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ROCK MECHANICS TESTING & ANALYSES
MISSISSIPPI CANYON BLK. 252 NO. 1 BP 1
MACONDO PROSPECT
BP AMERICA PRODUCTION COMPANY

ROCK MECHANICS FINAL REPORT

(Multi-Stage Triaxial Compressive Tests)

(Acoustic Velocities)

(Mohr-Coulomb Failure Analyses)

WFT Labs HH-46949

Performed by:

Weatherford Laboratories

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Procedures for Multi-Stage Triaxial Compressive Strength Test

The general procedures for multi-stage triaxial compressive test are summarized in the following:

1) End surfaces of rotary sidewall core are ground flat and parallel each other within 0.001 inch and physical dimensions of the specimen are recorded.

2) The specimen is placed between two platens and a heat-shrink jacket is placed over the specimen.

3) Axial strain and radial strain devices are mounted in the platens and on the lateral surface of the specimen, respectively.

4) The specimen assembly is placed into the pressure vessel and the pressure vessel is closed and filled with hydraulic oil.

5) Confining pressure is increased to the first-stage hydrostatic testing pressure.

6) Increase axial load at a constant displacement rate to the near-peak stress level while confining pressure is held constant.

7) Unload axial stress to 500 psi differential stress, increase confining pressure to the second-stage hydrostatic testing pressure and repeat step 6.

8) Unload axial stress to 500 psi differential stress, increase confining pressure to the third-stage hydrostatic testing pressure and measure acoustic velocities.

9) Increase axial load at a constant displacement rate until the specimen fails while confining pressure is held constant at the final stage.

10) Reduce axial stress to the initial hydrostatic condition after sample fails.

11) Reduce confining pressure to zero and disassemble sample.

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SUMMARY OF TRIAXIAL COMPRESSIVE TESTS

under dry condition

BP America Production Company **Offshore, Louisiana**
Macondo Mississippi Canyon Blk. 252 No. 1 BP 1

Sample No.	Depth (ft)	Confining Pressure (psi)	Compressive Strength (psi)	Static Young's Modulus ($x10^6$ psi)	Static Poisson's Ratio
2-4R	18087.00	500/1000/2000	8760	0.93	0.27
3-17R	18131.90	500/1000/2000	12672	1.69	0.41
3-19R	18141.90	500/1000/2000	10883	1.24	0.34

* compressive strength, Young's modulus and Poisson's ratio determined at third stage

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SUMMARY OF ULTRASONIC VELOCITIES AND DYNAMIC ELASTIC PARAMETERS

under dry condition

BP America Production Company **Offshore, Louisiana**
Macondo Mississippi Canyon Blk. 252 No. 1 BP 1

Sample No.	Depth (ft)	Confining Pressure (psi)	Bulk Density (g/cc)	Ultrasonic Wave Velocity*				Dynamic Elastic Parameter			
				Compressional		Shear		Young's Modulus ($x10^6$ psi)	Poisson's Ratio	Bulk Modulus ($x10^6$ psi)	Shear Modulus ($x10^6$ psi)
				ft/sec	µsec/ft	ft/sec	µsec/ft				
2-4R	18087.00	2000	1.99	10039	99.61	-	-				
3-17R	18131.90	2000	2.04	10481	95.41	6517	153.46	2.76	0.18	1.46	1.17
3-19R	18141.90	2000	2.00	10551	94.77	6861	145.76	2.87	0.13	1.31	1.27

* determined at 500 psi differential stress

- Shear wave of 2-4R was unable to determine.

