Creating a Working Infrastructure

A well-thought-out infrastructure is the first building block for any underground mine. This network directly relates to the geology and the mining method applied, but also reflects the individual choices of the mine owner.

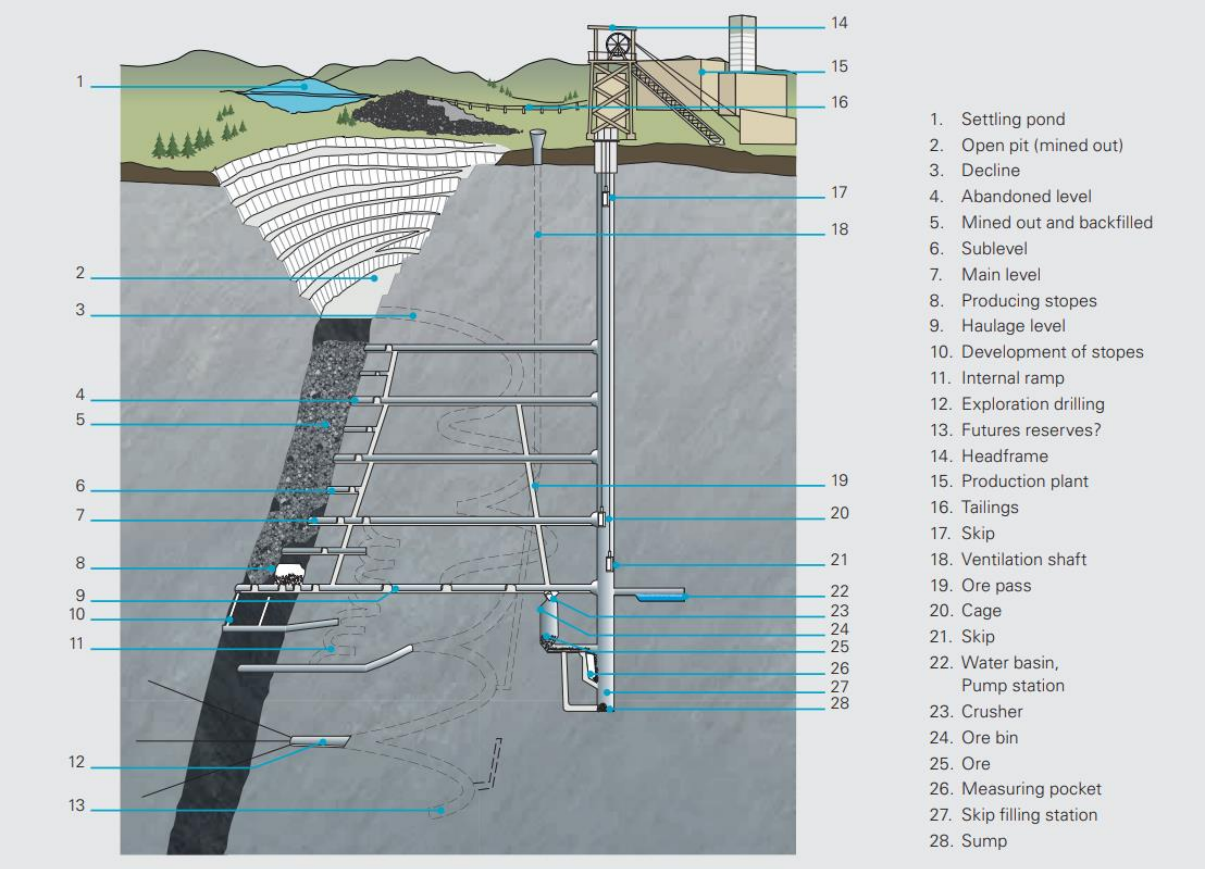


Figure 1 (above) and 2 (next page): Basic infrastructure requirements for a typical underground mine.

