Stratigraphic Modeling

Surface Mining

Reclamation

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Blasting

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Point Clouds

Carlson
MINING SOFTWARE

Software for Mining Professionals

Carlson
MINING SOFTWARE

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Carlson Headquarters, Maysville, Kentucky USA

Top attributes of Carlson Mining software solutions include:

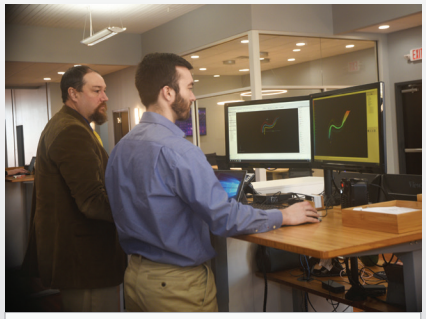
- Easy to learn
- Affordable
- Fast paced, client driven development
- DWG Based; runs inside AutoCAD®; comes with IntelliCAD® built-in
- Reads existing geologic data
- Optional database linking
- Modular design, pay only for what you need
- On-site and remote support and training
- Access to a production & support team with combined 100+ years of mining software experience

"From the very beginning of the company, Carlson Software has focused on mining applications. Our location within a five hour drive of virtually all mines in the U.S. Appalachian and Illinois coal basins dictated that and helped us realize the real need for automation of processes. Our goal is to ensure greater mining productivity utilizing best practices as they apply throughout the world. Together with our software engineers, our experienced sales staff, and our valued customers, we look forward to meeting your needs."

— R. Bruce Carlson
President & Founder
Carlson Software

For the complete mining software solution, look to Carlson

Carlson mining solutions are used throughout the world in all types of mining operations, including coal, phosphate, trona, limestone, aggregates, granite, clay, and the hard rock and metals markets. Whether the application is underground mining, surface mining, permitting, geologic mapping, reserves studies, or reclamation, **Carlson** provides uniquely powerful automation combined with our trademark ease of use. **Carlson Software** listens to its customers and builds the software to meet users' needs. We believe there is a direct correlation between our status as a dominant software in this market (approximately 90 percent of the US coal industry utilizes **Carlson Mining software**) and our commitment to both advanced technology and customer service. Enhancing the software is a never-ending process, which is seen through some of our recent improvements such as improved optimized pit design, new tools for underground solid design, and linking surface mine timing, spoil placement timing and the haul truck routes for the complete mining cycle.



"As a geologic modeling and mine planning software package, Carlson ranks highest in their user support and services."

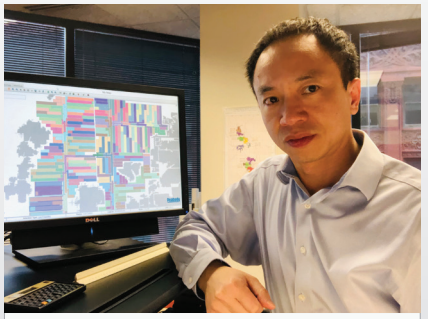
Brian Groff
Groff Engineering
Mt. Sterling, KY

"Carlson has allowed us to use new technology to its fullest. Carmeuse has been working with Carlson for 17+ years. We recently added a GPS drill to our fleet. It was just a quick conversation with Tyler and I learned about a command that would help streamline the drill pattern design process. With this command, I can take drill design and add the surface and floor elevations. This drill plan is used by the drill to navigate to designed hole locations and drill to a variable floor."

Melissa Martinie
Carmeuse Lime & Stone
Pittsburgh, PA

"Carlson is a much user-friendly software as compared to other mine planning software as it has CAD-based user interface. Thanks to the developers, they incorporated the fault modelling by providing the interpolation option which is necessary, when the complex nature of Indian Coal Geology is taken into consideration."

Sudharsan Rath
CMPDI
Ranchi, India



"Carlson software provides one seamless platform for multiple critical mining processes. As a customer of 25 years, we see significant value for surveyors, geologists, mining engineers and environmental engineers to work in this wonderful platform. The software equips with a full spectrum of sophisticated tools, but never lacks of flexibilities for users to be innovative."

Hui Hu
Peabody Energy
St. Louis, MO

Carlson Geology

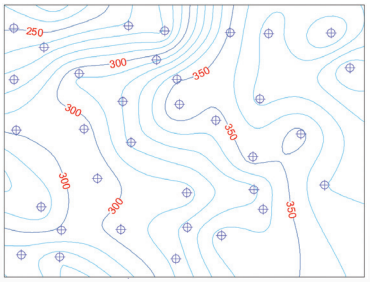
Stratigraphic Modeling

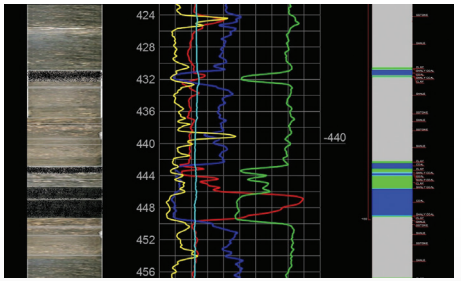
Analyze, model, and fine-tune your geology

The Carlson Geology Module uses drillholes, channel samples, and user-defined 3D polyline data to create accurate and easy-to-use geologic models. A variety of industry standard modeling algorithms are available, allowing you to create stratigraphic grid models and block models that are realistic, reproducible, and reliable.

Drillholes

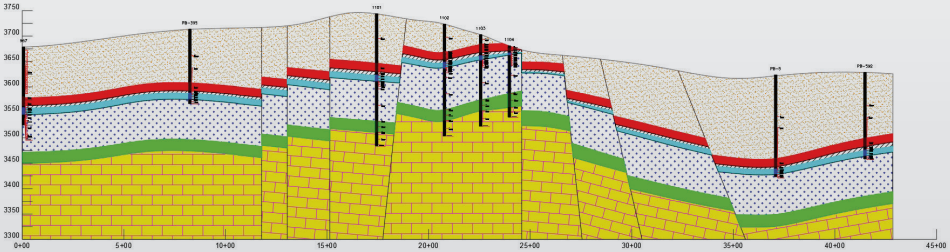
- Import from any format using custom settings
- Store drill data directly in the drawing or dynamically link to external databases
- Draw geologic columns in section-view or in 3D to correlate strata
- Validate holes with queries and reports
- Use tools such as Strata Polylines, Horizon Codes, and drillhole equations to build complex models
- Import E-Log geophysical LAS files and core images

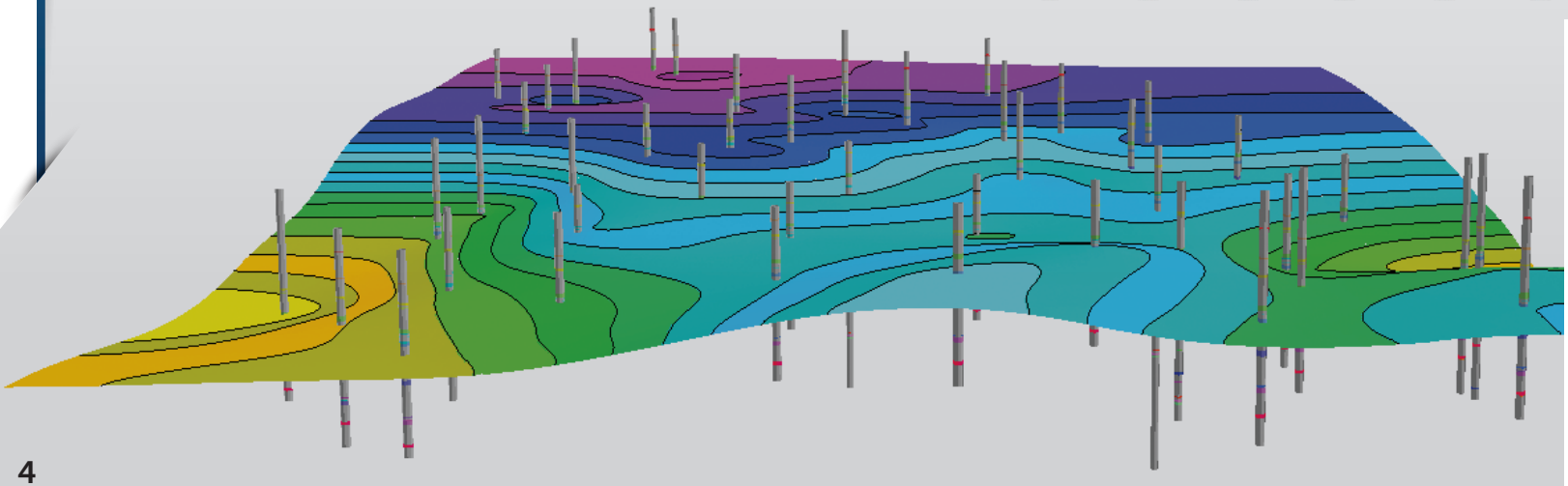


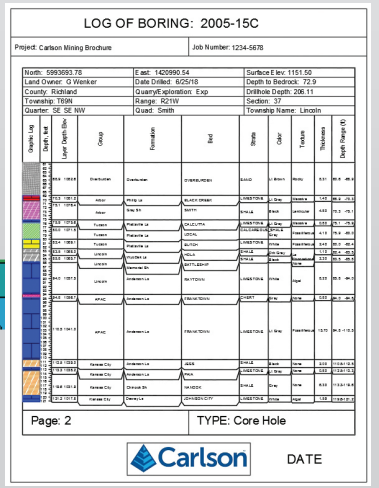


Modeling

- Use industry-standard modeling algorithms and supporting commands to ensure accurate representation of the geology
- Create macros to update models with new data
- Investigate models with inspection tools and colored, hatched isopachs
- Enhance models with Limit Lines and Strata Polylines for detailed strata behavior
- Automatically model strata pinchout and seam splits
- Account for incomplete drilling with conformance settings
- Compare Geologic Models and user-modified Mining Models to quantify available vs. recoverable reserves

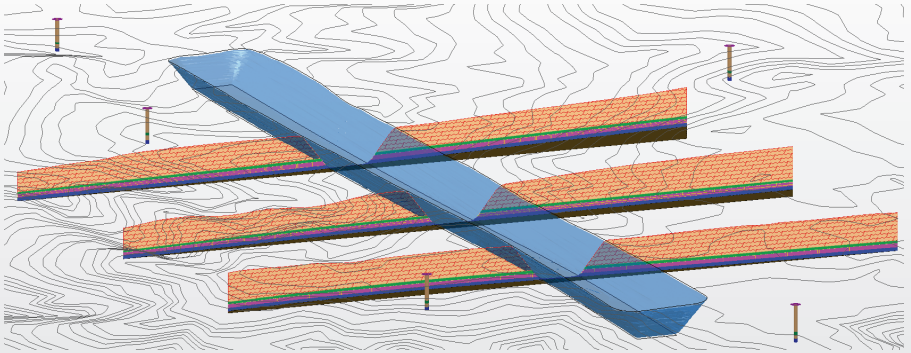






Cross-Sections & Fence Diagrams

- Plot geologic cross-sections or view in realtime with dynamic section line adjustment
- Color cross-sections by strata or grade and plot drillholes for reference
- Stack up sections in 2D, or draw in 3D to visualize with existing topography and mine designs
- Generate accurate dragline range diagrams on actual geologic models

