Digital Mine Planning Tools Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

The modern mining sector is undergoing an unprecedented digital transformation, driven by the convergence of massive data streams, automated field systems, and the urgent imperative for sustainable resource extraction. Digital Mine Planning Tools Training Course program is engineered to bridge the critical competency gap, equipping mining professionals with the technical mastery required to navigate next-generation Digital Mine Planning Tools. By shifting from static 2D/3D wireframing to dynamic, data-driven spatial architectures, this course establishes a foundational paradigm where spatial intelligence, algorithmic optimization, and operational reality seamlessly intersect.

Operating within a unified, multi-dimensional ecosystem, this course empowers participants to transcend conventional scheduling bottlenecks through the application of advanced computational engineering. Attendees will explore the deployment of cloud-based multi-scenario optimization engines, GPU-accelerated parallel processing algorithms, and stochastic block modeling, transforming how geologic uncertainty is mitigated. By integrating real-time asset tracking, automated haulage kinematics, and predictive environmental metrics directly into the core design workflow, the curriculum ensures that strategic life-of-mine (LOM) designs are inherently resilient, responsive, and executed with maximum asset utilization. This is not merely software training; it is an immersive, high-velocity incubator for the digital mine architects of tomorrow.

Programme Curriculum

Digital Mine Planning Tools Training Course

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Course Duration

10 Days

Course Objectives

1. Architect Dynamic Block Models
2. Execute Stochastic Risk Quantifications.
3. Optimize Open-Pit Ultimate Pit Limits.
4. Engineer Automated Underground Layouts.
5. Synthesize Spatial Big Data Environments.
6. Program Algorithmic Production Schedules.
7. Evaluate Autonomous Haulage Kinematics
8. Embed Automated ESG Constraints.
9. Design Integrated Waste and Tailings Depositories
10. Implement Digital Twin Interoperability
11. Conduct Advanced Cut-Off Grade Optimization
12. Master Immersive Spatial Visualizations.
13. Formulate Agile Reconciliation Frameworks

Target Audience

- Senior Strategic Mine Planning Engineers.
- Resource Geologists and Geostatisticians
- Operations Managers and Mine Superintendents
- Chief Technology Officers (CTOs) and Digital Transformation Directors.
- Geotechnical and Tailings Engineers
- Environmental Compliance and ESG Officers
- Data Scientists and Mining Software Developers.
- Investment Analysts and Mineral Economists

Course Modules

Module 1: Cloud-Native Geostatistical Data Architecture & Implicit Modeling

- Ingestion of massive, heterogeneous exploration drilling databases into scalable cloud repositories.
- Execution of implicit radial basis function (RBF) structural geological modeling routines.

- Application of multi-variable ordinary kriging and conditional simulation to generate spatial block models.
- Automated updating of geological wireframes using real-time field assay streaming pipelines.
- *Case Study:* Accelerating resource definition timelines by 40% at a copper-porphyry deposit in Chile through cloud-parallelized implicit modeling.

Module 2: Stochastic Grade Uncertainty & Orebody Intelligence

- Quantifying geological risk by analyzing hundreds of equally probable joint conditional simulation realizations.
- Applying random forest machine learning classifiers to predict localized rock type variations.
- Integrating **Measure-While-Drilling (MWD) parameters** (penetration rates, torque) into spatial grade control frameworks
- Formulating dynamic probability maps for localized contaminant distributions within the block model.
- *Case Study:* Minimizing processing plant feed variance at an iron ore operation in Western Australia using MWD-driven machine learning models

Module 3: Parametric Pit Design & Lerchs-Grossmann Optimization

- Configuring multi-directional, geotechnically constrained slope sectors within pit optimization engines.
- Generating nested pit shells using the Lerchs-Grossmann algorithm to identify optimal capital-payback zones.
- Simulating fluctuating multi-commodity price cycles to evaluate ultimate pit limit sensitivity.
- Automated design of optimal catch benches, safety berms, and dynamic haul road switchbacks.
- *Case Study:* Unlocking $150M in incremental NPV at a mature open-pit gold mine by executing GPU-accelerated nested pit optimizations.

