



MINING INDUSTRY
HUMAN RESOURCES COUNCIL

SPOTLIGHT: MINING ENGINEERS

2024





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Overview

Canada's mining industry has entered a promising new era of growth. Since 2020, increased demand for critical minerals and rising metal and mineral prices have fueled substantial capital investments and mineral exploration spending. With global momentum towards decarbonization and green energy initiatives, Canada's key position in the green economy offers a bright future for careers in its mining sector.

Establishing a robust talent pipeline is increasingly important for the sustainable growth of the industry. To this end, The Mining Industry Human Resources Council (MiHR) has identified several essential occupations that face potential labour shortages in the coming years. This publication focuses on one of these crucial occupations: **Mining Engineers** (NOC 21330)¹.

Aimed at both job seekers and employers, this report offers information on the position's primary responsibilities, level of remuneration, educational prerequisites and skills profile. Additionally, it delves into the geographical distribution, demographic characteristics, and latest employment and postsecondary education trends for mining engineers.

Job Description

Mining Engineers are responsible for planning, designing, organizing, and overseeing the development of mines, including mine facilities, systems, and equipment. They also play a crucial role in preparing and supervising the extraction of metallic or non-metallic minerals and ores from both underground and surface mines².

Mining Needs You

Why are Mining Engineers important?

We need Mining Engineers because they provide specific knowledge and leadership that is critical for developing and constructing new mines, and for managing existing mines. Mining Engineers work closely on teams with other engineers and technologists.

What is it Like to Work as a Mining Engineer in Mining?

Note: conditions vary according to employer and region.

Mining Engineers use their knowledge and skills to design systems and operations to extract minerals and metals to meet growing resource demands. They minimize the physical, environmental and social footprints associated with the extraction and processing of mineral resources and managing the waste materials produced – requiring knowledge of topics in every science and engineering discipline.

Why are People Attracted to this Career?

Mining Engineers seek challenging and rewarding technical work. With their strong analytical skills, they enjoy forming creative solutions to problems, and are well compensated for their efforts. They utilize new technologies effectively both independently and with a team. Engineers often work in a multidisciplinary environment and acquire knowledge and skills through work experience that may allow them to practise in associated areas of science, engineering, sales, marketing or management.

Source: Mining Industry Human Resources Council, "We Need Mining, Mining Needs You". <https://www.miningneedsyou.ca/job/mining-engineer/>

¹ Labour market data is aligned with Employment and Social Development Canada's (ESDC) National Occupational Classification (NOC) framework. Statistics cited throughout this report will correspond to NOC 21330 (Mining Engineers), as it is the closest match.

² Statistics Canada, Occupational and Skills Information System (OaSIS).

Duties and Responsibilities

Mining Engineers perform some or all of the following duties:

- Conduct preliminary surveys and studies of ore, mineral or coal deposits to assess the economic and environmental feasibility of potential mining operations.
- Determine the appropriate means of safely and efficiently mining deposits.
- Determine and advise on appropriate drilling and blasting methods for mining, construction or demolition.
- Design shafts, ventilation systems, mine services, haulage systems and supporting structures.
- Design, develop and implement computer applications such as for mine design, mine modelling, mapping or for monitoring mine conditions.
- Plan and design or select mining equipment and machinery and mineral treatment machinery and equipment in collaboration with other engineering specialists.

- Plan, organize and supervise the development of mines and mine structures and the operation and maintenance of mines.
- Prepare operations and project estimates, schedules and reports.
- Implement and co-ordinate mine safety programs.
- Supervise and co-ordinate the work of technicians, technologists, survey personnel, and other engineers and scientists.

Additional information:

- Supervisory and senior positions in this unit group require experience.
- Mining engineers work closely with geologists, geological engineers, metallurgical engineers, and other engineers and scientists, and mobility is possible between some fields of specialization.
- Engineers often work in a multidisciplinary environment and acquire knowledge and skills through work experience that may allow them to practise in associated areas of science, engineering, sales, marketing or management.

Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS).

