STABView™

Comprehensive
well planning software
for analyzing the risk of:

- *Wellbore Instability*
- *Sand Production*
- *Lost Circulation & Fracturing*
- *Fault or Bedding Plane Slip*

ADVANCED GEOTECHNOLOGY

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STABView™

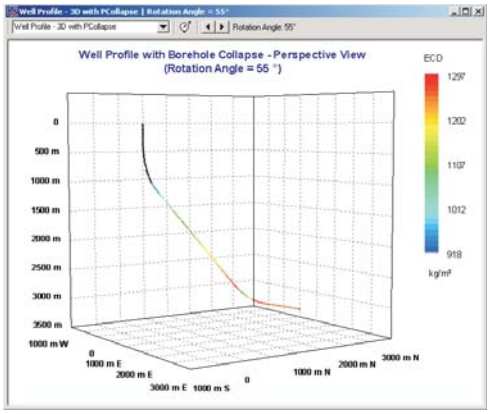
What is STABView?

STABView™ is a state-of-the-art well planning and analysis software for assessing the risk of wellbore instability, lost circulation, hydraulic fracturing, sand production, casing failure or slippage along weak discontinuities. STABView will help you optimize a well's trajectory or the window of bottomhole pressure or mud density to drill, complete, stimulate and produce from vertical, deviated, and horizontal wells in all geological settings. This comprehensive software was developed to set the standard for providing reliable, field-ready well designs and post-mortem analysis. STABView is currently used by engineers, geologists and technologists in:

- Exploration and production companies
- Oilfield service companies
- Engineering consultancies
- Geomechanics research centers
- Universities

Unique capabilities in STABView allow you to: calibrate your models to offset well observations; include all-important pore pressure, temperature and chemical effects; use realistic rock constitutive behavior; import and export to other programs, and much more. Efficient, rapidly-converging algorithms are used to solve the fundamental equations that govern the geomechanical behavior of the near-wellbore area.

"STABView is the veritable Swiss army knife of wellbore integrity software"



Powerful 3D visualization tools can display wellbore collapse, EMW or ECD, sanding pressure or fracture breakdown pressure along a well profile.

Applications

Drilling

1. Optimize your well casing program.
2. Select optimal drilling and completion fluids.
3. Optimize mud chemistry to inhibit clay swelling.
4. Avoid stuck pipe or coiled tubing.
5. Reduce reaming and cleaning time.
6. Avoid drillstring fatigue and failure.
7. Reduce the risk of lost circulation.
8. Improve directional control.
9. Assess suitable candidates for underbalanced drilling.
10. Model hydraulics with realistic enlarged hole sizes.
11. Interpret formation leak-off and stress tests.
12. Predict borehole deformations or squeezing behavior.
13. Predict borehole enlargement in permafrost zones.

Well Control

14. Assess near-wellbore stress and pore pressure conditions.
15. Evaluate hydraulic fracturing options to intersect a flowing well.

Formation Evaluation

16. Avoid stuck or damaged DST and logging tools.
17. Avoid log interpretation problems due to hole ellipticity.
18. Avoid logging limitations in OBMs.
19. Back-analyze in-situ stresses and pore pressures.
20. Evaluate the most permeable natural fracture sets.

Completions

21. Determine well candidates for barefoot completions.
22. Reduce unnecessary cased and perforated completions.
23. Evaluate EST and ESS candidates.
24. Avoid poor cement integrity.
25. Eliminate the risk of fracturing away your cement.
26. Optimize your perforating program.
27. Increase perforation penetration.
28. Eliminate unnecessary sand control.
29. Evaluate the need for a gravel pack in weak sandstones.
30. Evaluate casing deformations or failures due to formation shearing.
31. Design cavity completions for coalbed methane wells.

Stimulations

32. Determine the maximum injection pressure for matrix stimulation.
33. Evaluate the effects of hole trajectory on induced fractures.
34. Assess the potential for linking up induced hydraulic fractures.
35. Estimate the pressure required to re-open or cause slip on natural fractures and faults.

