soil disposal site needed	no	yes	no
Truckloads of soils or materials in/out	no	yes	yes
Suitable fill supply needed	no	yes	no
Causes “bathtub effect”	no	yes	no
Causes sulphate heave	no	no	yes
Moisture migration is reduced	yes	no	no
Increases soil strength	yes	??	yes

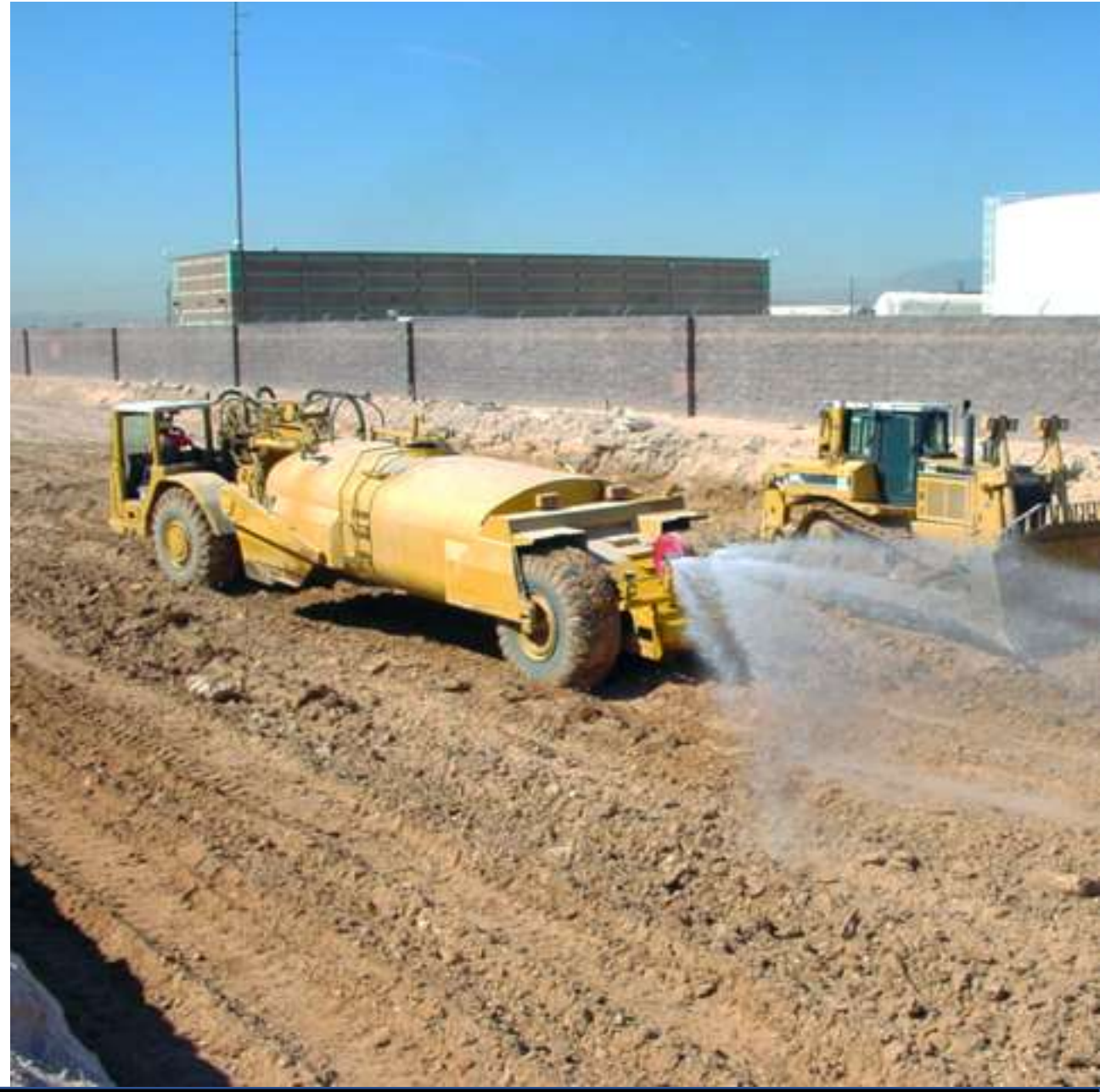
Environmentally Friendly

- Environmentally inert
- No airborne toxic exposure issues for personnel
- No dust pollution issues for public or personnel
- No heavy metals or toxins added to the soil
- Use of on-site soils eliminates transport of fills, waste and additives, greatly reducing CO2 emissions