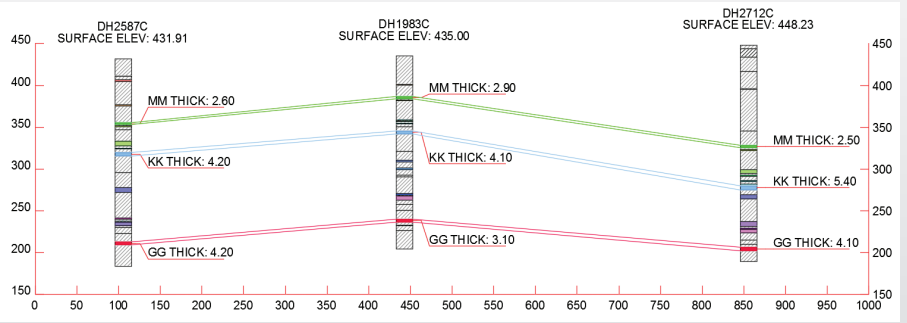


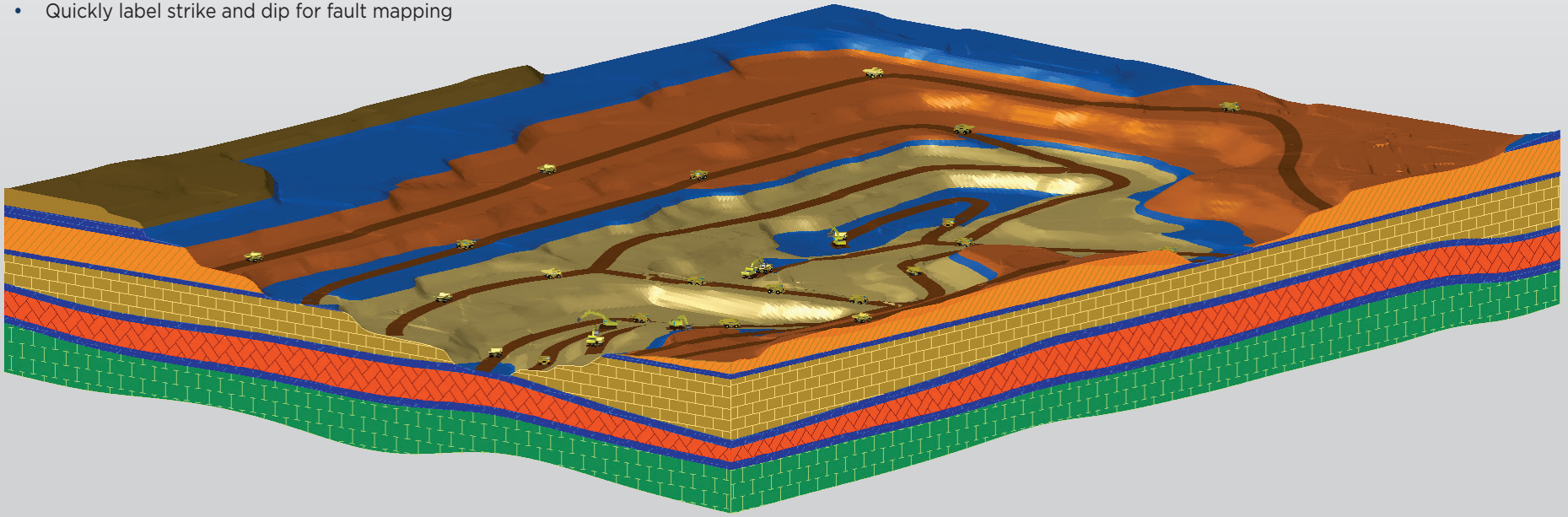
Faults

- Add fault lines with variable dip angles and displacements to represent normal or reverse faults
- Draw fault planes and strata grids for 3D visualization
- Calculate fault shift automatically by analyzing surrounding drillholes
- Quickly label strike and dip for fault mapping

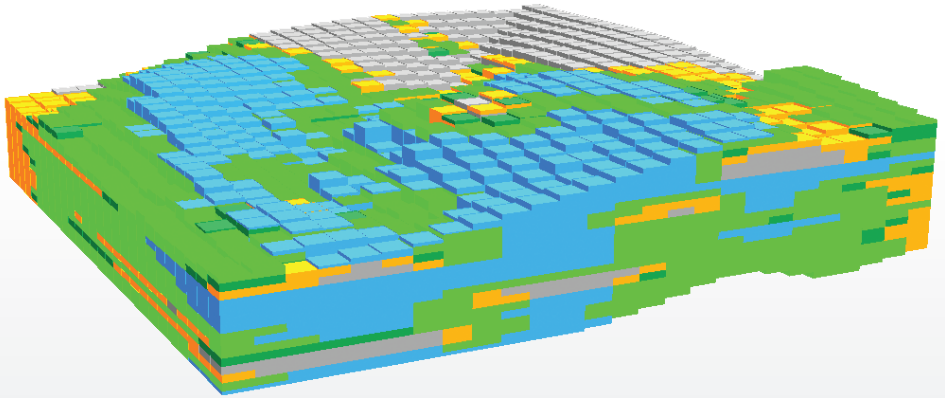
Mine Reserves

- Use Geologic Models for reserve estimation with weight-averaged quality attributes
- Generate strip ratio grids to determine economically feasible mine areas
- Detail reports with custom equations
- Export reports directly to text, Excel, Access, XML, and other database formats
- Analyze deposits with Reserve Classification to report measured, indicated, inferred, and hypothetical reserves
- Fine tune reserve estimation with waste dilution, strata specific recovery percentages, variable densities, and thickness filtering
- Calculate pit reserves by vertical quantities, overall highwall slopes, or detailed bench-by-bench designs
- Visualize volumes over time with surface history files





Carlson Geology



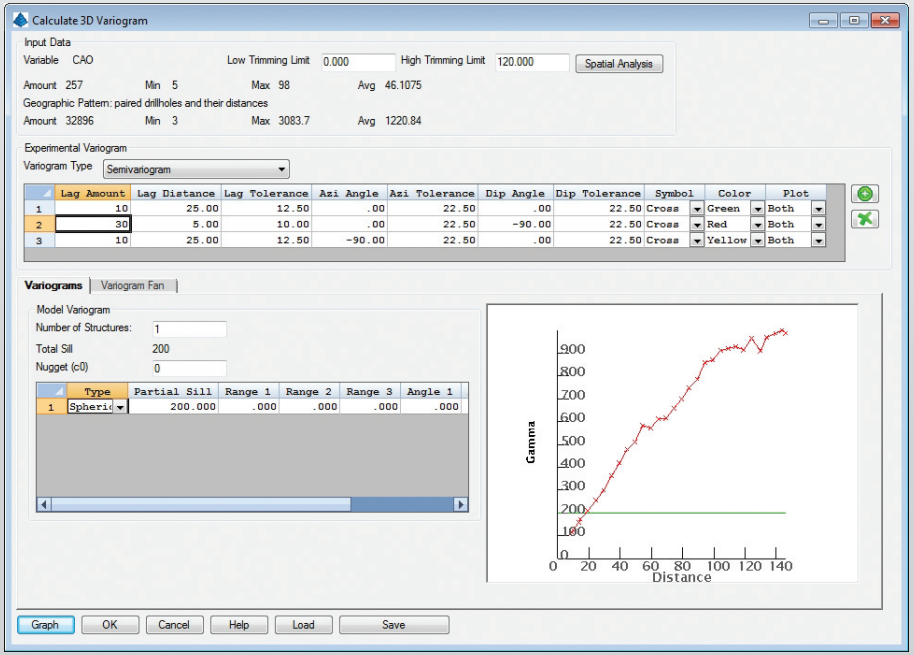
Block Modeling

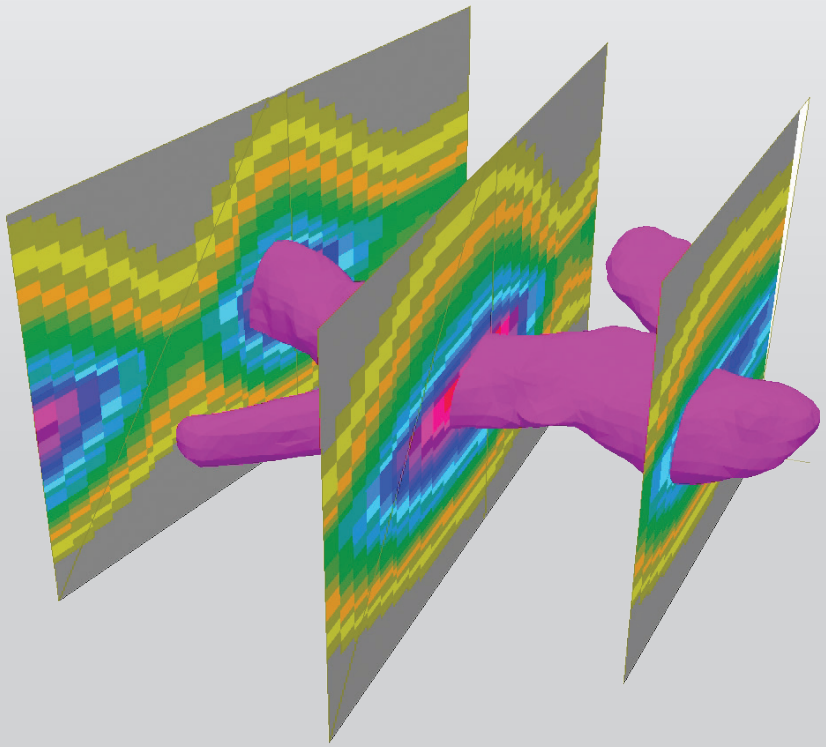
Kriging and Variograms

- Generate block models by 3D Kriging, Discrete, and Inverse Distance algorithms
- Use the Variogram Generator to analyze trends and determine the nugget, sill, and range with 3D anisotropy
- Choose from variogram types such as semivariogram, covariogram, and correlogram

Block Viewing

- Define grade ranges with multiple attributes to categorize different classes of material in reserve reports
- View partial or full block models with inclusion/exclusion perimeters constrained by surfaces or closed solids
- Isolate block grades to inspect specific qualities
- Inspect models by depth or elevation with dynamic feedback on grades
- Add drillholes, surface topography, and mine designs on top of blocks for full design visualization