Module 4: Long-Term Open-Pit Scheduling via Mixed-Integer Linear Programming (MILP)

- Formulating multi-period material destination models considering complex blending and processing constraints.
- Deploying heuristic and meta-heuristic scheduling algorithms to handle millions of block variables simultaneously.
- Balancing mining capacity limits against process-plant recovery factors over multi-decade horizons.
- Optimizing variable stockpile management strategies to maximize early cash flows.
- *Case Study:* Developing a 25-year life-of-mine plan for a complex poly-metallic deposit using MILP to stabilize refinery feed grades.

Module 5: Automated Underground Stope & Mine Layout Generation

- Configuring parametric optimization tools for the rapid geometric formulation of stable underground stopes.
- Algorithmic generation of decline networks, ventilation raises, and escapeways minimizing capital development costs.
- Applying geotechnical rock mass rating (RMR) maps to dynamically constrain stope dimensions.
- Simulating stress redistribution vectors to optimize sequence directions in sub-level caving.
- *Case Study:* Reducing underground capital development design cycle time from weeks to hours at a deep-level gold operation in South Africa.

Module 6: Advanced Cut-Off Grade Optimization & Economic Modeling

- Implementing Lane’s cut-off grade theory across changing processing, mining, and marketing constraints.
- Simulating the economic impact of carbon pricing and variable energy costs on net-smelter return (NSR) matrices.
- Automated valuation of option agreements and dynamic flex-rate mining capacities.
- Executing multi-variable capital expenditure (CAPEX) and operating expenditure (OPEX) sensitivity distributions.
- *Case Study:* Enhancing project IRR by 4.5% for a Tier-1 nickel asset by deploying a dynamic, energy-cost-aware cut-off grade model.

Module 7: Short-Term Operational Scheduling & Fleet Management Alignment

- Translating monthly strategic mandates into high-fidelity, shift-level tactical execution schedules.
- Modelling localized operational delays, shovel move times, and site-specific weather disruptions.
- Establishing automated digital handshakes between short-term plan horizons and Fleet Management Systems (FMS).
- Configuring dynamic shovel allocation rules to maintain target blending specifications at the primary crusher.
- *Case Study:* Reducing crusher wait times by 18% at an open-pit bauxite operation through integrated short-term planning and FMS dispatch logic.

Module 8: Discrete-Event Haulage Simulation & Kinematic Modeling

- Building high-resolution 3D digital haulage networks complete with rolling resistance and grade vectors.
- Simulating autonomous haulage system (AHS) truck fleet interaction, overtaking logic, and queue mechanics.
- Modeling the kinematic and fuel-burn impacts of implementing trolley-assist infrastructure on steep ramps.
- Predicting tire wear metrics (TKPH) across alternative road construction designs and payload profiles.
- *Case Study:* Optimizing a fleet of 40 autonomous trucks at a Canadian Oil Sands operation to reduce diesel consumption by 12%.

Module 9: Real-Time Spatial Reconciliation & High-Density LiDAR Ingestion

- Automating the processing of drone-derived (UAV) photogrammetry and mobile LiDAR point clouds.
- Executing rapid volume calculations comparing "As-Planned", "As-Blasted", and "As-Mined" surfaces.
- Calculating spatial compliance-to-plan indexes and mapping localized dilution and ore loss occurrences.
- Continuous back-propagation of operational structural geology modifications into the resource model.
- *Case Study:* Implementing daily automated drone-based reconciliation loops to capture and mitigate a 7% dilution spike at an open-pit gold mine.