- No landfill space consumed for waste soils
- Increased pavement life and reduced maintenance
- Allows for use of “waste” soils for fill

Application – Mixing

Mixing Operation

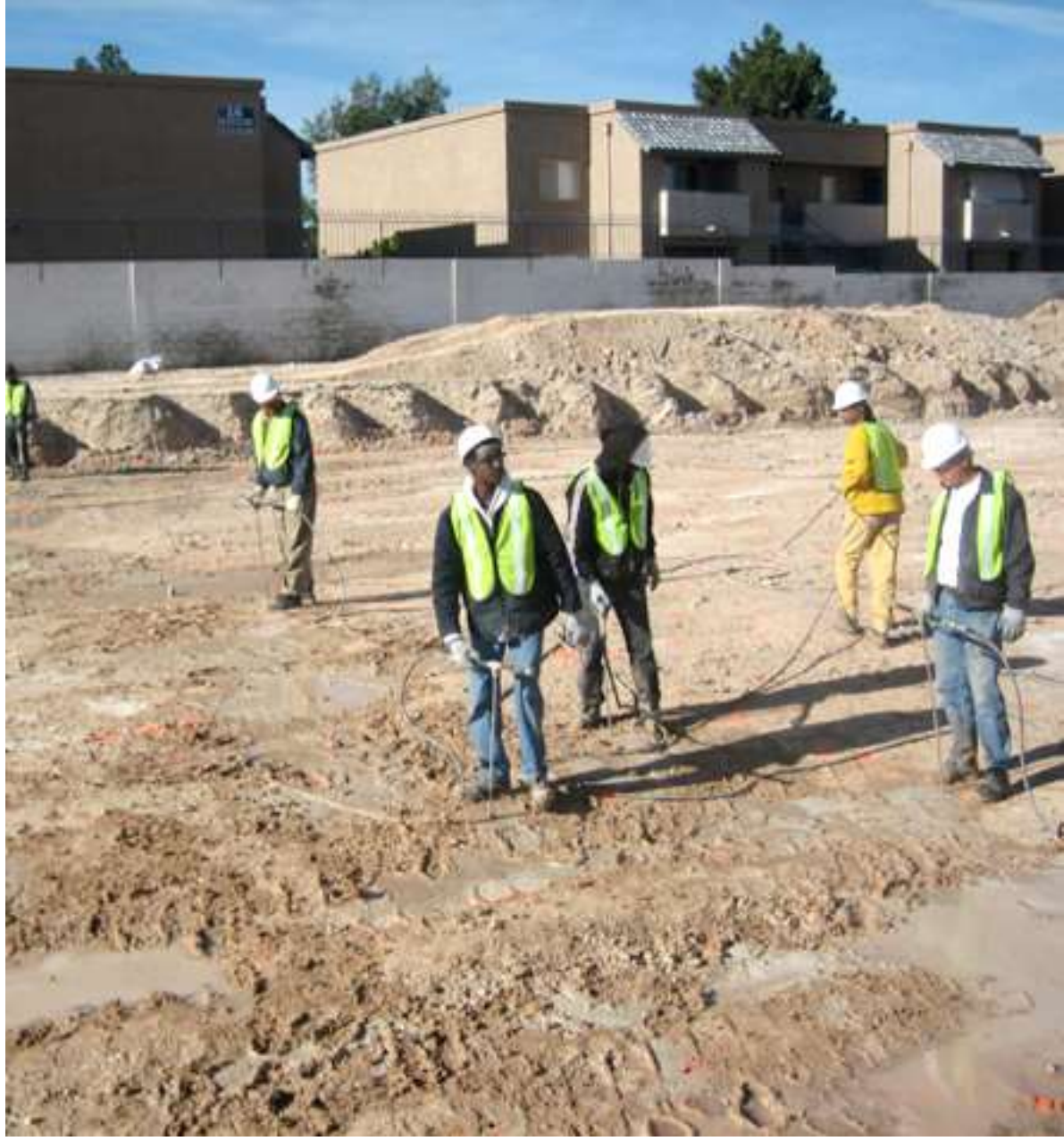
- For new construction of structures, flatwork and roadways
- Excavation of native soil to desired depth and re-compaction of treated soil in 8” loose lifts
- Physical mixing of solution into clay soil using construction disks, reclaimers or Bomags
- Guarantees best results and is used for all clays, including very hard clays and claystones