Wages and Pay

Mining engineering careers offer a compelling advantage in terms of earning potential. In 2021, the median annual income for *Mining Engineers (NOC 21330)* was \$116,000, more than 2.5 times the national average and higher than other popular engineering professions in Canada. The data also shows that wages offered by employers have been trending upward in recent years.

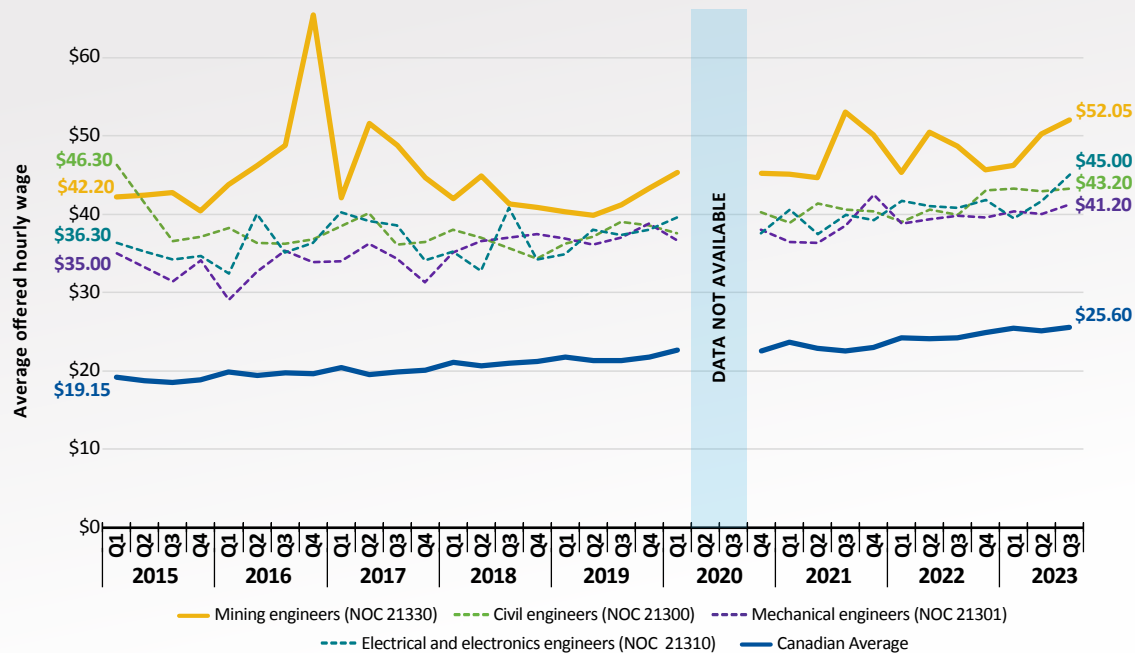


Median Annual Income (Wages, salaries and commissions), Mining Engineers and related occupations (2021)

NOC Code	Occupation	Median Annual Income
-	All occupations	\$43,200
21330	Mining Engineers	\$116,000
21300	Civil Engineers	\$87,000
21301	Mechanical Engineers	\$85,000
21310	Electrical and Electronics Engineers	\$95,000

Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Census of Population, 2021

Average offered hourly wage, Mining Engineers and related occupations (2021)



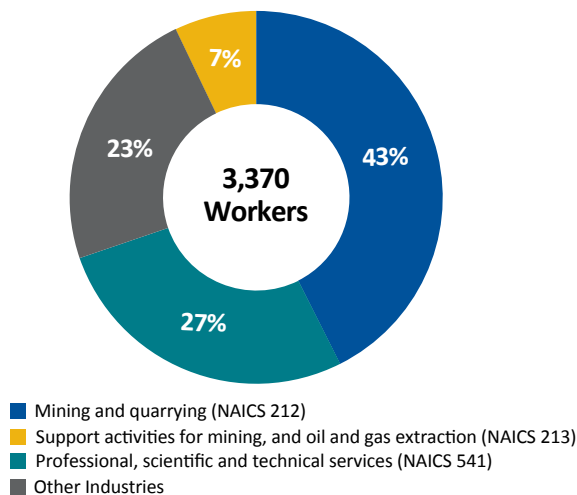
Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada Job vacancies, proportion of job vacancies and average offered hourly wage by selected characteristics, quarterly, unadjusted for seasonality, inactive (Table: 14-10-0328-01), 2024