Production

36. Reduce undesirable sand production.
37. Avoid openhole collapse under drawdown conditions.
38. Optimize drawdown to avoid sand production from perforations.
39. Reduce wellbore skin due to unnecessary sand control.
40. Assess the loading on a liner due to sand deformations.
41. Evaluate the risk of mechanical formation damage.
42. Design to collapse sand and pack it around liners or screens.
43. Optimize the performance of gas storage wells by reducing skin.
44. Design for sand production in heavy oil reservoirs (CHOPS).
45. Reduce water production from induced hydraulic fractures.
46. Calculate the maximum waterflood injection pressure to avoid fracturing.
47. Assess thermally-induced fracturing during waterflooding.

New and Novel Applications

48. Design wells for greenhouse gas sequestration.
49. Optimize horizontal directional drilling for pipelines.
50. Evaluate slurry and solid waste injection options.

Wellbore Stability, Lost Circulation, Fracturing and Sand Production Risk Analysis Software

Summary of Features

Drilling

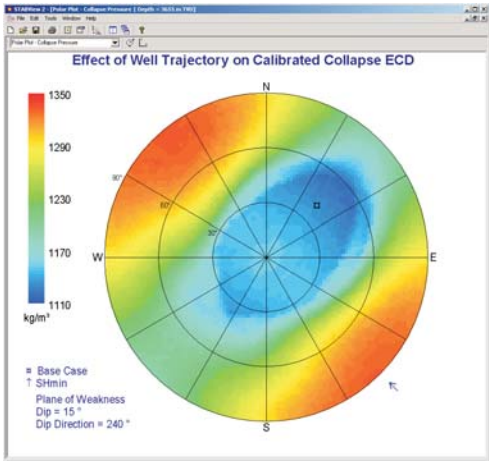
- 2D elastoplastic and 3D elastic models
- Stability and lost circulation predictions
- Pore pressure penetration effects
- Filter-cake and wall coating effects
- Plane of weakness effects
- Physico-chemical drilling fluid-shale interaction effects
- Temperature effects
- Underbalanced drilling effects

Completions/Stimulations

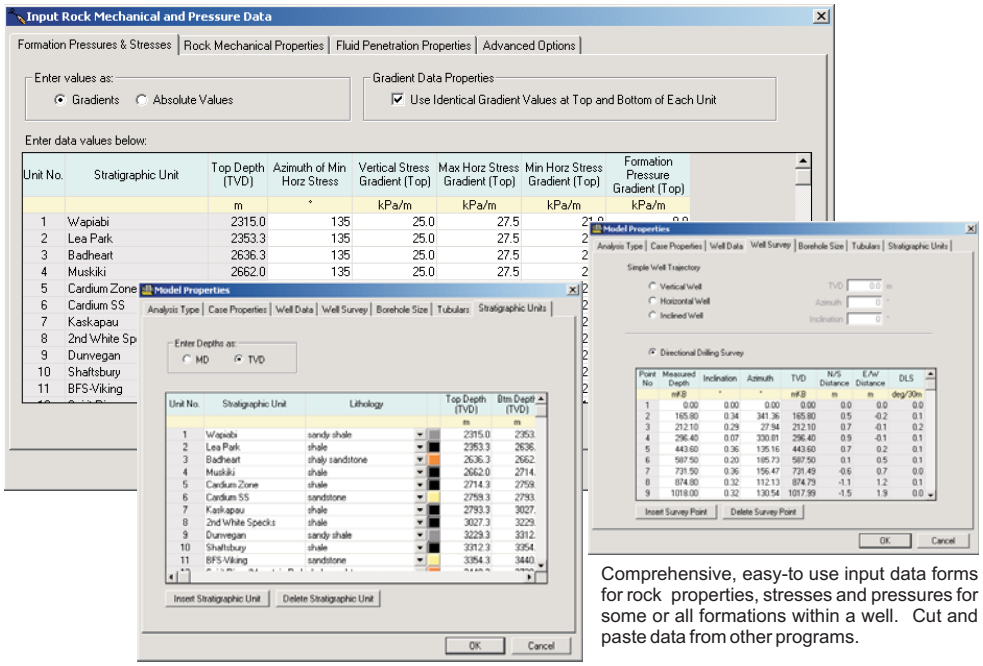
- Openhole, screens, slotted liners or perforations
- Steady-state inflow and outflow
- Strain weakening constitutive model
- Estimate liner or screen loading
- Borehole wall deformations
- Fracture initiation pressures
- Poro-elastic pressure depletion effects