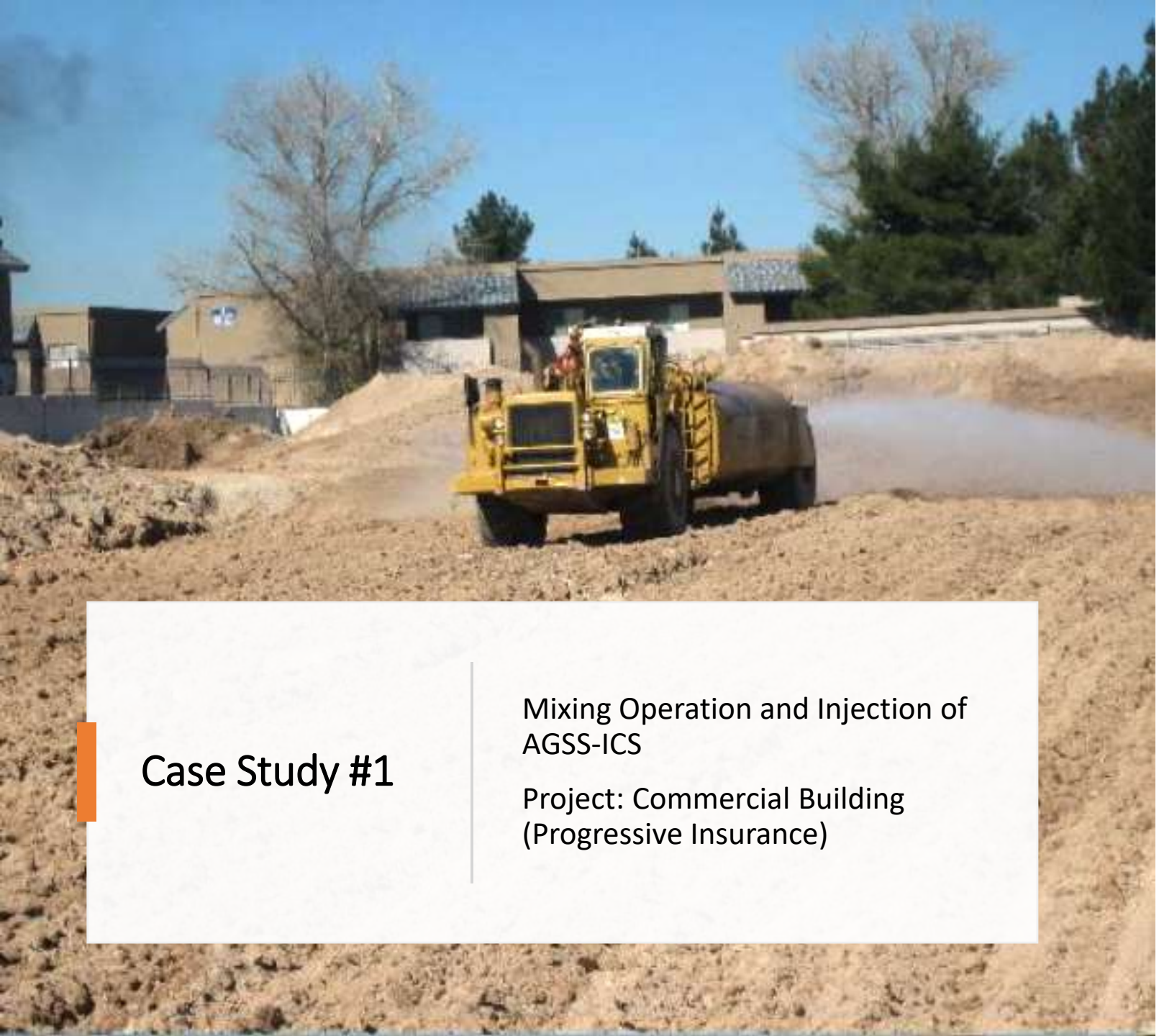


Application – Injection

Soil Injection

- Can be used for new construction or remediation of existing distressed structures
- Large injection rig can treat up to 10,000 ft^2 per day
- Hand injection is ideal for remedial treatment of existing structures, roads, etc.





Case Study #1

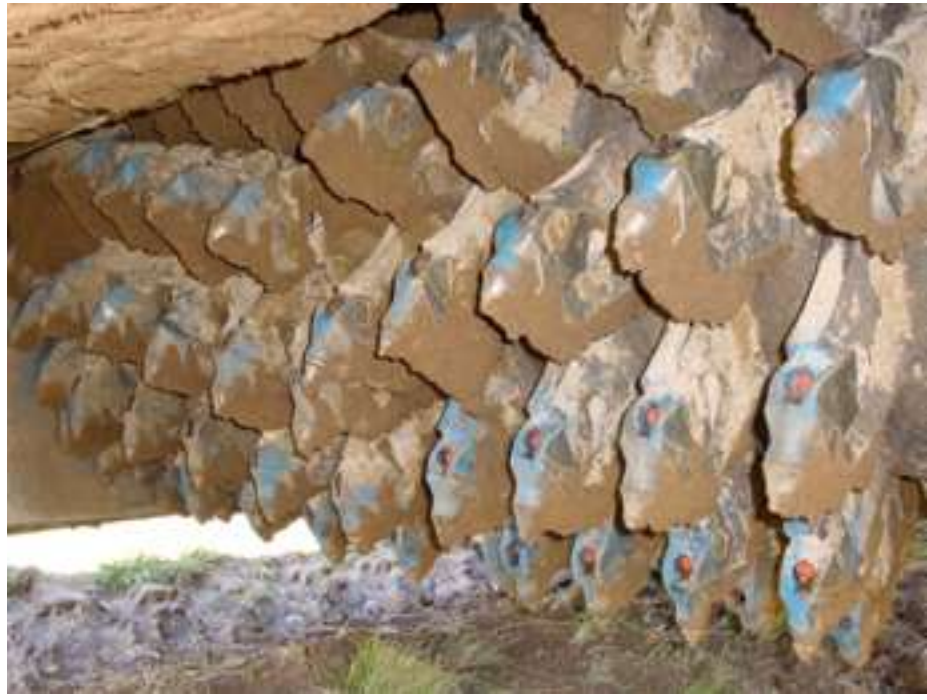
Mixing Operation and Injection of AGSS-ICS

Project: Commercial Building (Progressive Insurance)