Fence Diagrams & Drillholes

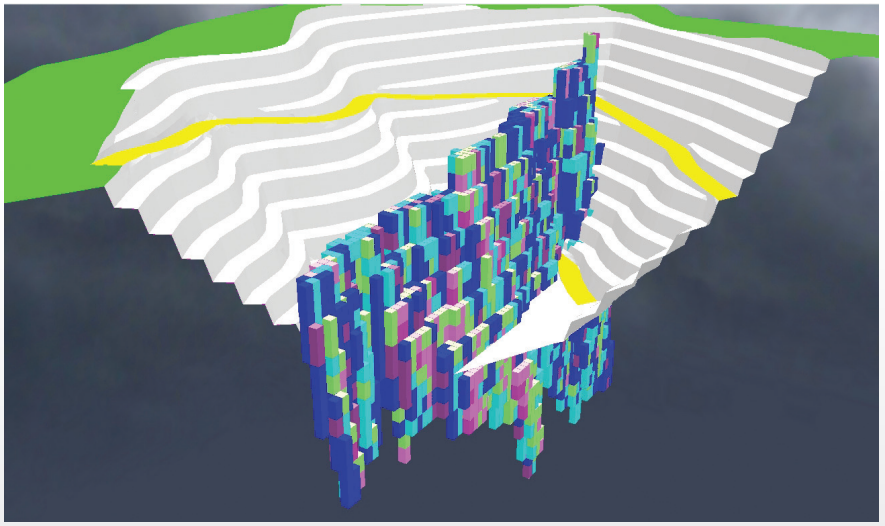
- Hatch and color sections by grade parameters for easy 2D and 3D viewing
- Color and size drillholes by grade parameters
- Color elevation or bench grids by ore quality

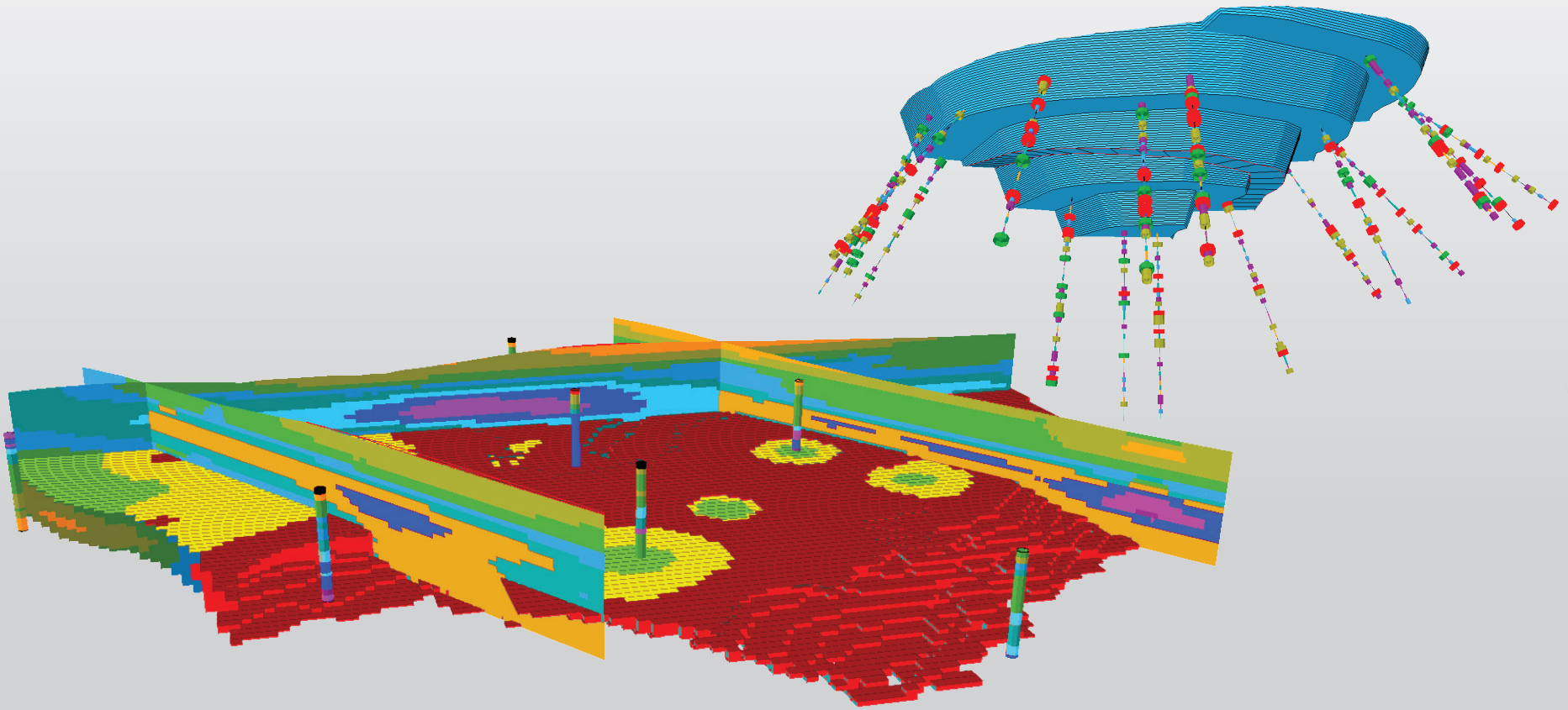
Mine Reserves

- Breakout tonnage and volume reports by grade zones
- Report average grade in each grade zone
- Calculate overburden for specific ore blocks

Optimized Pit Design

- Define block values with user-defined equations
- Create value block models to determine the profitability of each block
- Output optimal pit shells of profitable mining blocks
- Re-run calculations as costs change to view revised pit limits





Underground Mining

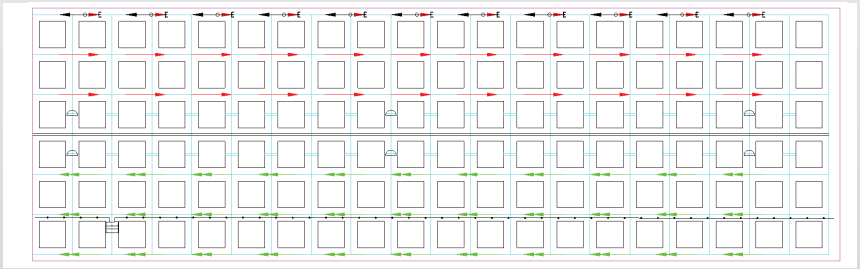
For Precise Designing, Scheduling, and Mapping of Stratigraphic Mines

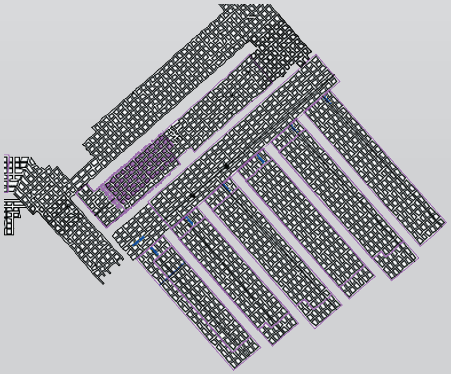
Plan, draft, and simulate your underground mine plan

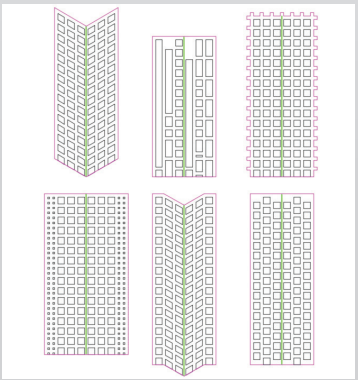
Quickly calculate volumes, generate tonnage reports, define any pattern of pillar cut, and produce accurate, customized reports with Carlson Software's renowned ease of use. Most tasks can be completed in minutes vs. hours, thereby increasing efficiency and cost savings.

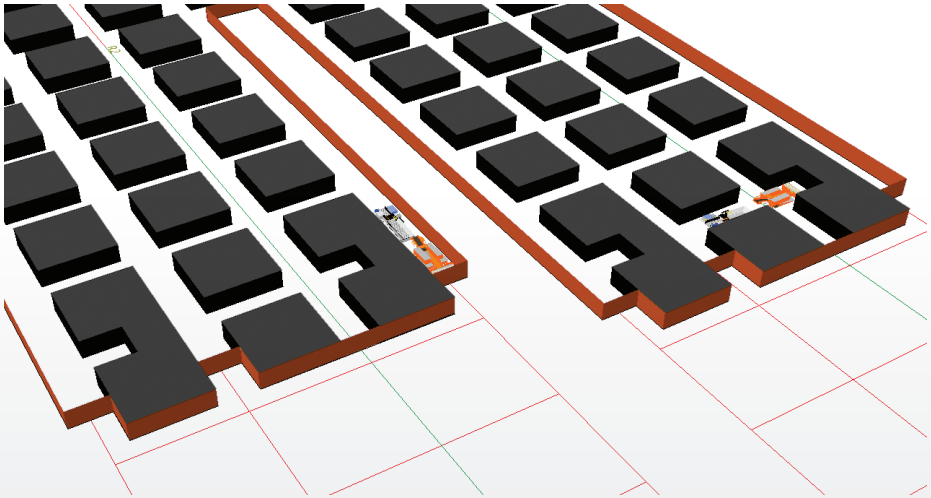
Underground Mine Mapping

- Process survey data and seamlessly generate mine maps
- Calculate end-of-month tonnage for each working section
- Use standard mapping symbols from the Mine Symbol Library, or build your own
- Layout your room and pillar mine automatically using Advanced Panel Layout tools
- View mine plans in 3D





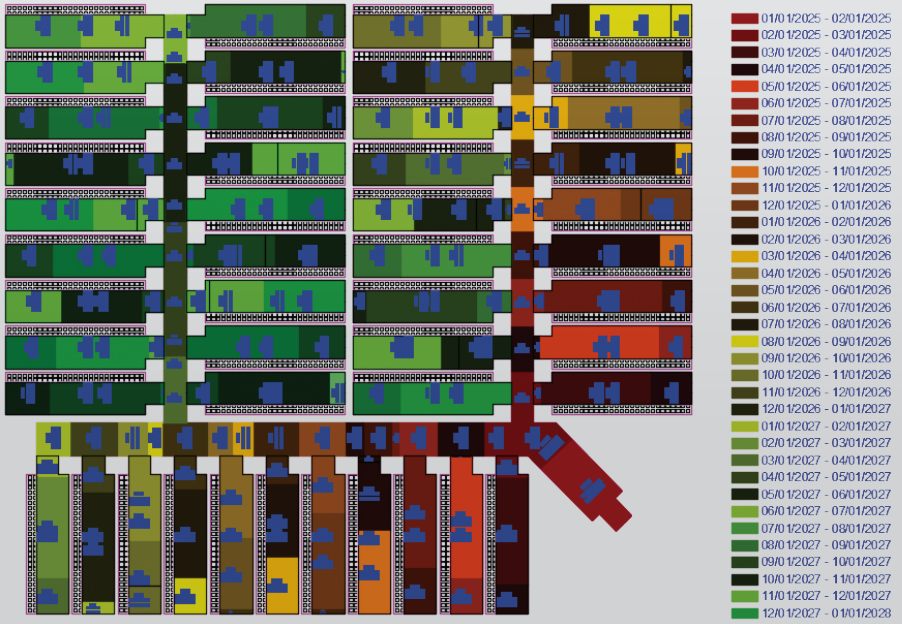




Underground Mine Reserves

Calculate reserves with quality attributes, thickness, and grades. Report/display with user-defined parameters, such as:

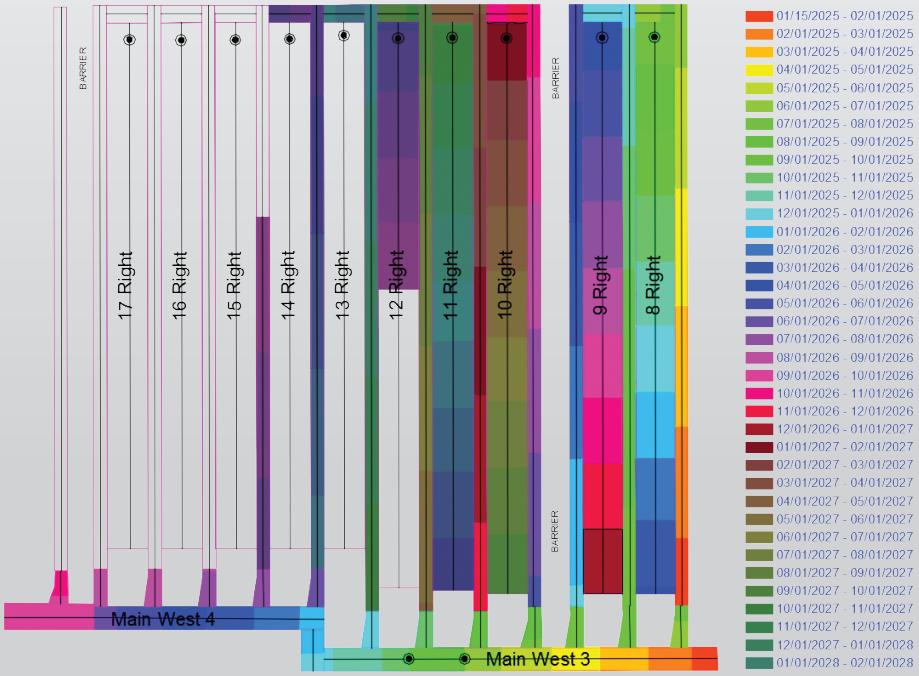
- Tonnage
- Overburden
- Area mined
- Quality
- Time period
- Equipment



Underground Scheduling

Panel precedence is critical in underground mining. Carlson's timing routines provide valuable information to assign equipment to reduce idle time and increase production rates by avoiding delays or illogical precedence rules. Advanced options for color settings, hatches, and transparency enhance visual feedback in the underground timing sequencing. Retreat mining can also be included in the scheduling and displayed in a variety of ways.

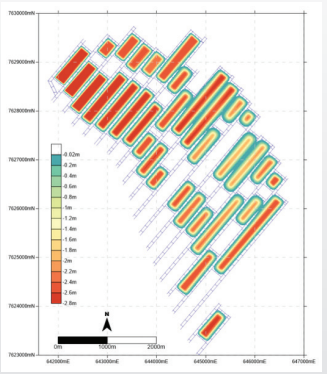
- Schedule timing and quality forecast based on actual geologic models
- Individually schedule mining sections based on both productivity and operating schedules
- Forecast difficult mining areas using Difficulty Factors as a function of time, location, or thickness
- Add location-based events to account for specific tasks such as belt moves, belt heads, stopping points, longwall moves, etc.
- Update mine plans with new information such as current position, and quickly reforecast timing
- Export reports directly to text, XML, Excel, Access, or other database formats
- Automatically calculate extraction ratios for custom pillar layouts
- Generate panel data from simple text on mine maps
- Report timing results by property owners

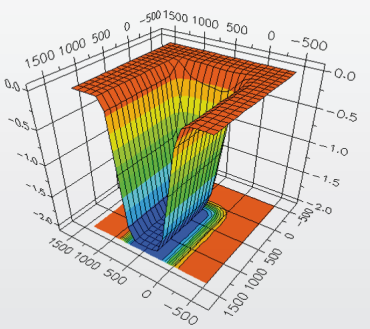


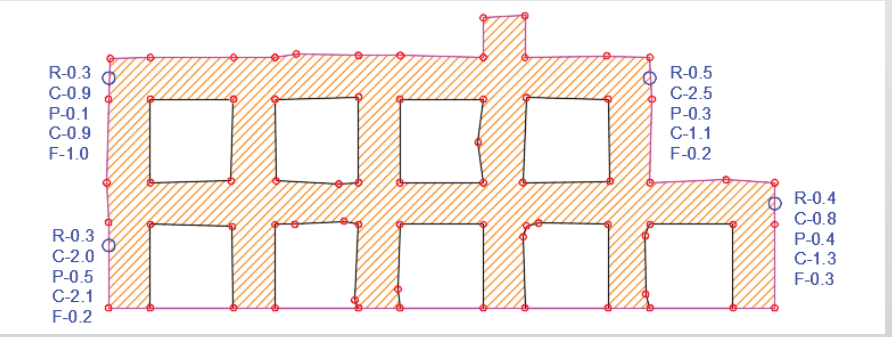
SDPS (Surface Deformation Prediction System)

This stand-alone program predicts and visualizes the settlement of the surface topography due to underground mining. Carlson grid files may be exported as an input, allowing calculations to be performed on your working mine plan data. SDPS was developed through the Virginia Polytechnic Institute and State University and is only distributed by Carlson Software.

- Generate Isopachs and 3D colored models of subsidence based on depth of mining, geological characteristics, and mine design parameters
- Model subsidence of the surface topography due to underground mining
- Generate subsidence profiles based on pillar dimensions, panel width, depth/type of overburden, and more







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MAINWEST3 <B:1>	01/15/2025	06/23/2025	159.18 days	CM1
9RIGHTBLEEDER	06/17/2025	07/08/2025	20.72 days	CM2
8RIGHTNECK	06/23/2025	07/05/2025	11.60 days	CM1
9RIGHTNECK	07/05/2025	07/16/2025	11.38 days	CM1
9RIGHTGATE	07/08/2025	12/07/2025	151.77 days	CM2
9RIGHTLW <B:1>	07/08/2025	07/19/2025	11.06 days	LONGWALL
10RIGHTNECK	07/16/2025	07/27/2025	11.17 days	CM1
9RIGHTLW <1:E>	07/19/2025	04/05/2026	260.07 days	LONGWALL
11RIGHTNECK	07/27/2025	08/14/2025	17.37 days	CM1
12RIGHTNECK	08/14/2025	08/28/2025	14.72 days	CM1
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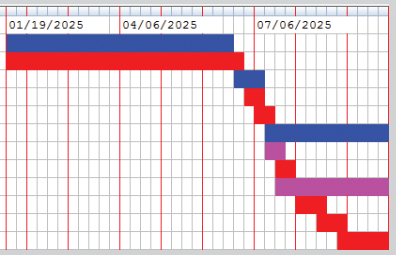
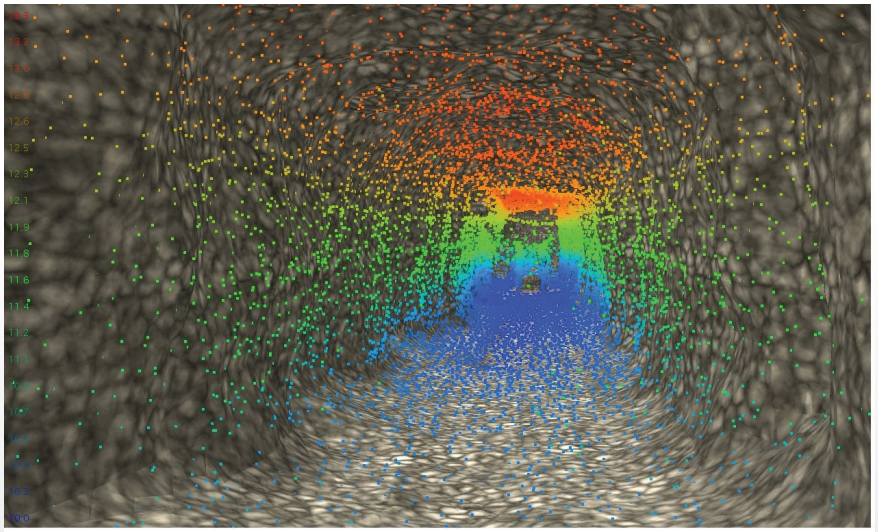


Underground Mining

Solids, Cavities, & Tunnels for Hardrock

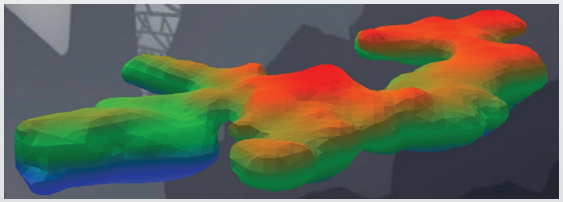
Design Solids

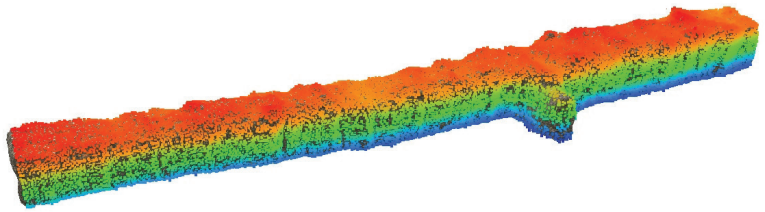
- Select existing CAD entities to define tunnel cross-section templates
- Define template transitions to seamlessly join unique sections of the tunnel
- Create solids from surfaces, rib polylines, or points
- Define profiles and centerlines for alignment, or use 3D polylines
- Design entries, drifts, raises, declines, and stopes