General

- Links to other software
- Rapidly converging solutions
- Graphical sensitivity analyses
- Offset well calibration options
- US oilfield, SI or mixed unit systems
- Comprehensive documentation
- Support and maintenance plans
- Single or multiple PC, network or ASP internet access licenses
- Perpetual, yearly or monthly leasing



Color polar plots show the minimum mud density, equivalent mud weight (EMW) or circulating density (ECD) required to prevent borehole collapse. STABView's 3D linear elastic model can account for the effects of weak bedding planes, fractures or faults.



Comprehensive, easy-to use input data forms for rock properties, stresses and pressures for some or all formations within a well. Cut and paste data from other programs.

Software Benefits

STABView will add to the bottom line in your organization by:

1. Reducing non-productive problem time during drilling, completion or workover operations,

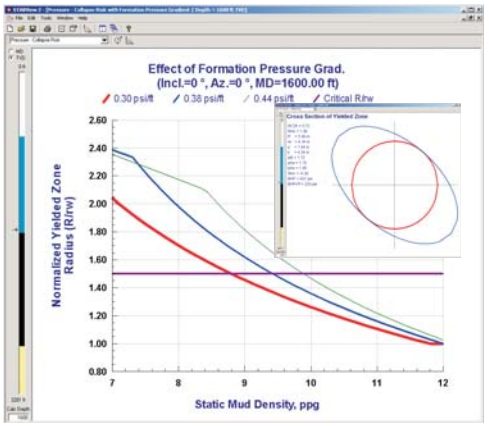
2. Elevating the knowledge base and technical capabilities of personnel involved with well design, construction or operations,

3. Allowing you to push the technical well design envelope for more challenging resources, such as in deepwater settings, tectonically deformed basins, permafrost regions, poorly cemented overpressured reservoirs, shale gas and coalbed methane.

Optimized engineering solutions to minimize risk and protect your investment.

Who Uses STABView?

- Chevron
- Shell International
- Petrobras
- Petronas Carigali
- Nexen
- Chinese Petroleum Corporation
- Weatherford
- Baker Oilfield Services
- Instituto Mexicano de Petroleo
- Newpark Drilling Fluids
- QMax Solutions
- Helix RDS



2D elastoplastic model predicts the size of the yielded zone around a borehole as a function of mud density or bottom-hole pressure, and various parameter sensitivities.

STABView™ Technical Features (Version 3.0)

Types of Wells

- Vertical, horizontal, or deviated wells
- Offshore or onshore wells
- Single or multiple zone analyses
- * Multi-branching wells

Drilling Instability

- Evaluate instability risks as function of ECD, EMW, BHP, SG, mud density, over- or underbalance pressure
- 3D linear elastic models
- 2D elastoplastic models
- 3D passive shear failure initiation (borehole ballooning)
- Swab and surge pressure effects
- Underbalanced drilling features
- Calculate a mud density, EMW, ECD or bottomhole pressure required to achieve a tolerable instability risk, e.g., hole enlargement
- Calculate wellbore instability risks for a specified mud density, ECD, EMW or bottomhole pressure
- Calculate and display the drilling "mud weight window"
- Thermo-elastic effects due to steady-state conductive heat transfer
- Export a predicted profile of enlarged hole sizes for hydraulics optimization