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SUMMARY OF MOHR-COULOMB FAILURE ANALYSES

BP America Production Company — **Offshore, Louisiana**
Macondo Mississippi Canyon Blk. 252 No. 1 BP 1

Sample No.	Depth (ft)	Confining Pressure Pc = σ_3 (psi)	Differential Stress $\sigma_1 - \sigma_3$ (psi)	Compressive Strength σ_1 (psi)	Unconfined Compressive Strength (psi)	Angle of Internal Friction (deg)	Coeff. Of Internal Friction	Cohesion (psi)
2-4R	18087.00	500	2874	3374	1645	34.2	0.68	435
		1000	4301	5301				
		2000	6760	8760				
3-17R	18131.90	500	4519	5019	2405	42.3	0.91	532
		1000	6444	7444				
		2000	10672	12672				
3-19R	18141.90	500	3085	3585	863	41.6	0.89	194
		1000	4438	5438				
		2000	8883	10883				

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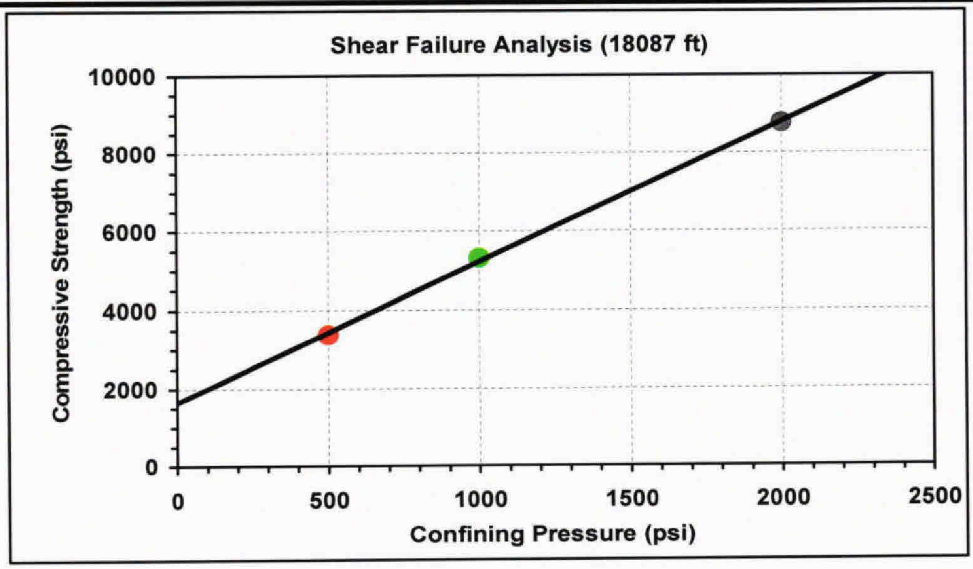
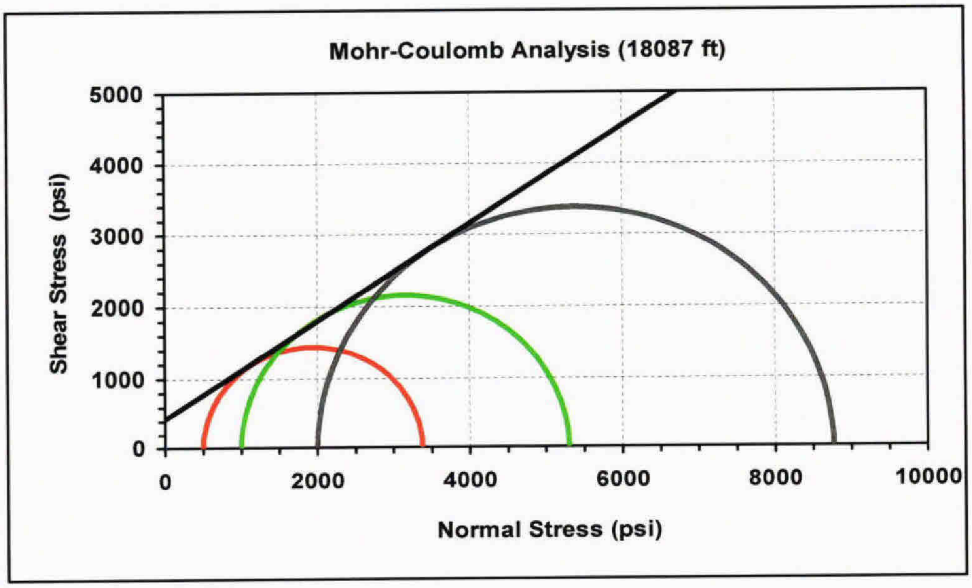
Result of Mohr-Coulomb Failure Analysis using Multi-Stage Triaxial Test