Summary of Swell Test Data
New Construction of Commercial Building

BLACK MOUNTAIN ENGINEERING, INC.
Consulting Engineers & Scientists

DATA SUMMARY OF CHEMICAL TREATMENT ON LARGE COMMERCIAL BUILDING ON BOULDER HIGHWAY					
LOCATION	DRY DENSITY (PCF)	INITIAL MOISTURE CONTENT (%)	FINAL MOISTURE CONTENT (%)	SWELL (%) FOR UNTREATED SOIL	SWELL (%) FOR TREATED SOIL
4080 Boulder Hwy. N.W. - 2.0 feet	90.6	22.6	36.1	**13**	
4080 Boulder Hwy. N.W. – 2.0 feet	92.1	22.6	25.7		**0**
4080 Boulder Hwy. S.W. – 2.0 feet	94.7	17.4	23.5	**11**	
4080 Boulder Hwy. S.W. – 2.0 feet	96.1	17.6	24.5		**0**
4080 Boulder Hwy. N.E. – 2.0 feet	95.8	10.0	24.8	**15**	
4080 Boulder Hwy. N.E. – 2.0 feet	97.0	10.4	21.4		**1**
4080 Boulder Hwy. C.E. – 2.0 feet	98.2	11.6	23.0	**16**	
4080 Boulder Hwy. C.E. – 2.0 feet	99.0	12.3	16.8		**1**
4080 Boulder Hwy. N.C. – 1.5 feet	106.7	14.0	16.9	**10**	
4080 Boulder Hwy. N.C. – 1.5 feet	107.5	15.5	17.4		**0**



