Formula 1

Content placeholder

Formula 2

Content placeholder

Related Content

Title	Type	Slug
Blast Design Excel Template v4.2	resource	blast-design-excel-template
Drill Rig Maintenance Inspection Checklist	resource	drill-rig-maintenance-checklist
Rock Mass Rating (RMR) Field Survey Sheet	resource	rmr-field-survey-sheet
Drilling Energy Benchmarking Dashboard (Power BI)	resource	drilling-energy-dashboard
TBM Advance Rate Prediction Curve Library	resource	tbm-advance-rate-library

Detailed Explanation

PPK workflows in underground mines address the fundamental challenge of achieving high-accuracy geospatial data without real-time GNSS signal availability. Unlike RTK (Real-Time Kinematic), which requires continuous radio or cellular telemetry—a practical impossibility in deep, shielded mine tunnels—PPK records raw GNSS observables (L1/L2 pseudorange and carrier-phase) and precise timestamps on both the rover (e.g., drone-mounted GNSS/IMU unit) and a stationary base station located at a known surface or near-portal benchmark. After data collection, the rover's raw logs are synchronized with the base station's concurrent logs using precise time stamps (typically PPS-synced to UTC via GPS-disciplined oscillators) and processed offline using specialized software (e.g., NovAtel Inertial Explorer, Emlid Studio, or Pix4Dmapper with PPK support) to resolve integer ambiguities and compute centimeter-accurate trajectory solutions. Critical to underground application is the integration of

inertial navigation aiding: when GNSS signals drop out entirely (e.g., beyond portal or in steel-lined drifts), the IMU provides dead-reckoning continuity, and tightly coupled PPK+INS processing fuses GNSS updates with IMU dynamics to constrain drift and maintain positional integrity. The SOP mandates strict procedures for base station siting (minimizing multipath, ensuring line-of-sight to sky pre-deployment), rover calibration (lever-arm offsets, boresight angles), time synchronization verification, metadata tagging (survey control IDs, tunnel names, shift logs), and traceable uncertainty reporting per ISO 17123-8 and AS/NZS 4495 standards.

Key Components

#	Component
1	Time-Synchronized Dual-Frequency GNSS Receivers
2	Calibrated IMU and Lever-Arm Offset Documentation
3	Survey-Grade Static Base Station with Known Control Coordinates

Applications

#	Application
1	High-Accuracy 3D Tunnel Deformation Monitoring
2	Drone-Based Stockpile Volume Calculations in Declines and Haulage Ways
3	As-Built Validation of Development Drifts Against Design Models

Related Concepts

#	Concept
1	RTK vs PPK Trade-offs
2	Tightly Coupled GNSS/INS Integration
3	Underground Control Network Design

Tags

> underground mining, drone surveying, PPK, geospatial accuracy, mine safety