Places of Work

Industries that Employ Mining Engineers

Most Mining Engineers are concentrated within three sectors; *Mining and quarrying*, *Support activities for mining and oil and gas extraction*, and *Professional, scientific and technical services* employed roughly three fourths of the mining engineer workforce across Canada in 2021. Within these industries, some of the businesses that hire Mining Engineers include mining, consulting and manufacturing companies.

Employment by Industry, Mining Engineers (NOC 21330) (2021)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Census of Population, 2021.

Types of Employers

Below is a short list of the types of workplaces that typically employ Mining Engineers in Canada:

- Consulting engineering companies
- Education institutions
- Governments
- Manufacturing
- Mining companies
- Research institutions

Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS).

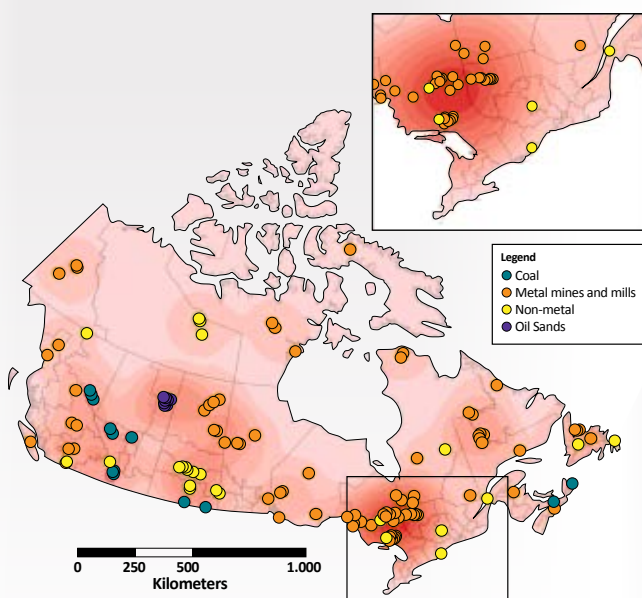
Work Setting

Many Mining Engineers in Canada work in proximity to mining operations such as mineral mines or sand-and-gravel quarries, while others work in engineering services offices. These places of work can be situated in remote areas or near urban centers.

While some maintain regular office hours, those who work onsite in mining operations may have more irregular schedules. The nature of the job often requires full-time commitment, with some individuals working more than the standard 40-hour work week. Variable schedules are particularly common in remote locations³.

Mining Engineers frequently engage in fly-in fly-out (FIFO) work arrangements, commuting to and from remote mine sites for extended periods that span several days or weeks before their return. This practice can improve operational efficiency and cost-effectiveness for the company while also enhancing the work-life balance of employees.

MAP 1 Producing Mines in Canada

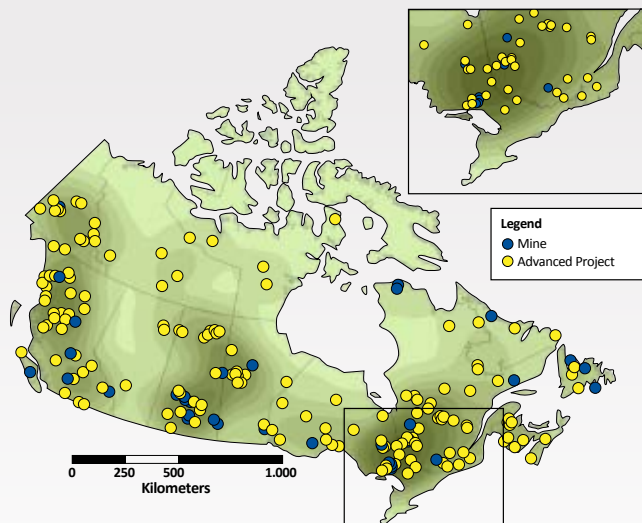


Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Natural Resources Canada, Principal Mineral Areas, Producing Mines, and Oil and Gas Fields in Canada, 2022

As per NRCan data from 2022, Canada had a total of 135 active mines. Map 1 depicts their geographic spread, denoting the type of operation and where there is a higher density of mines relative to other areas. The figure shows the largest cluster of mining activity is found in Northeast Ontario and Abitibi-Témiscamingue, Québec, where there is a long and established history of mining.