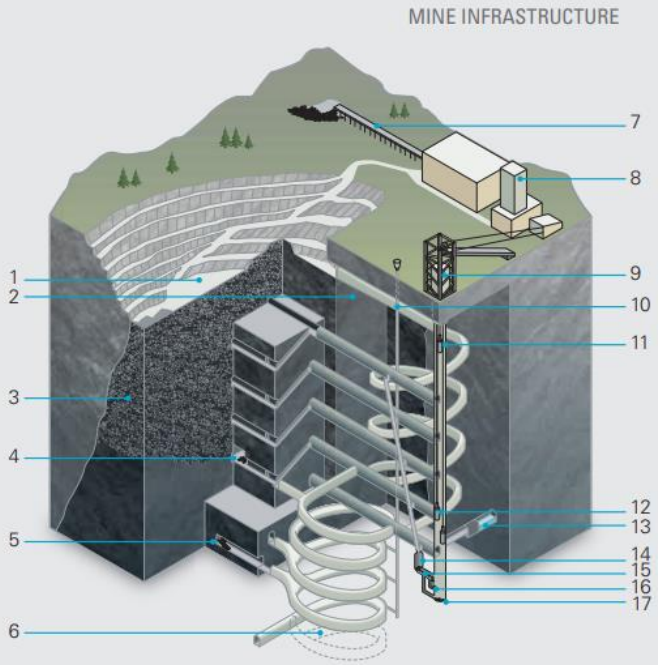
The departure point is the same, but as all underground mines are different, it naturally follows that the infrastructure required to extract the ore and bring it to the surface has to be tailor-made. This work starts in the earliest study phases and is adjusted and adapted successively as the final mine plan gradually emerges.

There is no "one-size-fits-all" solution. Instead, the infrastructure is determined by a range of considerations, starting with the nature and shape of the orebody through to specific environmental objectives.

It is vitally important that the main level, sublevels, ramps, ore passes and shafts that comprise the main elements of the mine infrastructure, are always installed in rock-mechanically safe areas and at a safe distance from mining operations.

For example, the roadways that run to and from the mining areas should be placed where they are least affected by the ongoing production drilling and blasting, ensuring that they will be easy and safe to use. Similarly, all shafts should be placed at a good distance so as to avoid disturbance to the mining operations.

As shown in Figures 1 and 2, the infrastructure needs to make sure that every possible need of the mine is systematically met, from shafts and access installations to ventilation needs, drainage and pumping, utilities and material handling.



1. Open pit (mined out)
2. Decline
3. Mined out and backfilled or caving masses (SLC, BC)
4. Production
5. Producing stopes, development of stopes
6. Future reserves
7. Tailings
8. Production plant
9. Headframe
10. Ventilation shaft
11. Skip
12. Cage
13. Water basin Pump station
14. Ore bin
15. Conveyor belt
16. Measuring pocket
17. Sump

A Holistic approach

There is another aspect of this holistic, total approach to infrastructure planning that is sometimes overlooked or underappreciated. If all parameters are taken into consideration before mine development begins, and modern equipment is used, there are huge cost savings to be made.

The installation of compressed air, electric power, ventilation, water and other resources are typical examples. These can be strategically located as utility points wherever they are needed in the mine, instead of running cables and pipes over long distances down ramps with great risk of leakage and waste. The main raise functions as a hub from which utilities are sourced on different levels and is the first step toward implementing a modern resources management system.

Typically, a mine's infrastructure aims to meet the following needs:

- Services: electricity, water, ventilation, drainage, pumping and maintenance.
- Transportation: draw points, ore passes, ore bins, skips, ramps, hoists, access drifts, roadways and tunnels for trains, trucks, and conveyor haulage.
- Safety: emergency routes and rescue chambers.
- Mine development: areas for ongoing exploration and expansion.

Robbins raiseborer used to drill service and personnel shafts, ore passes, stope openings and ventilation shafts.

Proactive thinking

As a testament to its importance, more and more technological development is now focused on improving the infrastructure of existing underground mines, as well as modernizing the approach for new mines.

This includes the ability to drill long, straight holes (ITH); the use of raiseborers for raises, ore passes and shafts, which also greatly increases safety; the installation of modern communication and remote monitoring systems; and the possibility to adapt ventilation supply to the needs of each mining area. All these developments lead to significant efficiency gains and cost savings.

This becomes especially important for mines that at some point in their lifetimes may go deeper, which presents a range of new challenges such as increased seismic activity requiring more advanced stress analysis and more complex rock reinforcement.

Flexibility and a proactive mindset are key in sustainable mining operations, today and in the future. In this respect, infrastructure is the most important starting point and, if planned correctly, will be the backbone for long-term success.