Lost Circulation and Fracturing

- 3D elastic tensile fracture criterion
- Penetrating fluids (water, selected drilling and completion fluids)
- Non-penetrating fluids (cement, some muds)
- Thermo-elastic effects on fracture breakdown due to steady-state conductive or convective heat transfer
- Analyze packer and sleeve induced fractures
- Fracture toughness-based breakdown criterion (after Morita)
- Specify a critical fracture plugging aperture
- * 3D fracture link-up pressure

Sand Production and Control

- 2D elastoplastic models
- 3D linear elastic models
- Extent of horizontal well collapse (rubble fill percentage)
- Near-wellbore skin can be used as an input parameter
- Perforated, openhole, slotted liner, screen and expandable completions can be analyzed
- Cylindrical or hemi-spherical perforation cavities
- Input pressure drop across liners, screens and expandables
- First-order estimate of isotropic loading on liners or screens
- First-order estimate of borehole wall deformations

In-situ Stresses

- Biaxial stress state (2D models)
- Triaxial stress state (3D models)
- Correct stresses for reservoir pressure depletion or injection effects
- * Rotated principal stresses, e.g. salt, thrust fault stress regimes
- * Future link to AGI stress prediction software: ROCKStress™

Planes of Weakness, Faults and Natural Fractures

- Account for the effects of ubiquitous, weak discontinuities on the risk of borehole collapse
- Mohr-Coulomb failure criterion
- Shear failure and slip tendency analysis for weak bedding planes, faults, natural fractures, cleats
- Re-opening pressure analysis for weak bedding planes, faults, natural fractures, cleats

Pore Pressure and Capillarity

- Steady-state pore pressure conditions (inflow or outflow)
- Capillary threshold pressure for OBM and pseudo-OBM
- Apparent capillary strength for weak sands
- Filter cake efficiency model for permeable sandstones
- Wall coating efficiency model for shales
- Effect of an instantaneous BHP change
- Fluid viscosity and permeability effects
- Formation damage and skin effects
- Steady-state non-Darcy flow effects for high rate gas wells and perforations
- Compressible fluid effects in the near-wellbore area
- Skin damage option for underbalanced drilling

Rock Failure Models

2D Elastoplastic Model

- Strain-weakening Mohr-Coulomb

3D Elastic Models

- Mohr-Coulomb
- Modified Lade
- Non-linear Hoek-Brown
- Tensile fracture criteria
- Passive shear failure initiation

Other Options

- Biot or Terzaghi effective stress
- * Empirical hole size effects on effective rock strength
- * Time-dependent loss or gain of rock strength

Borehole Stresses and Pressures

(As a function of radial distance)

3D Elastic Models

- Principal stresses (σ_1, σ_2, σ_3)
- Normal stresses (σ_θ, σ_r, σ_z)
- Shear stresses ($\tau_{r\theta}$, τ_{rz}, $\tau_{\theta z}$)
- Pore pressure

2D Elastoplastic Models

- Pore pressure
- Normal and shear stresses

* *New feature in development*

STABView™ Technical Features (Version 3.0)

Borehole Deformations and Strains

2D Elastoplastic Model for Isotropic Stresses

- Total strains
- Plastic strains
- Total radial displacements

Chemical Effects

- Osmotic pressure model for clay inhibition effects based on shale and mud activities (API RP13 specification)
- Handles many common oil-based and water-based drilling fluids
- Database of published shale water activities and membrane efficiencies for a variety of shales and fluids
- Drilling fluid activity calculator

Thermal Effects

- Steady-state conductive or convective heat transfer effects on fracture breakdown pressure
- Steady-state conductive heat transfer effects on 3D elastic borehole collapse risk
- Time-dependent thawing and hydraulics model for permafrost

Integration with Other Software

- Export text or graphics files
- Seamless integration with Microsoft Word, Excel, PowerPoint
- Import well survey data
- Cut and paste annular pressure data from wellbore hydraulics and multiphase flow modeling software

* Run interactively with casing design, pore pressure, hydraulics and other wellbore design software