BP America Production Company — **Offshore, Louisiana**
Macondo Mississippi Canyon Blk. 252 No. 1 BP 1

Sample No.	Depth (ft)	Confining Pressure, Pc = σ_3 (psi)	Differential Stress, $\sigma_1 - \sigma_3$ (psi)	Compressive Strength, σ_1 (psi)	Slope on σ_1 vs Pc	Unconfined Compressive Strength (psi)	Angle of Internal Friction (deg)	Coeff. Of Internal Friction	Cohesion (psi)
2-4R	18087.00	500	2874	3374					
		1000	4301	5301	3.57	1645	34.2	0.68	435
		2000	6760	8760					





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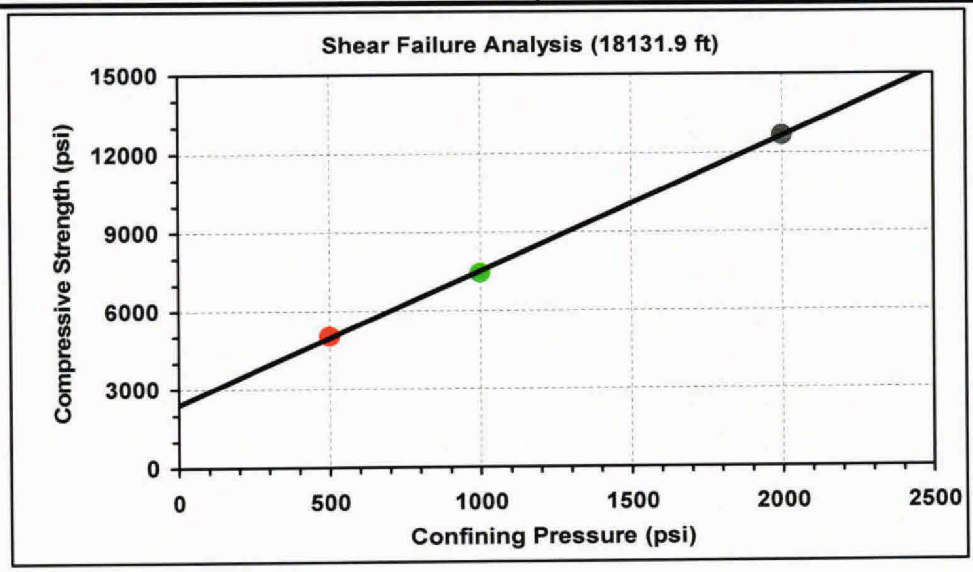
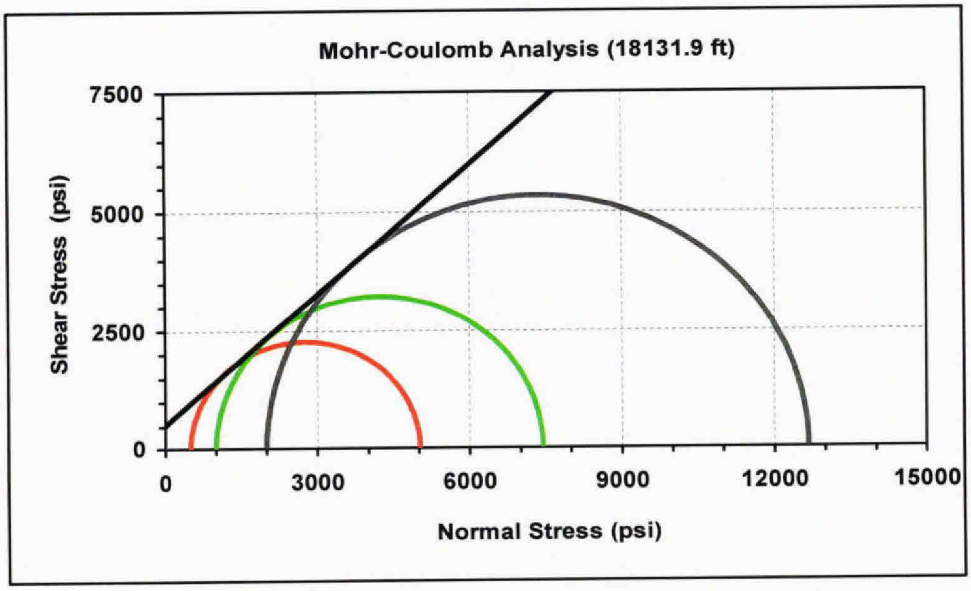
Result of Mohr-Coulomb Failure Analysis using Multi-Stage Triaxial Test