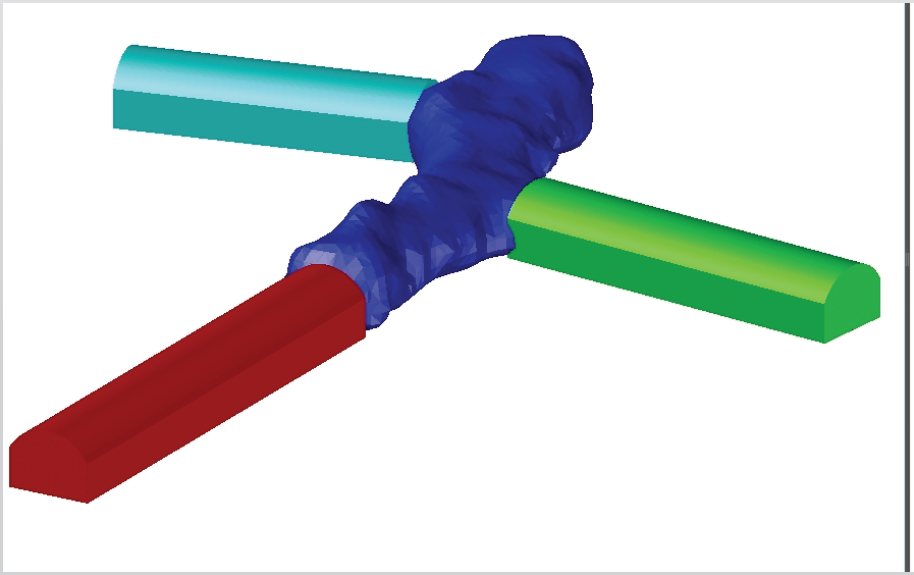


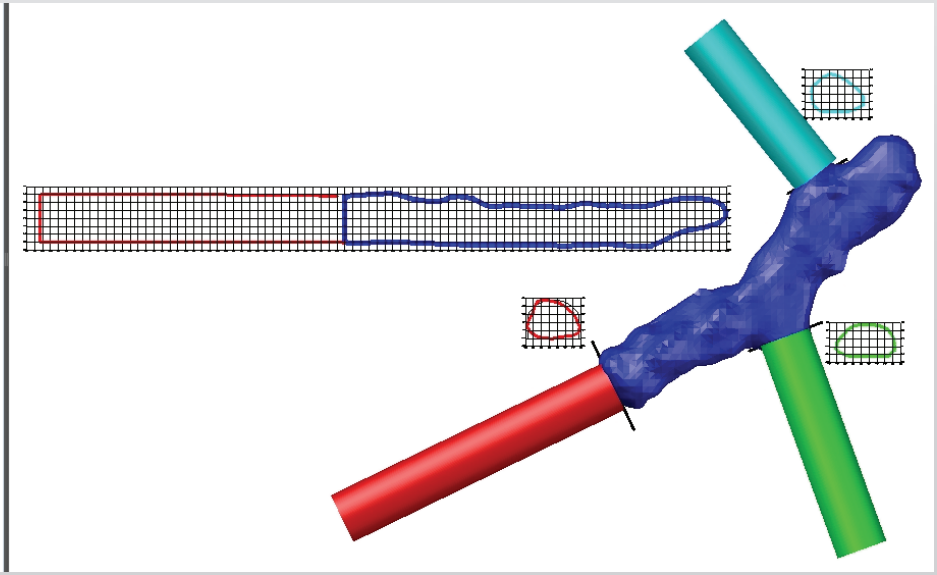
Cavity Surveys

- Import cavity surveys from scanners such as the Carlson C-ALS or Void Scanner
- Reduce and filter points to remove noise and unnecessary cavity features
- Use methods such as Poisson or pure triangulation to generate solids









Solid Editing

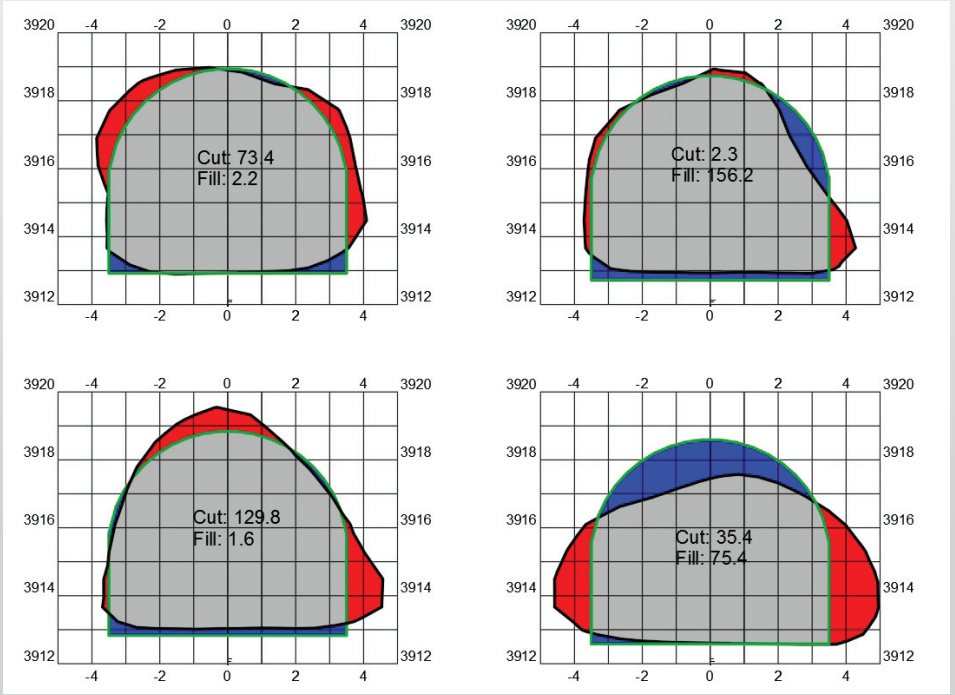
- Edit solids with tools such as rotate, heal, scale, smooth, simplify, and trim
- Merge, combine, and compare multiple solids
- Report offset point distance to solid

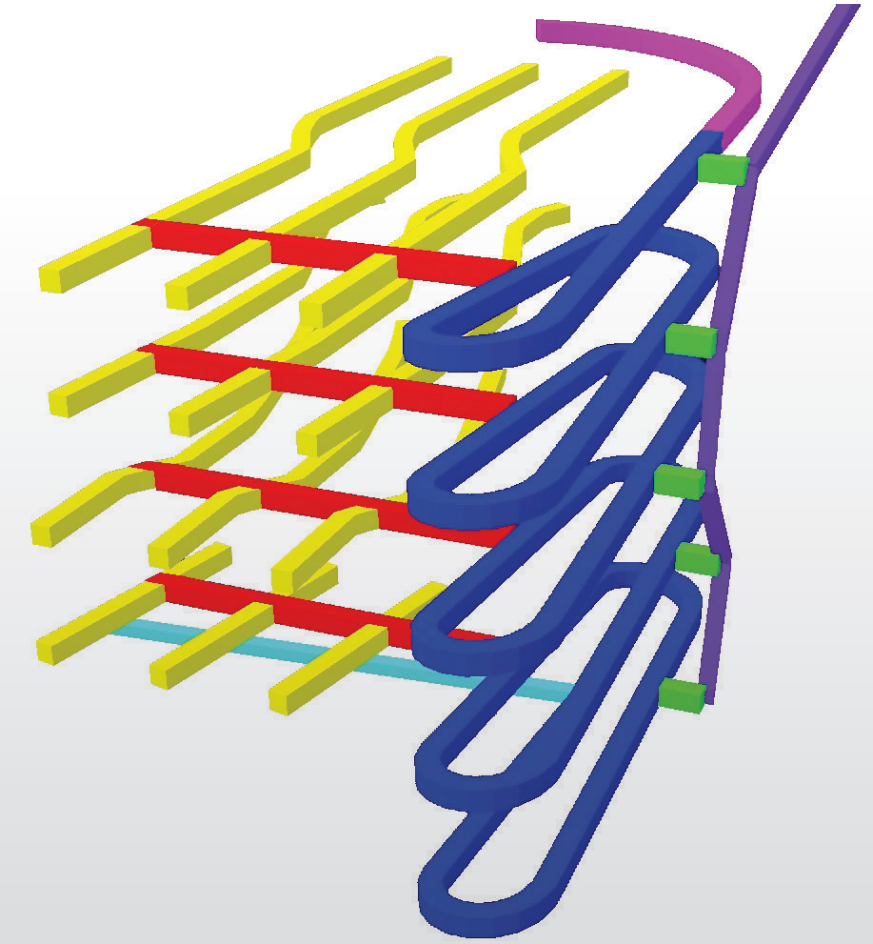
Sections and Volumes

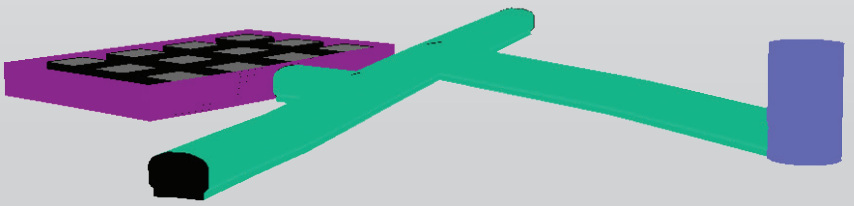
- Inspect solids with cross sections
- Compare designs to as-mined to quantify and visualize over/underexcavation
- Calculate solid volumes; use a Geologic Block Model to report tons and grades

Visualizing Solids

- View solids together with block models, drillholes, and 3D sections with color variations and transparency
- Draw solids as 3D polyline loops, or as full 3D faces
- Link multiple solids together to show progression and mine advance







Surface Mining

For Precise Designing, Scheduling, and Mapping of open pit, strip mines, and quarries

Design, modify, and simulate your surface mine

The Carlson Surface Mining module enables users to find the most efficient mine design by testing layouts in plan, section, and 3D view. Highlights include:

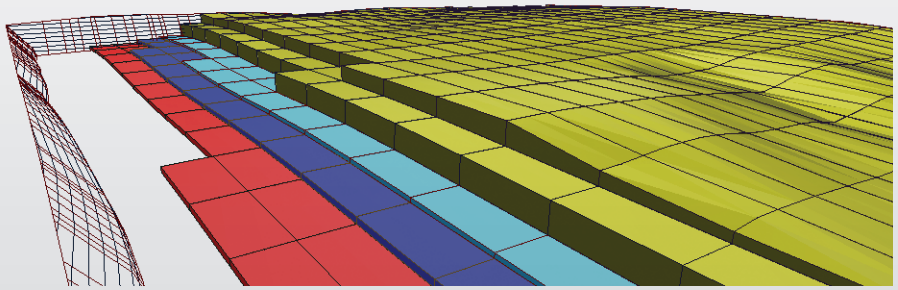
- Integrate geologic and surface modeling with plan view, 3D view, and section view mine layout routines
- Generate accurate calculations of overburden, ore quantities, strip ratios, rehandle, and cost
- Easily incorporate any designed road/ditch centerline, dam, building pad, pit or other surface feature into a final terrain
- Link pit advance, dump scheduling, and haul truck routes for the complete mine progression