* Interactive data exchange capabilities

Databases

- STABView case history database (optional)

* Links to ROCKSBank™, AGI's worldwide rock mechanical and petrophysical properties database

* Links to ROCKStress™, AGI's in-situ stress database and calculator

* Auto-populate multi-zone analyses from external databases, e.g., Peloton's WELLVIEW

Reports and Graphics

- Parameter sensitivity plots available for most stability models
- Scrollable "mud weight window" with re-scaling and zoom
- Color polar contour plots for all 3D models
- Export graphics to BMP and EMF file formats
- Clipboard support for copying and pasting output graphics and text
- Print to any Windows-supported device
- Single or multi-zone input and output reports
- Print preview capability for text reports
- Well plan and profile plots with color-contoured BHP, mud density, drawdown pressure, or other risk parameters
- Customizable color selection for lithologies

* New export file formats: PDF, JPG, GIF, RTF, XLS

* 3D visualization capabilities

Calibration & Validation Options

- Fix an acceptable BHP, drawdown pressure or mud density based on the performance of an offset well
- User-defined borehole breakout angle criterion

* Calibration options for borehole collapse and fracture breakdown

* Automatic inversion of best-fit parameters from hole enlargement observed on caliper logs from offset wells

Units

- US oilfield and SI units
- High precision units for shallow wells and pipeline horizontal directional drilling (HDD)
- Customizable mixed units

Functionality

- Right-click drop-down menus on all screen output
- Solution algorithms optimized for rapid performance
- Designed for graphical sensitivity analyses
- Preferred user settings saved on exit
- Ability to cancel calculations in progress
- Run button to compute results as required

Operating Systems

- Windows NT/2000/XP/Server 2003

Network/Deployment Options

- Up to 3 PC installations for a single USB security key
- LAN version available with one or more concurrent seats
- Customized network configurations can be arranged