BP America Production Company — **Offshore, Louisiana**
Macondo Mississippi Canyon Blk. 252 No. 1 BP 1

Sample No.	Depth (ft)	Confining Pressure, Pc = σ_3 (psi)	Differential Stress, $\sigma_1 - \sigma_3$ (psi)	Compressive Strength, σ_1 (psi)	Slope on σ_1 vs Pc	Unconfined Compressive Strength (psi)	Angle of Internal Friction (deg)	Coeff. Of Internal Friction	Cohesion (psi)
3-17R	18131.90	500	4519	5019	5.12	2405	42.3	0.91	532
		1000	6444	7444					
		2000	10672	12672					





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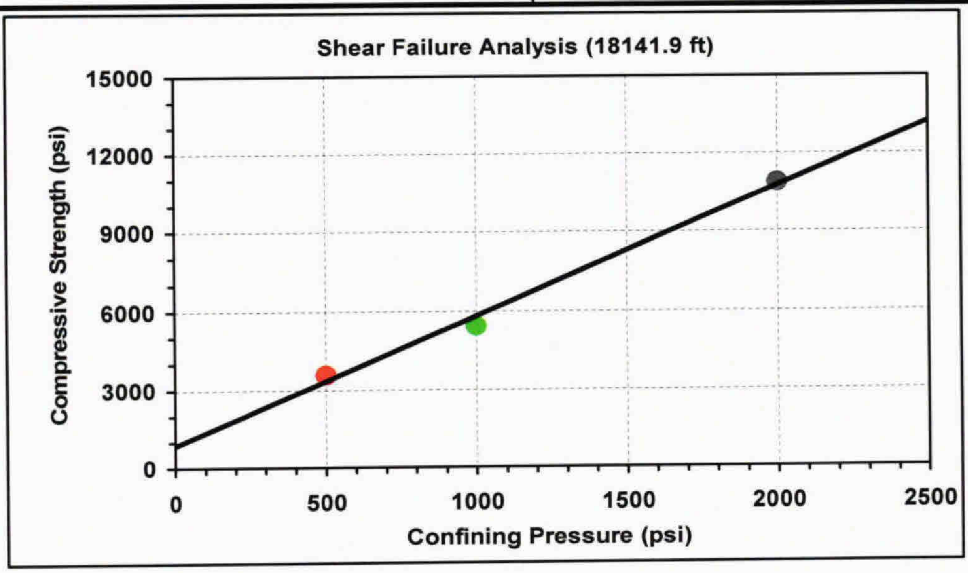
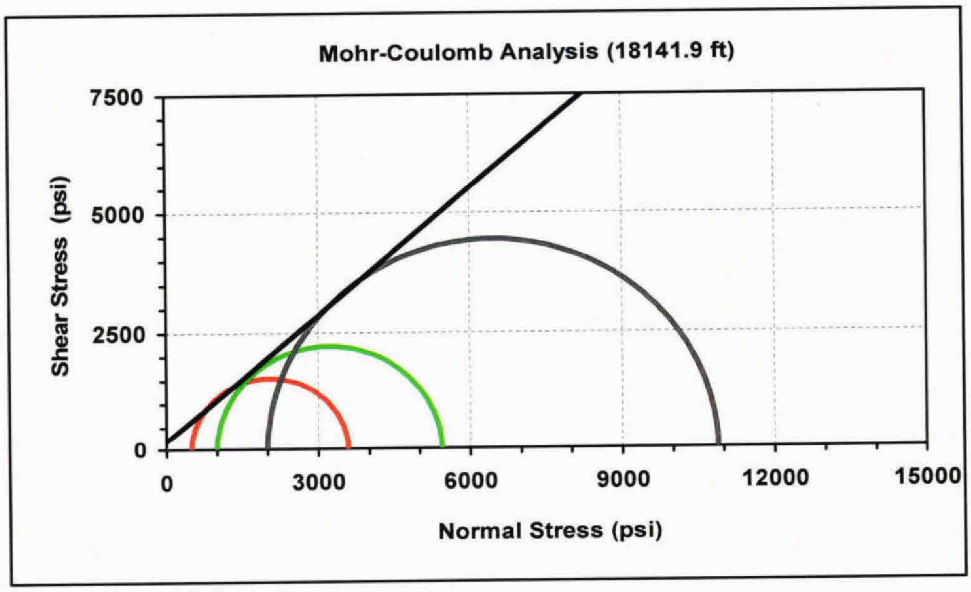
Result of Mohr-Coulomb Failure Analysis using Multi-Stage Triaxial Test

