

Managing Complexity and Decision-Making in Sub-Horizontal Flat Stopping: Insights from an Undergraduate Study at Bellevue Gold Mine

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ABSTRACT

Sub-horizontal flat stopping operations are increasingly defined by geological uncertainty, cost pressure, and heightened productivity expectations. In these tightly coupled systems, minor planning assumptions can materially influence dilution, recovery, sequencing stability, and overall operational risk. Managing this complexity requires adaptive decision-making supported by strong cross-functional collaboration rather than reliance on static technical optimisation.

This Honours study examines the alignment between stope design intent and operational execution at Bellevue Gold Mine. Using comparative analysis of planned and mined stopes within an active underground production environment, the research evaluates how geological variability, sequencing constraints, and real-time production pressures influence performance outcomes.

Results demonstrate systematic divergence between planned designs and executed stopes, driven primarily by orebody variability and time-critical operational decisions. A central finding is the persistent trade-off between dilution control and productivity, where short-term operational responses can materially alter technical and economic outcomes. The study highlights limitations of deterministic planning approaches and underscores the importance of continuous feedback between geology, planning, and operations to manage uncertainty effectively.

This work reframes mine planning as a dynamic leadership and governance function within complex mining systems. Strengthening collaboration, integrating adaptive feedback loops, and embedding systems thinking into decision-making are critical to improving resilience and performance in flat stopping environments. These insights are transferable to underground operations managing similar complexity across the industry.