Case Study #2

- Mixing Operation of AGSS-ICS
- Project: Commercial Lofts

Summary of Swell Test Data
New Construction of Commercial Lofts

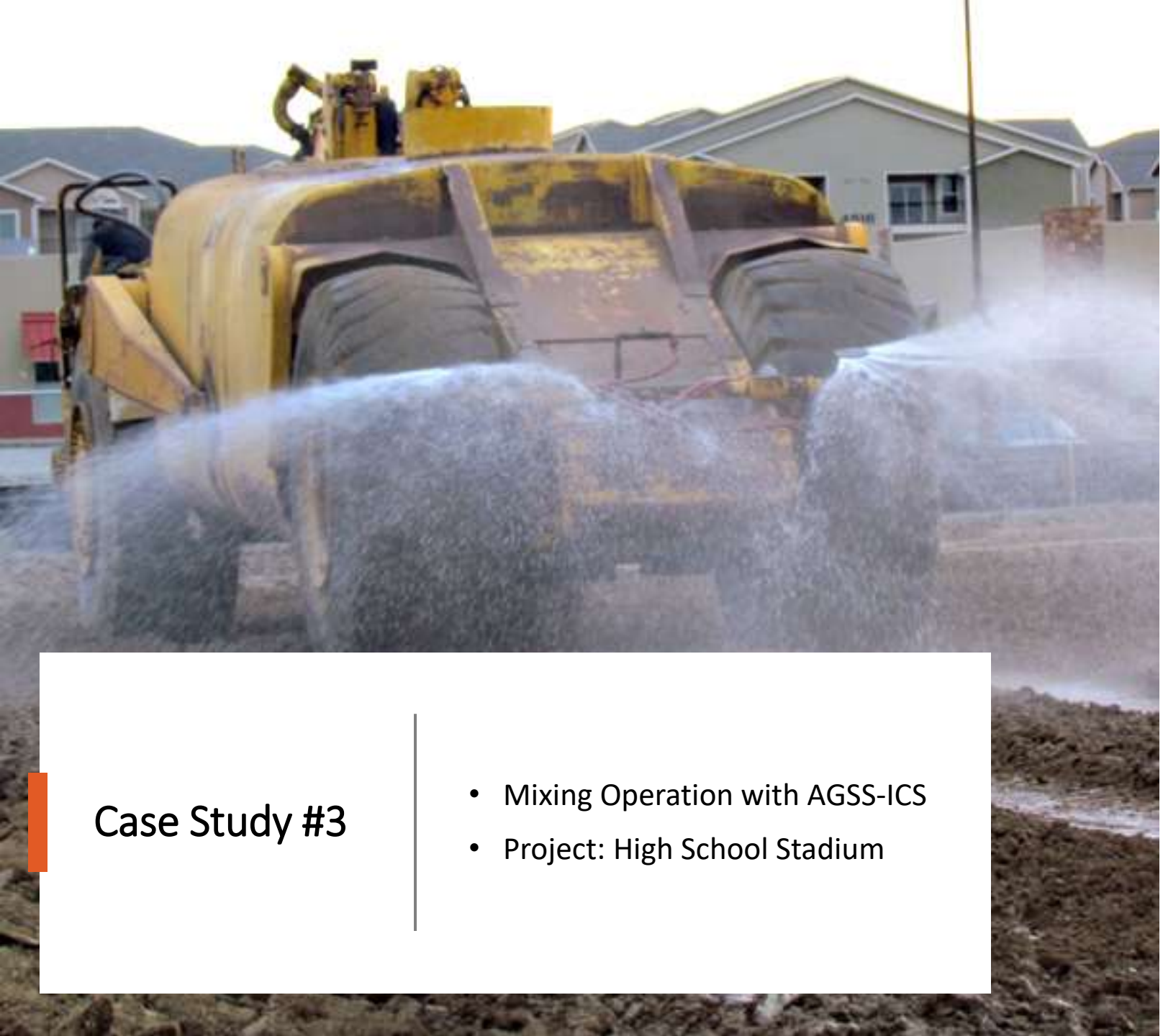
Douglas FOUNDATION SOLUTIONS

LABORATORY SWELL TEST SUMMARY FOR COMMERCIAL LOFTS PROJECT

Test Type	Statistical Parameter	Dry Density (pcf)	Pre-swell Moisture Content (%)	Post-swell Moisture Content (%)	Percent Swell (%)
Treated Undisturbed Swell Tests (21 day test results)	Number Sampled & Tested	96	96	96	96
	Mean	95.6	22.5	27.2	**2.4**
	Standard Deviation	6.38	4.24	4.70	1.49
	Range	72.7 – 105.8	16.4 – 41.0	20.7 – 47.7	0.3 – 7.5
Untreated Remolded Swell Tests	Number Sampled & Tested	73	73	73	73
	Mean	94.5	23.9	40.9	**20.4**
	Standard Deviation	1.91	1.67	16.9	22.3
	Range	87.9 – 103.3	21.8 – 32.2	21.9 – 95.8	0.1 – 91.0

THREE DAY AND TWENTY ONE DAY LABORATORY SWELL TEST SUMMARY ON TREATED SAMPLES FOR THE COMMERCIAL LOFTS PROJECT

Test Type	Statistical Parameter	Dry Density (pcf)	Pre-swell Moisture Content (%)	Post-swell Moisture Content (%)	Percent Swell (%)
3 Day Swell Test Results for Treated Undisturbed Samples	Number Sampled & Tested	37	37	37	37
	Mean	92.0	24.9	30.0	**2.52**
	Standard Deviation	9.10	7.21	8.29	1.67
	Range	63.3 – 105.6	13.6 – 51.1	20.0 – 62.4	1.0 – 10.3
21 Day Swell Test Results for Treated Undisturbed Samples	Number Sampled & Tested	37	37	37	37
	Mean	92.8	24.1	29.1	**1.80**
	Standard Deviation	7.42	5.26	5.91	1.39