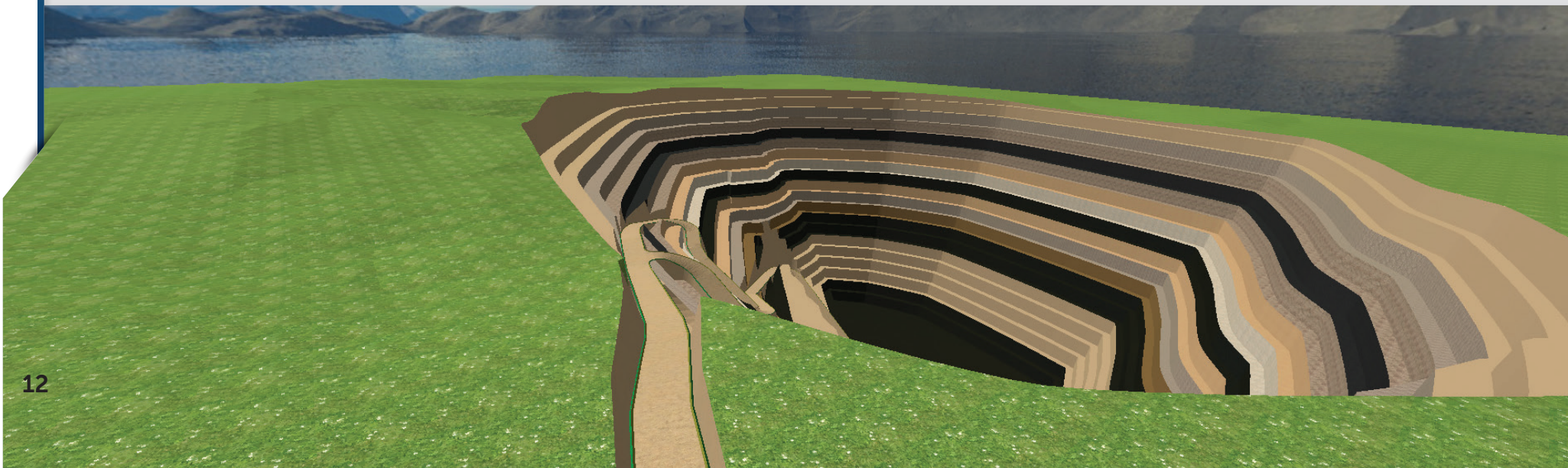
3D Pits and Spoil Design

- Design pits with varying highwall angles and bench parameters
- Construct spoil piles in a variety of shapes and styles
- Incorporate ramps in the pit or spoil pile with berms and ditches automatically, or with RoadNetwork from Carlson Civil
- Designate benches by strata, elevation, width, or depth for both pits and spoil

Pit, Property, & Spoil Layouts

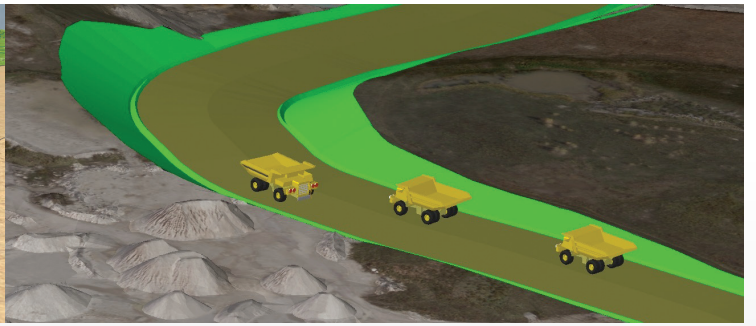
- Utilize multiple pit layout algorithms to represent full mine pits or simply subdivide reserves into smaller production blocks for short-term scheduling
- Create simple or complex pit shapes using commands such as Pit Matrix Layout and Layout by Advance
- Subdivide and identify pits with property lines to automatically calculate royalties with Surface Mine Reserves
- Calculate reserves from drillholes on-the-fly, block models, or stratified geologic models
- Choose between vertical quantities, overall highwall slopes, or detailed bench layback designs
- Store quantities and qualities into the pits for scheduling
- Create full reports including volume, tonnage, quality, area, and strip ratios
- Analyze deposits with Reserve Classification for measured, indicated, inferred, and hypothetical categorization in Surface Mine Reserves





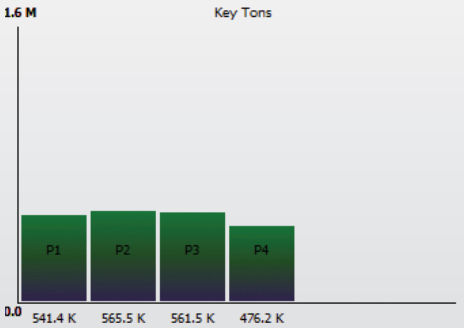
Haul Truck Cycle Analysis

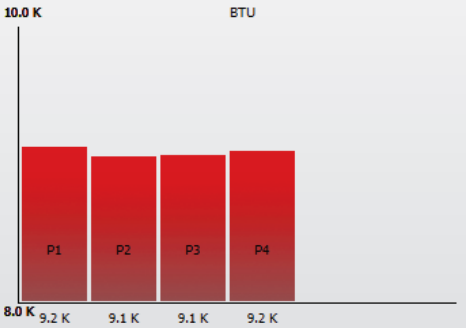
- Define fleet productivity
- Incorporate different truck types into one fleet
- Create haul road networks for possible routes based on color coded 3D polylines representing actual slope, length, and position
- Calculate cycle time, as well as overall productivity or required fleet size
- Simulate haulage in a 3D movie
- Link to spoil and dump scheduling routines

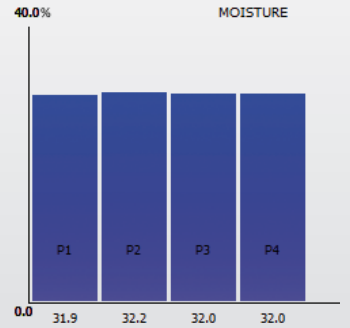


Civil Module for RoadNetwork

- Use Carlson Civil as a base foundation for surfaces, sections, profiles, and roads
- Quickly redesign and edit haul roads and ramps
- Output to sections and updated surfaces with color coded road features
- Simulate vehicles driving on the designed road for operator training and preparation



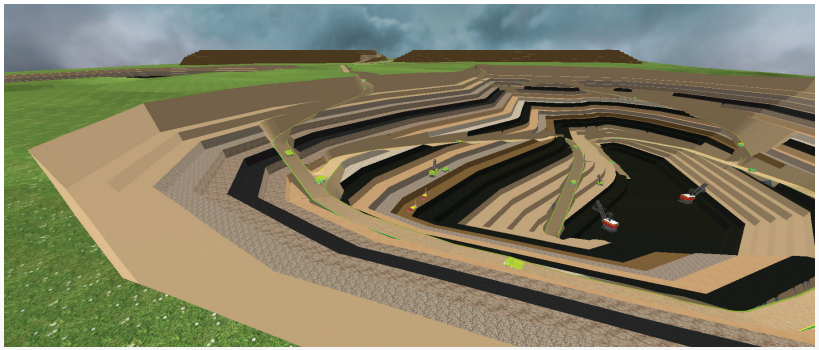


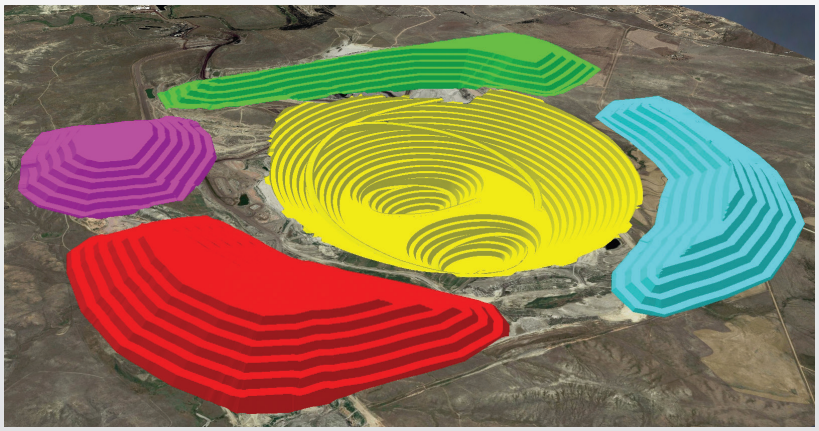


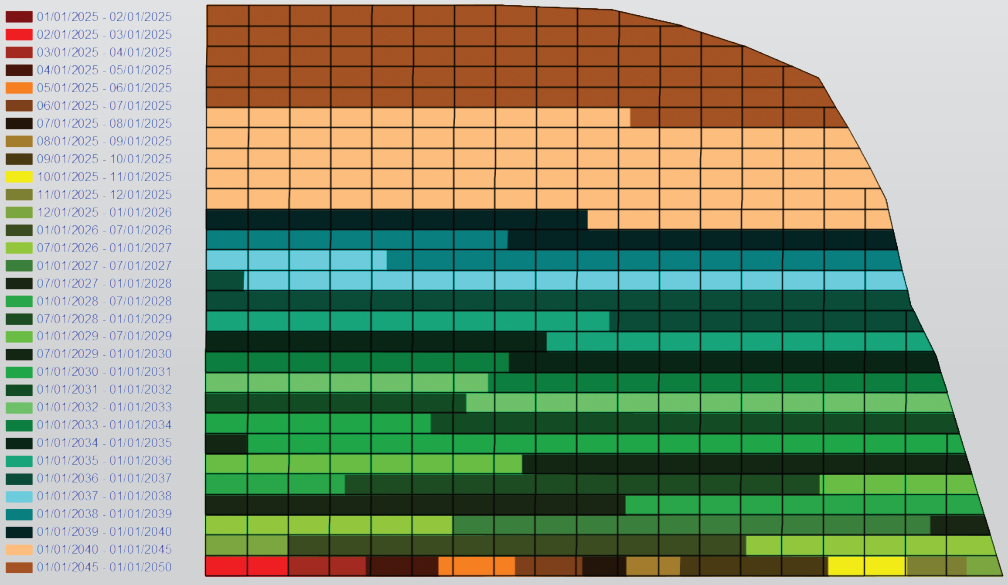
Scheduling and Timing

Carlson's timing routines allow you to evaluate multiple scenarios while providing detailed production reports. As timing may be based on calendar periods, tonnages, or volumes of overburden, the user is able to analyze the project intuitively. With upgraded features to analyze haul cycle routes, sequence dragline cuts, and easily define the mine progression, Carlson Surface Mining completes the project.