BP America Production Company
Macondo Mississippi Canyon Blk. 252 No. 1 BP 1

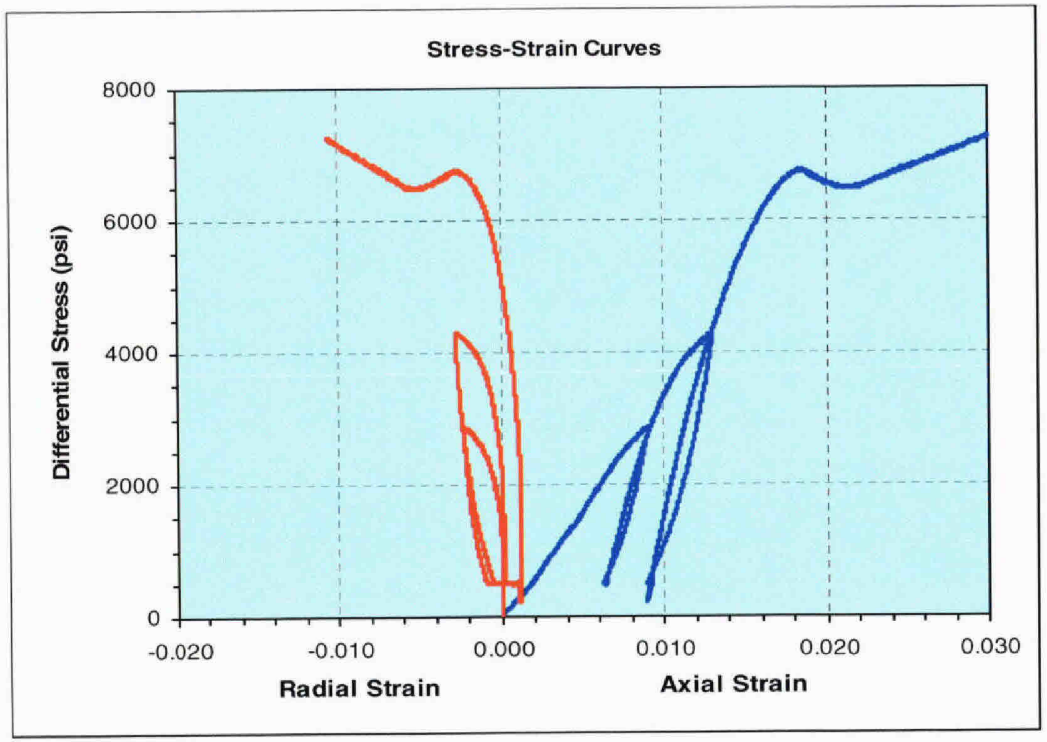
Offshore, Louisiana

Sample No.	Depth (ft)	Confining Pressure, Pc = σ_3 (psi)	Differential Stress, $\sigma_1 - \sigma_3$ (psi)	Compressive Strength, σ_1 (psi)	Slope on σ_1 vs Pc	Unconfined Compressive Strength (psi)	Angle of Internal Friction (deg)	Coeff. Of Internal Friction	Cohesion (psi)
3-19R	18141.90	500	3085	3585	4.95	863	41.6	0.89	194
		1000	4438	5438					
		2000	8883	10883					