	Range	72.7 – 105.8	16.7 – 41.0	20.7 – 47.7	0.3 – 7.2



Case Study #3

- Mixing Operation with AGSS-ICS
- Project: High School Stadium

Summary of Swell Test Data New Construction High School Stadium

- Average treated swell = 0.45%
- Untreated swell varied between 2%-10%

Table 1. Swell Test Summary from Construction

West Side of Stadium			East Side of Stadium		
Sample No.	Depth Below Finished Subgrade (ft)	Swell Potential (%)	Sample No.	Depth Below Finished Subgrade (ft)	Swell Potential (%)
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GI16298	8	0.9	GI16385	8	0
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GI16318	6	0.0	GI16402	5	0.1
GI16319	6	0.7	GI16403	5	0.7
GI16320	6	0.0	GI16404	5	0.5
GI16330	5	0.0	112116A	3	0.7
GI16331	5	0.5	112116B	3	0.9
GI16332	5	0.0	112116c	3	1
GI16342	4	0.4	GI16409	1	1
GI16343	4	1.6	GI16410	1	0.5
GI16343*	4	0.7	GI16411	1	1
GI16344	4	0.3	GI16421	0	0.2
GI16349	3	0.7	GI16422	0	0.2
GI16350	3	1.8	GI16423	0	1.7
GI16350*	3	1.0	GI16423*	0	0
GI16351	3	0.0			
GI16360	0	0.4			
GI16361	0	0.1			
GI16362	0	0.6			

*Retested about 3 weeks after sampling

Average Treated Swell = 0.45%

Untreated Swell Varied between 2% - 10%

The nuclear moisture/density tests performed during construction met the moisture and compaction specification outlined in STRATA's geotechnical plan sheets for the project titled "Campbell County Athletic Play Fields, Campbell County Athletic High School South Campus, Gillette, Wyoming" dated May 26, 2016.