- Base surface mining rates on overburden removal or ore tonnage
- Define equipment calendars for individual units or collective fleets
- Create multiple calendars to explore "what if?" scenarios
- Produce color-coded timing maps
- Report timing by calendar periods, tonnage, or volume of overburden
- Set production requirements per user-defined time periods
- Integrate precedence rules to account for timing constraints
- Schedule pits with 3D Pick for short range sequencing
- Create 3D surfaces of each period to simulate the mine progression
- Schedule spoils and dumps linked to the pit advances
- Play back as movie simulation of entire mine advance







Surface Mining

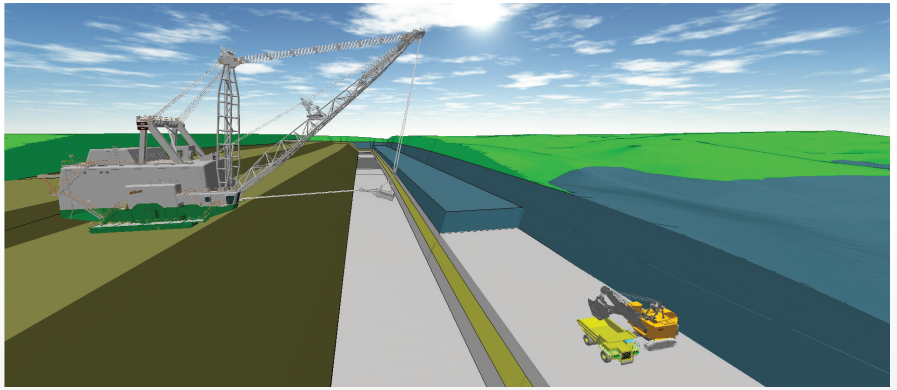
Designs for Draglines, Dozers, and Blasting

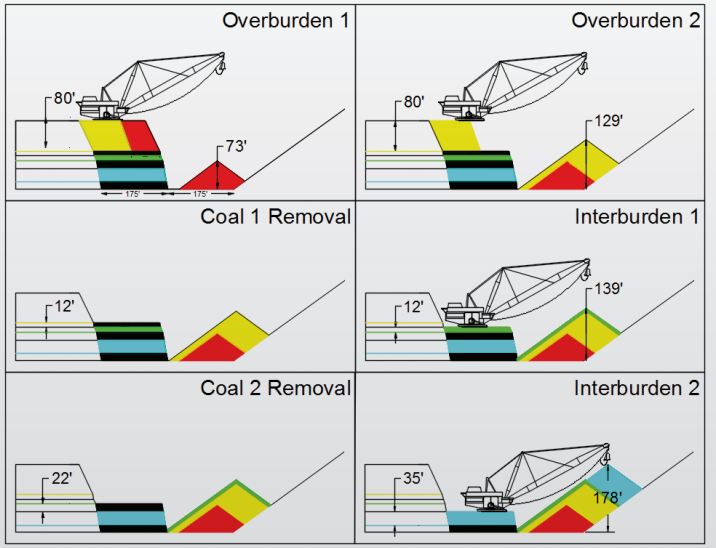
Dragline Range Diagrams

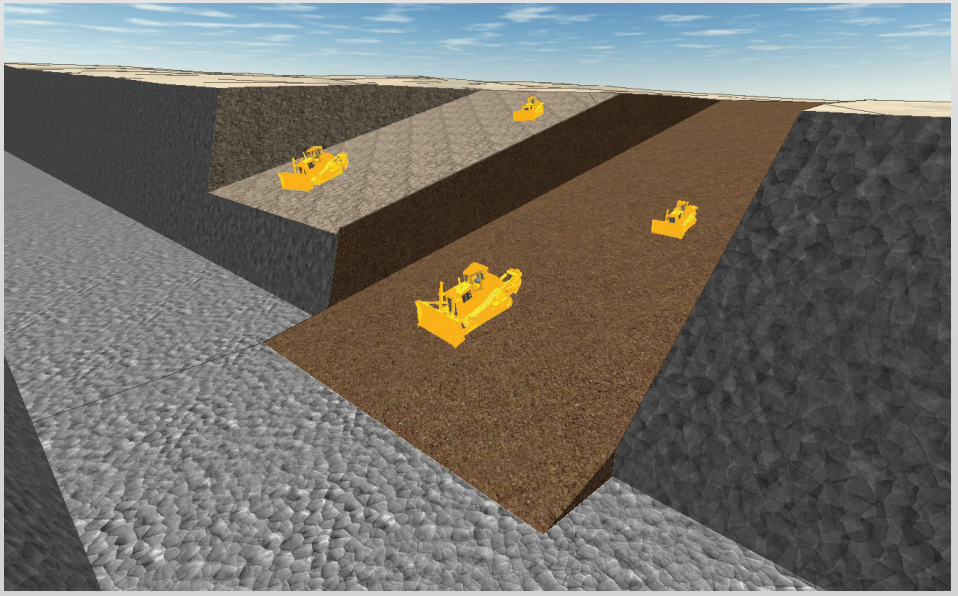
- Test interactive range diagram options for detailed dragline sequences and associated volumes
- Quickly update range requirements by changing strata and pit dimensions
- Analyze dragline height, reach, and digging depth based on design geometry
- Evaluate designs based on actual geologic sections with the Cut and Place series of commands
- Output final pit sections to 3D; extrude down a centerline to create a 3D pit surface

Dozer Push and other Auxiliary Equipment

- Combine dozer push analysis with cast blasting, shovel, flatten spoil, and dragline analysis to obtain optimal combination of equipment type and sequencing
- Process section designs to create pits and spoiled surfaces in 3D, colored or textured by actual geological outcrops





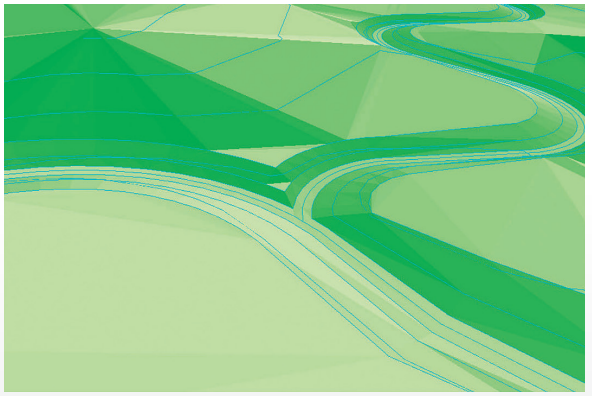


Natural Regrade

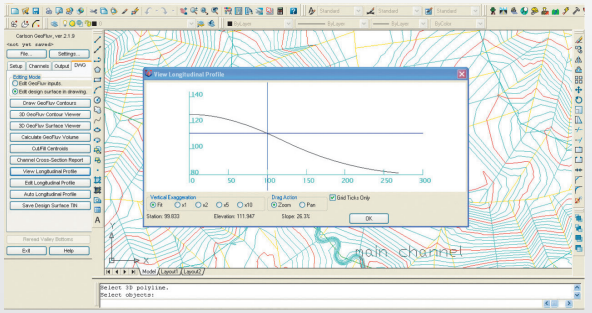
Reclaim, revegetate, and restore your mine site

Do it right the first time with Natural Regrade for mine reclamation. Working with nature brings real savings!

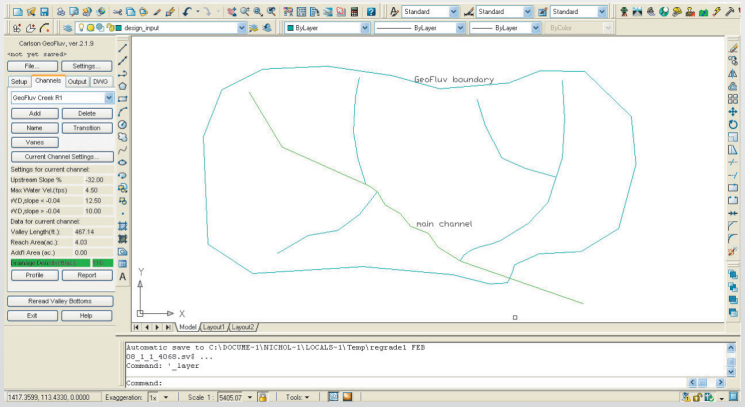
- Meet and exceed environmental standards
- Provide maintenance-free stability against erosion for true sustainability
- Attain water quality comparable to undisturbed surrounding lands
- Encourage wildlife and plant diversity
- Enhance view sheds by restoring areas to their natural beauty



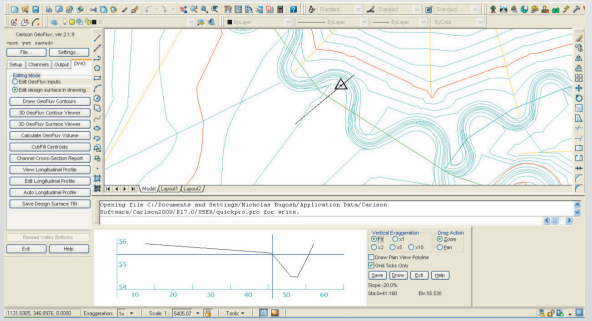
Natural Regrade makes a design for a stable landform that satisfies local empirically determined user inputs



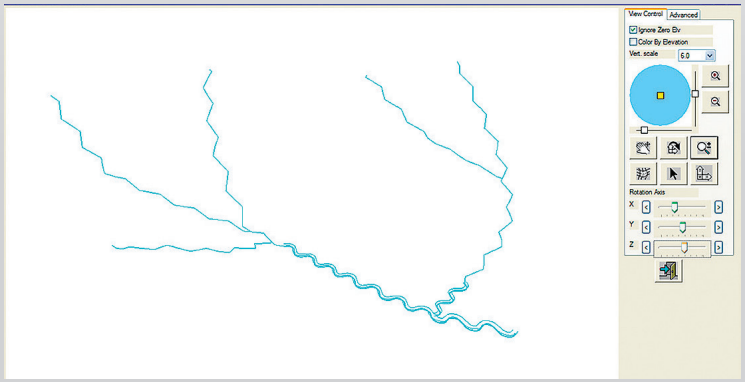
GeoFluv™ creates complex slopeprofiles with con-vex-to-concave infl ection point deter-mined locally



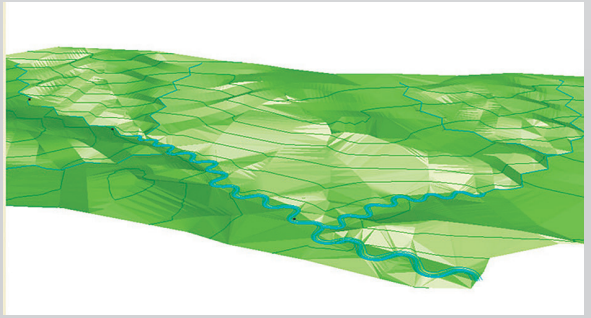
Natural Regrade automatically sets channel confluences to grade — change one and the others adjust



Plan view and cross-sectional channel geometry based on bankfull discharge has additional floodprone area



GeoFluv™ integrated 3D channel network using local empirically-determined drainage density

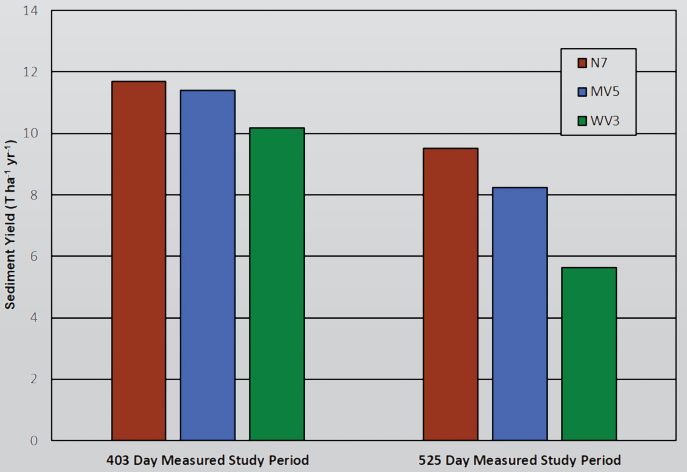


Powerful 3D viewer aids final design editing of the draft landform

Log Church Creek AML highwall before and after at an Abandoned Mine Lands site in Indiana. This project won the OSM 2008 Mid-Continent Regional Abandoned Mine Land reclamation award.