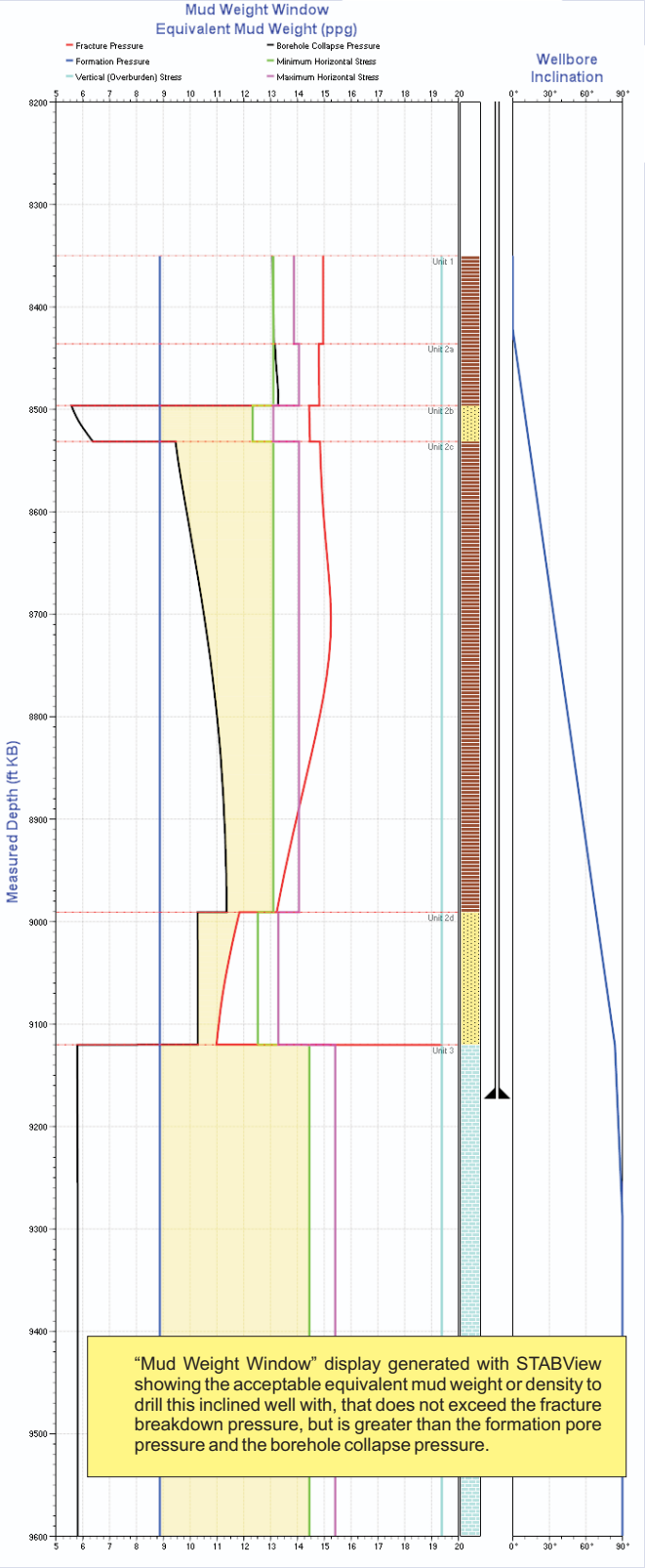
Internet Accessible Version

* Available on *AGI Live!*, Advanced Geotechnology's ASP for short term trials, demonstrations, remote out-of-office access, course instruction and monthly leasing. Contact AGI for more information.

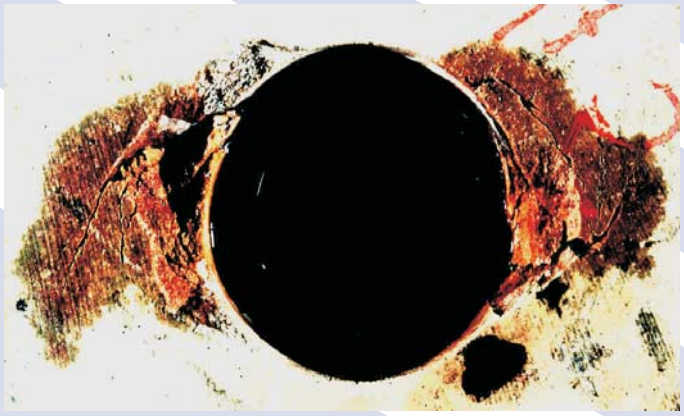
Help & Documentation

- Real-time input data validation
- Online Acrobat and hardcopy user manuals
- Example files for all problem types
- Comprehensive list of related publications
- STABView case history collection (optional)
- AGI website and email support
- AGI newsletter "Geotechnology Views"

* *New feature in development*



"Mud Weight Window" display generated with STABView showing the acceptable equivalent mud weight or density to drill this inclined well with, that does not exceed the fracture breakdown pressure, but is greater than the formation pore pressure and the borehole collapse pressure.



Acknowledgements

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About Advanced Geotechnology

Advanced Geotechology is a consulting, training and software company based in Calgary, Canada that specializes in petroleum geomechanics. We were founded in 1994 and have conducted over 300 consulting and research projects for more than 80 organizations around the globe. We also provide training courses for engineers and geoscientists in geomechanics and reservoir characterization.

Advanced Geotechnology also developed and markets **ROCKSBank™** - the industry's first commercial rock mechanical and petrophysical properties database. **ROCKSBank** allows users to efficiently manage, analyze, search for and store valuable laboratory and log-derived formation rock property data. The database is delivered with a comprehensive worldwide dataset for thousands of rock samples and discontinuities. Non-proprietary rock mechanical and acoustic property data for many reservoir and caprock formations from petroleum basins around the world have been compiled, quality-rated and organized for rapid review, analysis and application. Proprietary data can also be stored, analyzed and compared to data from the open literature.

Contact us today if you would like to learn more about our services and software.

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