Three of the swell tests performed during construction had swell potentials greater than 1 percent. Portions of the samples were maintained in STRATA's laboratory. Portions of the 3 samples that exceeded 1 percent were tested again approximately 3 weeks after treatment to allow the chemical more time to react with the clay. Each of the 3 retest results were less than 1 percent swell. The swell tests that were done during the treatment of the soil met project specifications.

Using the retest values, the average swell potential is about 0.5 percent. If 0.5 percent swell were to be realized over the 8-foot treated zone, due to an increase in the moisture content, the resulting movement at the ground surface would be about ½-inch.

Summary of Swell Test Data (Continued)

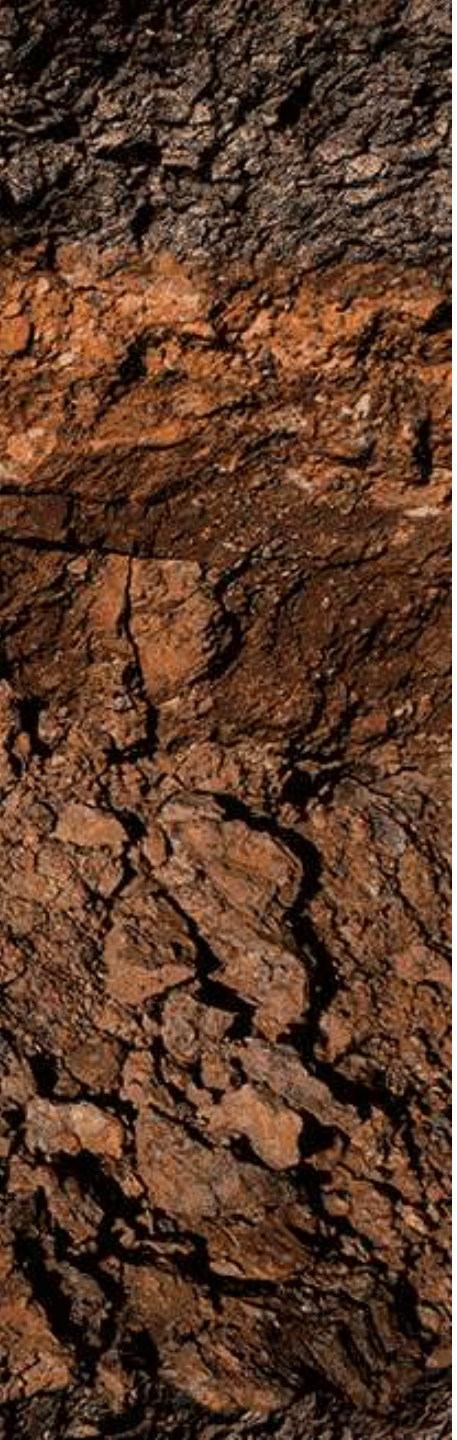
- Average treated swell = 0.43%
- Untreated swell varied between 2% - 10%

Gillette High School Football Field and Track Test Pit Sampling and Swell Testing