Result of Multi-Stage Triaxial Compressive Test



Company	BP America
Project Title	Macondo
WFT Project No.	HH-46949
Date	May, 2010

Sample No.	2-4R
Depth (ft)	18087.00
Saturation State	Dry
Confining Pressure (psi)	500/1000/2000
Bulk Density (g/cc)	1.99
Compressive Strength* (psi)	8760
Young's Modulus* (x10^6 psi)	0.93
Poisson's Ratio*	0.27

* determined at third stage

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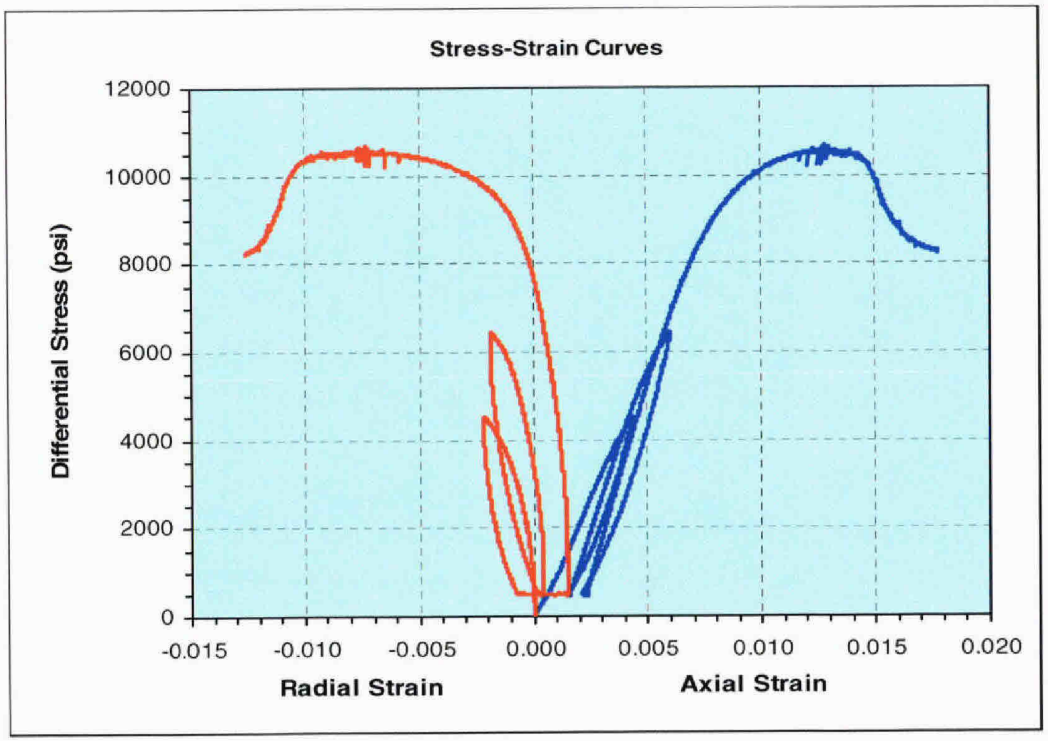
Result of Multi-Stage Triaxial Compressive Test