La Plata highwall before and after at an active truck and shovel coal mine in New Mexico

GeoFluv reclamation wildlife features can include small animal habitats that mimic rock outcrops instead of unnatural piles of boulders



Natural vs. GeoFluv Sediment Yield results

Bugosh, N. and E.G. Epp, 2019. Evaluating Sediment Production from Native and Fluvial Geomorphic-Reclamation Watersheds at La Plata Mine, Catena, 174 (2019) 383-398.

Blast Commander

Analyze, Design, and Edit your Blasts

Utilize point clouds, meshes, and borehole deviation information for blast optimization

Carlson Blast Commander delivers information essential to drilling & blasting. Comprehensive designs can include Carlson Quarryman and Boretrak Data for accurate highwall and blasthole positioning. Drilling information can be sent via Carlson Command for drill rig guidance, which can return updates to the office for a field-to-finish process.

Cloud and Mesh Editing

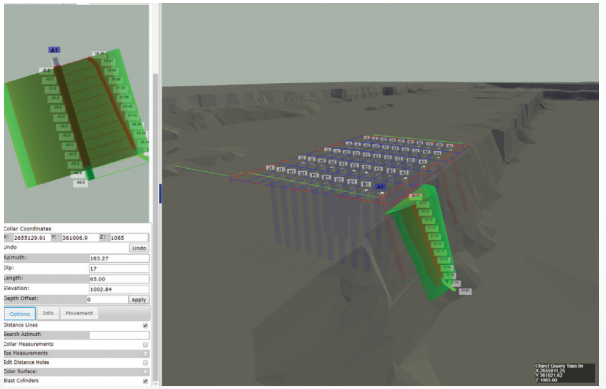
- Import scans and boretrak data from a variety of formats
- Register, merge, and consolidate multiple scans using network least squares error minimization
- Remove anomalies with cloud cleaning, reducing, and resampling tools
- Filter meshes to remove insignificant data points

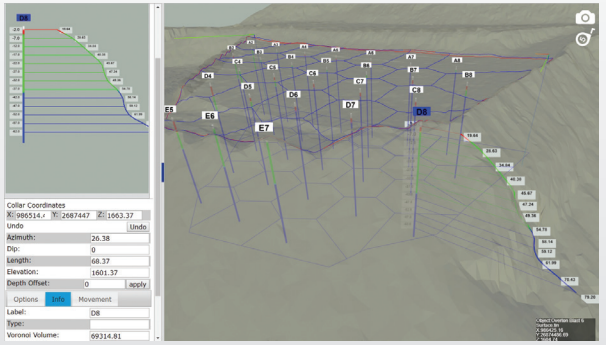
Pattern Layout

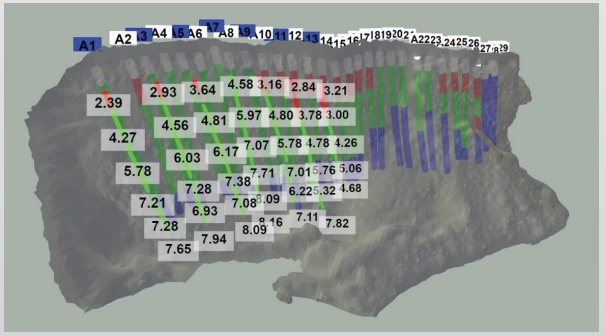
- Design blast patterns using standard parameters such as burden, spacing, dip, length, etc.
- Optimize the pattern based on burden measurements and a variety of inspection tools
- Compare blast designs to as-drilled hole surveys

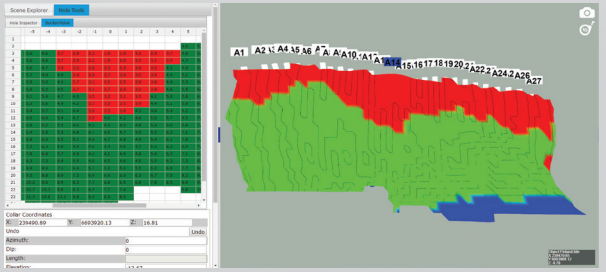
Data Extraction

- Determine burden between holes and topography in 3D
- Generate surfaces, hole coordinates, volumes, and profiles
- Draw inclusion lines to indicate the perimeter of the blast or establish the face extents
- View profiles of the holes relative to the mesh for further analysis









Point Cloud

For large-scale, accurate mine surveys

Utilize drone flights, lidar, and laser scanner clouds in CAD

Carlson Point Cloud delivers powerful automation for large data sets. View and process hundreds of millions of points all with Carlson's ease-of-use. Whether the data represents an aerial drone survey or an underground cavity scan, this powerful module allows you to extract the information you need without sacrificing detail.

Import / Export

- Import/export large point clouds containing millions of points
- Import from standard point a variety ofcloud formats, including LAS, FSC, E57, Leica, Faro, DEM, GeoTiff, and more
- Export to ASCII, LAS, or PDF, as well as a variety of Carlson files

Cloud Editing

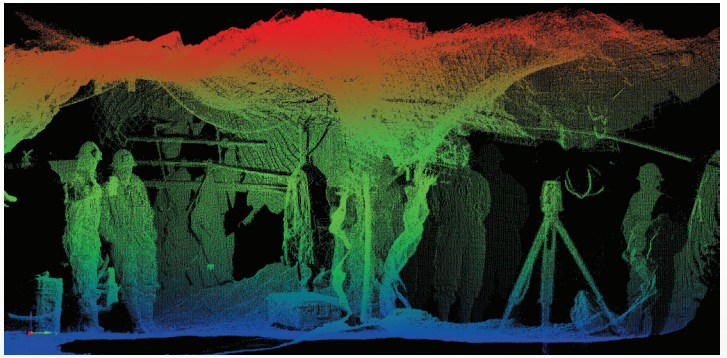
- Register and merge multiple scans into one cloud
- Remove anomalies with cloud cleaning, reducing, and resampling tools
- Smooth and simplify clouds to remove unwanted data points
- Remove trees, powerlines, fence lines, vehicles, etc. to extract the bare earth surface

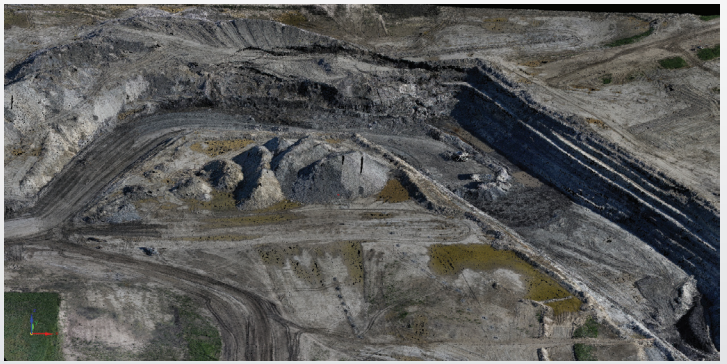
Viewing Cloud Data

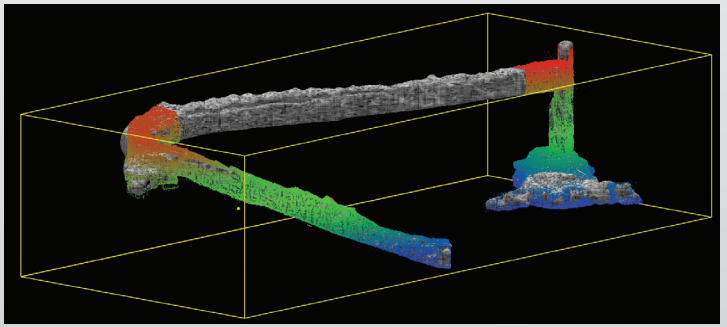
- View multiple clouds at once
- Color by RGB, elevation, or intensity
- Adjust point size and cloud detail
- View as cross sections

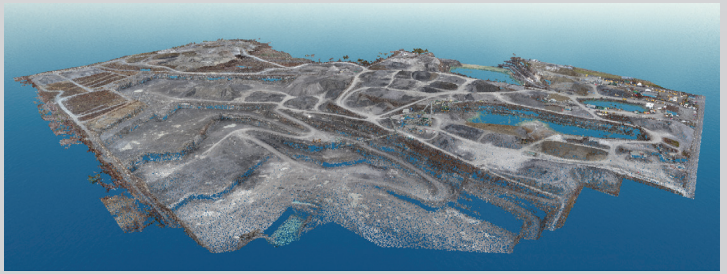
Entity Extraction

- Create drawing symbols from poles, trees, etc
- Generate contours, profiles, sections, and breaklines and draft them directly in CAD
- Draw linework with snap modes to extract edges
- Extract 3D breaklines automatically based on surface zones and slope
- Trace alignments across the site and generate profiles or sections
- Create surface Grids, TINs and 3D Solids









Seamless integration with Carlson Machine Control and Laser Measurement Divisions

Carlson
BREAK NEW GROUND

www.carlsonsw.com

The Complete Workflow

Carlson provides mining hardware and software tools for a comprehensive, yet easy-to-use workflow. Software modules cover exploration, surveying, modeling, mine planning and design, blasting, scheduling, extraction, reclamation, and mine closure. Use these modules with the Laser Measurement Division hardware for accurate mine mapping and monitoring. Upload designs to the Carlson Machine Control Divisions Grade products for equipment and mine control with remote access and viewing.

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