3 U.S. Bureau of Labor Statistics, Occupational Outlook Handbook, 2023.

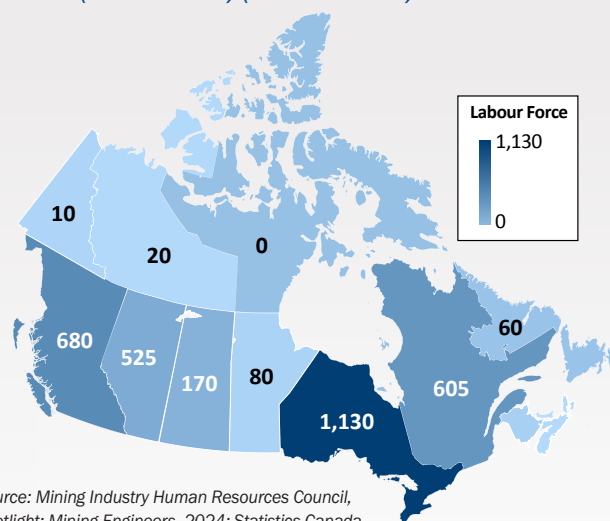
MAP 2 Critical Mineral Projects in Canada



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Natural Resources Canada, Principal Mineral Areas, Producing Mines, and Oil and Gas Fields in Canada, 2022

The shift to a green economy in Canada will largely depend on critical minerals that will make clean energy technologies possible. With its vast geological landscape, Canada is well positioned to be a producer of key critical minerals as they are anticipated to increase in demand. Map 2 displays critical mineral projects across Canada in 2021. These projects encompass a variety of critical minerals, including Zinc, Copper, Cobalt, Nickel, among several others.

MAP 3 Labour Force by Province, Mining Engineers (NOC 21330) (2021 Census)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Census of Population, 2021

Map 3 shows how the labour force of Mining Engineers is distributed across the country by province of residence. Among provinces, Ontario has the largest number of Mining Engineers, followed by British Columbia and Quebec.

Education, certification and licensing

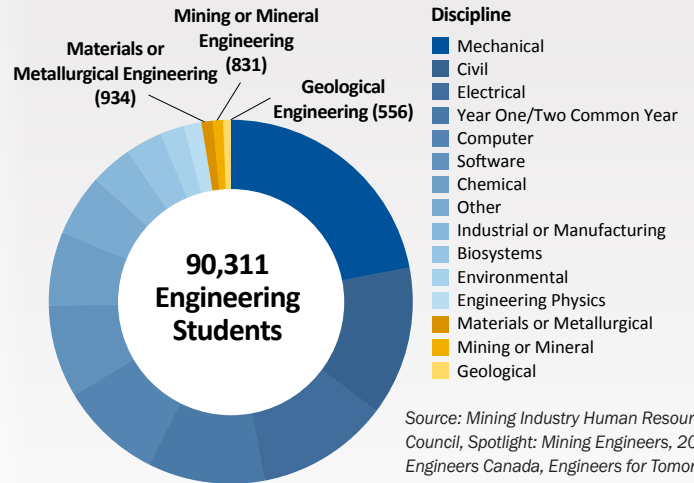
The following list includes the education, training and/or certifications required to work as a Mining Engineer in Canada.

Educational Requirements

- A bachelor's degree in mining engineering or in a related engineering discipline is required.
- A master's degree or doctorate in a related engineering discipline may be required.
- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practise as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, and after three or four years of supervised work experience in engineering and passing a professional practice examination.

Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Occupational and Skills Information System (OaSiS)

Canadian Undergraduate Enrolment in Accredited Engineering Programs (2020)



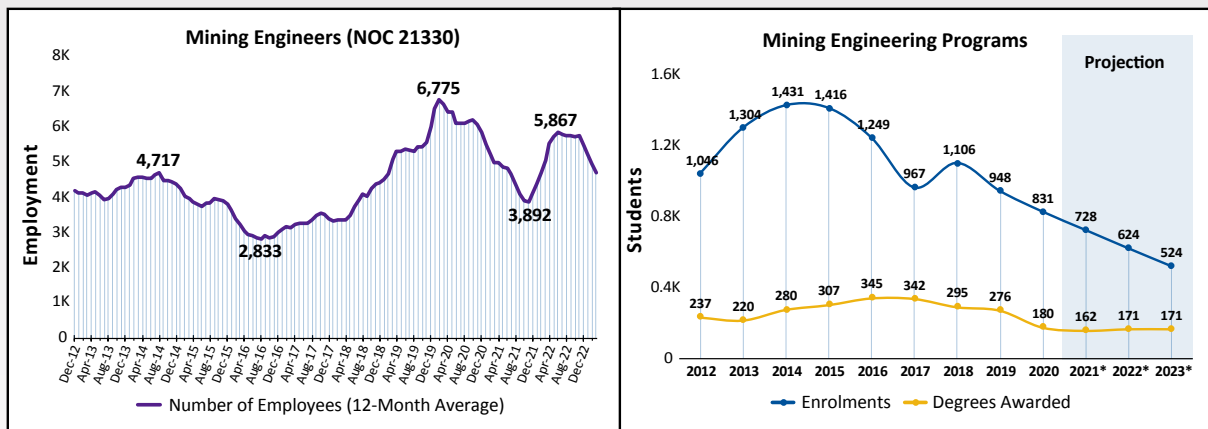
Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022

Postsecondary Education Trends

Mining engineering is one of the least commonly chosen disciplines among undergraduate engineering students in Canada. The three most popular programs

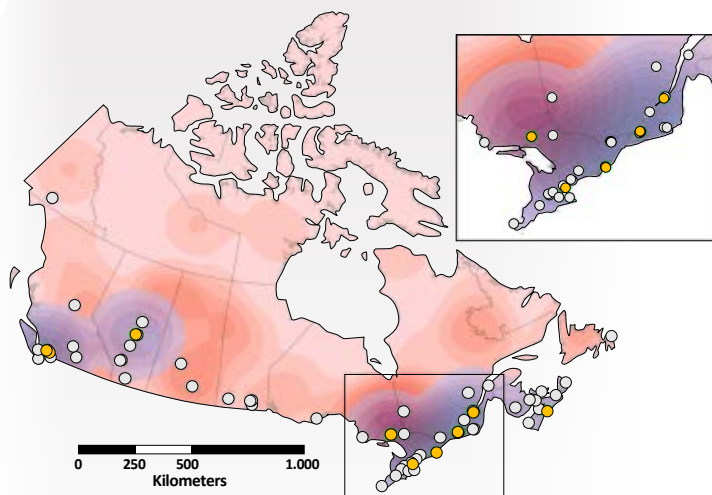
There is a noticeable disconnect between employment trends for Mining Engineers and the enrolment and graduation trends observed in mining engineering programs. From 2016 to 2020, employment for Mining Engineers roughly doubled while enrolments declined by 33% and graduates declined by 48%. This underscores the postsecondary system's inability to respond to growth signals from the mining labour market.