Borehole and Test Pit Locations	Elevation (ft.)	Strata Dry Unit Wt. (pcf)	NTI Dry Unit Wt. (pcf)	Average Dry Unit Wt. (pcf)	Strata In-Situ Moisture Content (%)	NTI In-Situ Moisture Content (%)	Average In-Situ Moisture Content (%)	Average Wet Unit Wt. (pcf)	Calculated Incremental Vertical Pressure (ksf)	Calculated Total Vetical Pressure (ksf)	Applied Vertical Pressure for Swell Test (ksf)	Initial Moisture Content at Beginning of Swell Test (%)	Final Moisture Content at End of Swell Test (%)	Strata Swell (%)	NTI Swell (%)
5" Post Tensioned Concrete Track	1.42							150.0	0.06	0.06					
12" Base Course	1.0							140.0	0.14	0.20					
B-1	-0.5	101.7	103.4	102.6	20.9	19.5	20.2	123.3	0.06	0.26	0.2500			0.6	
B-1	-3.0	104.3	103.9	104.1	18.7	16.7	17.7	122.5	0.31	0.57	0.5625			0.8	0.6
B-1	-5.5	103.4	103.4	103.4	21.2	19.7	20.5	124.5	0.31	0.88	0.8750			1.5	0.2
B-1	-7.0	108.9	110.2	109.6	15.9	13.3	14.6	125.5	0.31	1.19	1.1875			-0.5	0.2
										Average Strata Swell Percentage for Borehole B-1 =				0.73	
										Average NTI Swell Percentage for Borehole B-1 =					0.42
5" Post Tensioned Concrete Track	1.42							150.0	0.06	0.06					
12" Base Course	1.0							140.0	0.14	0.20					
B-2	-0.5	100.5	101.7	101.1	23.2	20.7	22.0	123.3	0.06	0.26	0.2500			0.4	
B-2	-3.0	100.5	102.8	101.65	18.8	17.0	17.9	119.8	0.30	0.57	0.5625			1.4	0.4
B-2	-5.5	107.1	108.9	108	19.4	16.9	18.2	127.6	0.31	0.88	0.8750			-0.4	0.1
B-2	-7.0	113.1	112.8	112.95	17.2	16.8	17.0	132.2	0.32	1.20	1.1875			0.8	0
										Average Strata Swell Percentage for Borehole B-2 =				0.65	
										Average NTI Swell Percentage for Borehole B-2 =					0.20
5" Post Tensioned Concrete Track	1.42							150.0	0.06	0.06					
12" Base Course	1.0							140.0	0.14	0.20					
B-3	-0.5	101.1	103.2	102.2	23.6	22.4	23.0	125.6	0.06	0.27	0.2500			0	
B-3	-3.0	104.4	104.0	104.2	19.8	18.7	19.3	124.3	0.31	0.58	0.5625			0.6	0.3
B-3	-5.5	100.3	101.2	100.8	17.8	16.0	16.9	117.8	0.30	0.88	0.8750			-0.3	-0.8
B-3	-7.0	99.2	106.2	102.7	18.6	16.7	17.7	120.8	0.30	1.18	1.1875			0.8	0.3
										Average Strata Swell Percentage for Borehole B-3 =				0.35	
										Average NTI Swell Percentage for Borehole B-3 =					0.13
5" Post Tensioned Concrete Track	1.42							150.0	0.06	0.06					
12" Base Course	1.0							140.0	0.14	0.20					
B-4	-0.5	106.5	108.7	107.6	18.1	16.3	17.2	126.1	0.06	0.27	0.2500			0.8	0.5
B-4	-3.0	110.1	109.4	109.8	17.4	16.4	16.9	128.3	0.32	0.58	0.5625			0.1	
B-4	-5.5	98.1	100.0	99.1	20.3	17.6	19.0	117.8	0.31	0.89	0.8750			1.6	0.1
B-4	-7.0	99.2	99.5	99.4	16.3	16.6	16.5	115.7	0.29	1.18	1.1875			-1.3	-0.9
										Average Strata Swell Percentage for Borehole B-4 =				0.63	
										Average NTI Swell Percentage for Borehole B-4 =					0.16

Untreated Swell Varied between 2% - 10%

Average of Strata Swell data including negative numbers (compression) =	0.43%	
Average of Strata Swell data when negative numbers are made zero =	0.59%	
Average of NTI Swell data including negative numbers (compression). Includes Sheets A & B =		0.13%
Average of NTI Swell data when negative numbers are made zero. Includes Sheets A & B =		0.21%



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