Module 10: Environmental & Safety-Constrained Mine Planning (Blasting Safety Index)

- Integrating blast design parameters (burden, spacing, charge weight) directly into spatial planning interfaces.
- Modelling blast-induced peak particle velocity (PPV) attenuation vectors to protect adjacent civilian infrastructure (Végsöová, 2026).
- Simulating localized atmospheric dust (PM_{10}) dispersion profiles based on real-time meteorological forecasts (Végsöová, 2026).
- Enforcing safe acoustic and noise level exposure barriers within the daily mine sequence (Végsöová, 2026).

- *Case Study:* Maintaining regulatory environmental compliance at an urban limestone quarry in Central Europe using a digital Blasting Safety Index (BSI) model (Végsöová, 2026).

Module 11: Dynamic Waste Rock Dump & Tailings Storage Facility (TSF) Lifecycle Design

- Parametric modeling of progressive waste dump lift configurations, ensuring structural and geotechnical safety factor criteria.
- Integrating waste rock dump sequencing directly with the primary pit extraction timeline to minimize haul distances.
- Simulating downstream, centerline, and upstream tailings storage facility embankment raises in a 3D environment.
- Modeling acid mine drainage (AMD) risk zones within waste dumps by applying material type routing rules.
- *Case Study:* Mitigating structural risk and saving $30M in lifecycle handling costs at a copper asset by optimizing co-disposal waste-tailings sequencing.

Module 12: Extended Reality (XR) Platforms & Immersive Collaborative Planning

- Exporting complex 3D mine designs and production schedules into Virtual Reality (VR) environments.
- Conducting remote, multi-disciplinary, cross-site mine plan risk assessments within an immersive digital room.
- Deploying Augmented Reality (AR) headsets to field geology and blasting crews for real-time design overlay visibility.
- Using immersive simulation environments to train underground equipment operators on newly engineered mine layouts.
- *Case Study:* Eradicating high-risk spatial equipment interference hazards at an underground base metals mine through weekly immersive VR layout reviews.

Module 13: Mine-to-Mill Integration & Geo-Metallurgical Digital Twins

- Mapping processing parameters (Bond Work Index, hardness, mineral recovery rates) directly onto the spatial block model.
- Simulating the downstream fragmentation impacts of variable blast designs on primary crusher throughput.
- Deploying machine learning models to predict processing plant flotation recovery based on incoming ore block chemistry.
- Establishing real-time tracking loops for ore blocks from the blasting face, through stockpiles, to the concentrator feed.
- *Case Study:* Increasing throughput by 9% at a copper concentrator by linking geo-metallurgical block parameters directly to automated SAG mill feed adjustments.

Module 14: Automated Infrastructure Siting & Surface Logistics Topology

- Utilizing Multi-Criteria Decision Analysis (MCDA) and spatial GIS layers to algorithmically optimize site infrastructure layouts.
- Simulating overland conveyor routing topologies, stockpile locations, and rail-loop geometry.
- Modeling surface hydrology, catchment areas, and extreme precipitation runoff routing to size pit dewatering systems.
- Evaluating the spatial and capital cost impacts of shifting from truck haulage to In-Pit Crushing and Conveying (IPCC) networks.

- *Case Study:* Optimizing an IPCC layout at an open-pit coal operation to reduce lifecycle operational costs by 22% over alternative trucking scenarios.

Module 15: Strategic Asset Decarbonization & Electrification Scheduling

- Modeling the dynamic electrical grid demand profiles required to transition from diesel fleets to fully battery-electric vehicles (BEV).
- Scheduling charging station infrastructure placement and haulage route power grids within the spatial mine plan.
- Simulating the dynamic trade-offs between progressive rehabilitation timelines and active open-pit mining footprints.
- Calculating the embedded and operational Scope 1 and Scope 2 carbon footprint profiles for alternative life-of-mine schedules.
- *Case Study:* Formulating a defensible roadmap to Net-Zero operations by 2040 for a multi-asset mining corporation by embedding electrification schedules into all active site models.

Training Methodology

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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