Employment and Postsecondary Education Trends (Undergraduate), Mining Engineers (2012–2023)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022

MAP 4 Universities with Mining Engineering Programs (2020-2021)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Engineers Canada, Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2016-2020, 2022

Legend
 ● With Mining Engineering Enrolment
 ○ Without Mining Engineering Enrolment

Of the 90 universities shown in Map 4, only 10 schools across Canada offered undergraduate mining engineering programs in the 2020-2021 academic year:

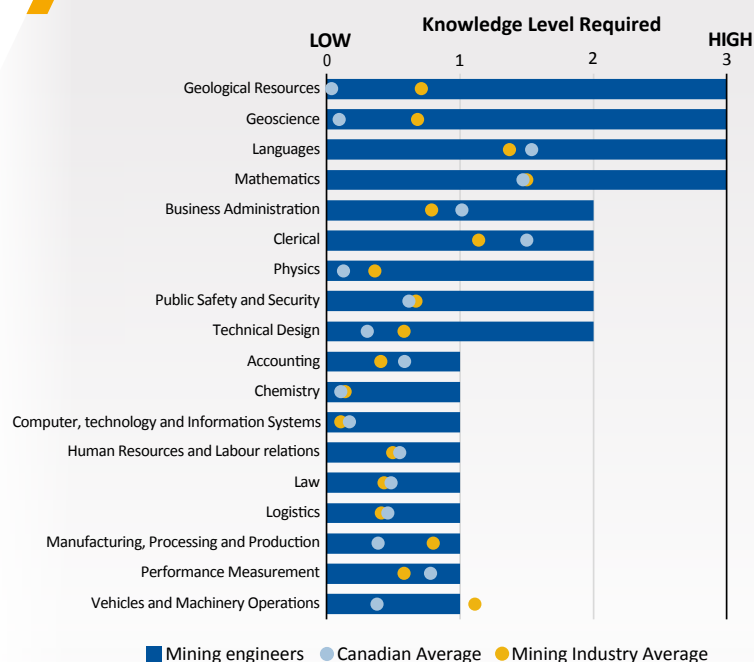
- British Columbia Institute of Technology
- Dalhousie University⁴
- École Polytechnique de Montréal
- Laurentian University
- McGill University
- Queen's University
- Université Laval
- University of Alberta
- University of British Columbia
- University of Toronto

Knowledge, Skills, Abilities and Personal Attributes

The Occupational and Skills Information System (OaSIS)⁵ describes the various competencies and characteristics of workers in a given occupation. The following charts provide a set of ratings for the level of knowledge or proficiency attributed to Mining Engineers in Canada.

In this context, knowledge refers to the principles and practices most frequently used by mining engineers for the execution of workplace tasks or activities.

Knowledge



■ Mining engineers ■ Canadian Average ● Mining Industry Average

Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS)

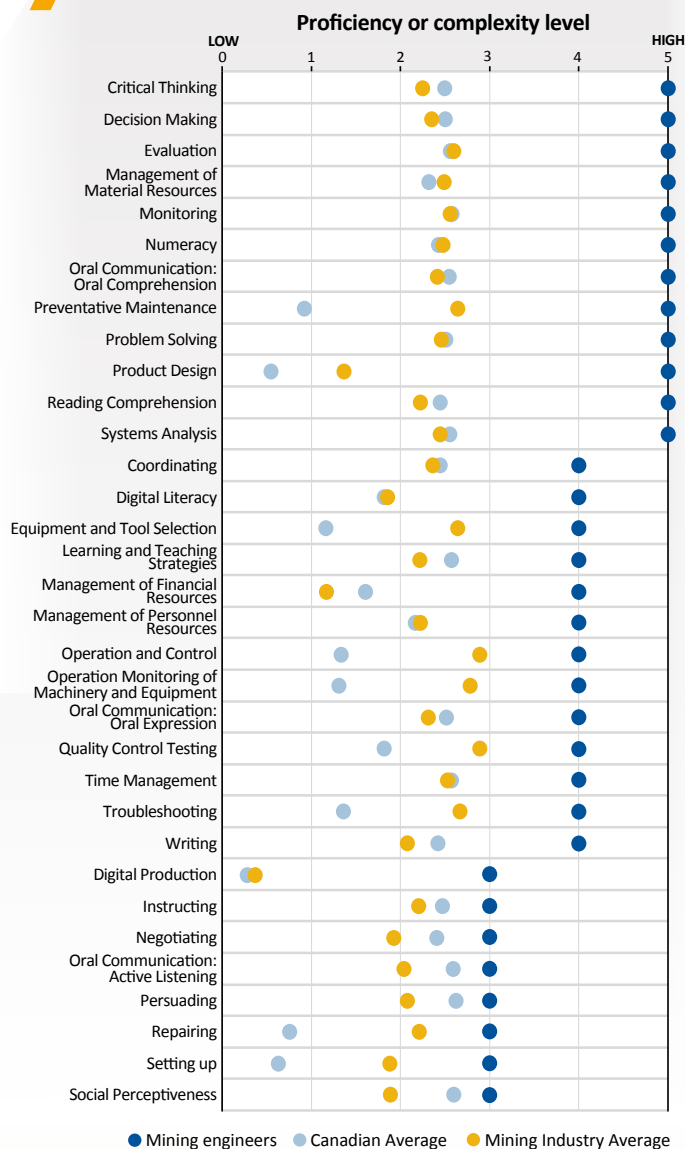
⁴ Dalhousie University has suspended its Mineral Resource Engineering Program as of 2023-2024.