Company	BP America
Project Title	Macondo
WFT Project No.	HH-46949
Date	May, 2010

Sample No.	3-17R
Depth (ft)	18131.90
Saturation State	Dry
Confining Pressure (psi)	500/1000/2000
Bulk Density (g/cc)	2.04
Compressive Strength* (psi)	12672
Young's Modulus* (x10^6 psi)	1.69
Poisson's Ratio*	0.41

* determined at third stage

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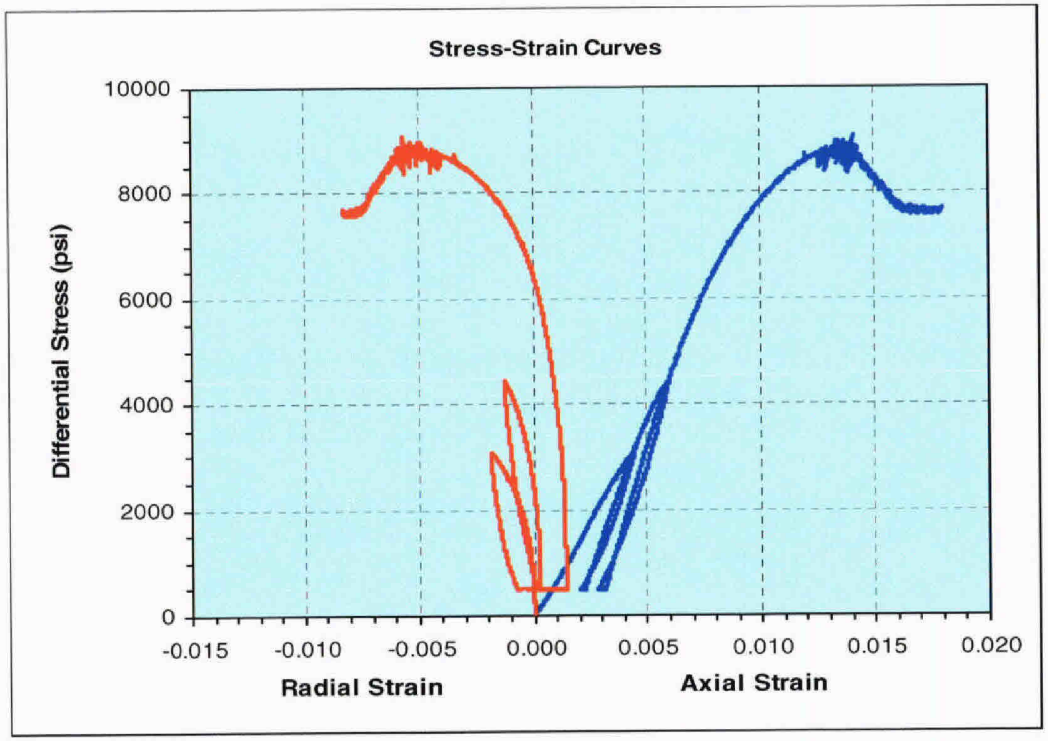
Result of Multi-Stage Triaxial Compressive Test



Company	BP America
Project Title	Macondo
WFT Project No.	HH-46949
Date	May, 2010

Sample No.	3-19R
Depth (ft)	18141.90
Saturation State	Dry
Confining Pressure (psi)	500/1000/2000
Bulk Density (g/cc)	2.00
Compressive Strength* (psi)	10883
Young's Modulus* ($x10^6$ psi)	1.24
Poisson's Ratio*	0.34

* determined at third stage

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