⁵ The OaSIS is a database developed by Employment and Social Development Canada (ESDC) that provides ratings for worker characteristics such as skills and abilities as well as the work environment associated with Canadian occupations.

Skills can be defined as the proficiencies that an individual needs to possess in order to perform effectively in a job, role, function, task, or duty.

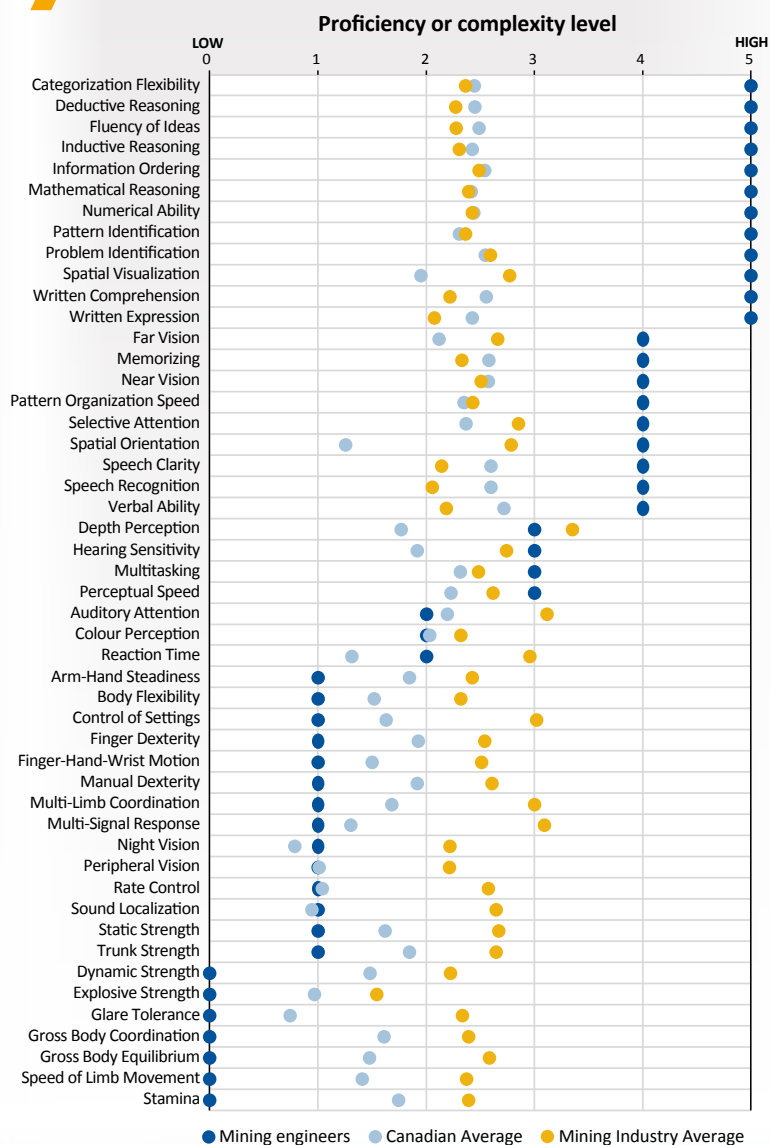
Abilities can refer to inherent and cultivated aptitudes that facilitate the attainment of knowledge and skills required to fulfill job responsibilities effectively.

Skills



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS)

Abilities



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Occupational and Skills Information System (OaSIS)

Similar to abilities, personal attributes are inherent traits that are cultivated through social contexts and personal experiences. They shape the person and are a valuable asset in determining work performance.

Personal Attributes



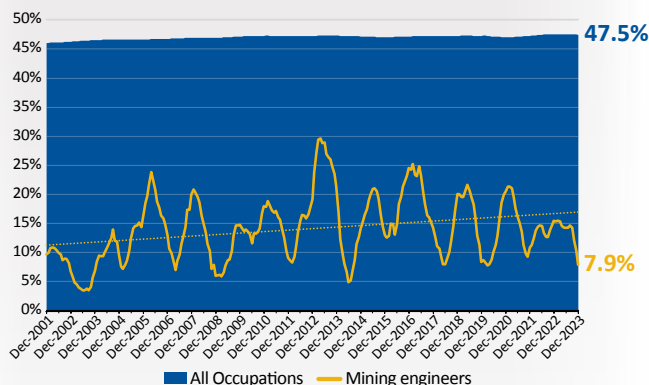
Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Labour Force, Occupational and Skills Information System (OaSiS)

Demographic Representation

Understanding the demographic profile of Mining Engineers is crucial for workforce planning, promoting diversity and inclusion, tailoring skills development programs, implementing retention strategies and gaining insights into industry trends.

Women's representation among Mining Engineers (7.9%) has been highly volatile but remains significantly lower than the Canadian average (47.5%) as of December 2023.

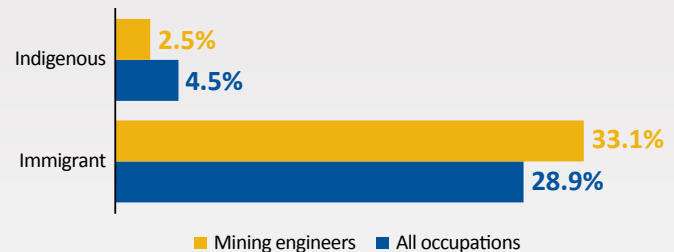
Women's Representation (2001-2023, 12-month Moving Average)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Labour Force Survey (Custom Data)

According to the Census, the proportion of immigrants in this occupation (33%) surpasses the level found across all occupations (29%). The reverse is true in the case of Indigenous peoples; their representation among Mining Engineers is only 2%, compared to 4% across all occupations in Canada.

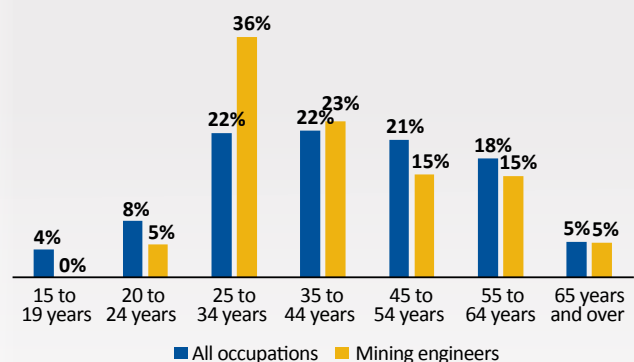
Indigenous & Immigrant Representation (2021 Census)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Census of Population, 2021

Most Mining Engineers fall within the 25 to 34 age bracket (36%), with a significant portion (20%) nearing or past retirement age. To ensure a robust labour supply pipeline, it is imperative to recruit young workers to replenish the gap created by retiring workers.

Age Distribution (2021 Census)



Source: Mining Industry Human Resources Council, Spotlight: Mining Engineers, 2024; Statistics Canada, Census of Population, 2021

