DIGGING DEEPER:

Understanding the Engineering, Geoscientist, Technologist and Technician Labour Market in the Asia Pacific Gateway

March 2017

ASIA PACIFIC GATEWAY
SKILLS TABLE

Canada

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EXECUTIVE SUMMARY

The Asia Pacific Gateway (APG) is fundamental to growing Canada's middle class and building a strong Canadian economy.

Some occupations such as Engineers, Geoscientists, Technologists and Technicians (EGTT's) contribute to supporting the APG more than others. The construction and transportation sectors are primary drivers to providing well-paying, long-term jobs for Canadians within these occupations.

In 2015, the Asia Pacific Gateway Skills Table (Skills Table) partnered with the Applied Science Technologists and Technicians of BC (ASTTBC), Association of Professional Engineers and Geoscientists of BC (APEGBC), Association of Consulting Engineering Companies BC (ACEC-BC), and Government of BC and published a 10-year labour market forecast for 31 EGTT occupations. Key highlights from the 2015 Engineers, Geoscientists, Technologists and Technicians (EGTT) Labour Market Outlook were:

- → For Engineers: 15,600 job openings to be filled, 47% created by Expansion, 53% by Attrition
- → For Technologists and Technicians: 14,770 job openings, 61% by Expansion, 39% by Attrition
- → For Geoscientists and Oceanographers: 780 job openings, 30% by Expansion, 70% by Attrition
- → 1 in 5 Engineers working in 2015 will retire by 2024, on average 800-850 will leave per year
- → 1 in 4 Technologists and Technicians working in 2015 will retire by 2024, on average over 900 a year
- → Just under 1 in 4 Geoscientists and Oceanographers working in 2015 will retire by 2024, on average about 55 a year
- → New Supply was dependent on Immigration (32%) and New Entrants (57%) in all of the regions
- → Employers will need to be creative in finding and keeping team members.

The labour market forecast was well received by partners and industry and spurred discussions and interest from the engineering, technologist and technician community to conduct further research in four areas:

- → Occupation vs. Discipline
- → Standard Workplace Structures
- → New Entrants
- → Location of Work and Location of Workers

This study, "Digging Deeper: Understanding the Engineering, Geoscientist, Technologist, and Technician Labour Market in the Asia Pacific Gateway", was released in April 2017. The first study of its kind in BC and Canada, it provides information to help guide forecasters, employers, industry associations and government to make decisions in future planning.

Data was collected via employer and workforce surveys as well as employer interviews. Data was analyzed and validated in regional focus groups.

Occupation vs. Discipline

The study examined the effectiveness of using the National Occupational Classification (NOC) as the basis for predicting demand and supply for these occupations. The results indicated that for the most part, the NOC is an accurate tool to predict demand and supply for EGTT occupations in BC's labour market.

Eight out of the 10 respondents said the NOC descriptions accurately reflect the work tasks they perform. However, the NOC was not seen as being accurate because of missing scope in the work descriptions for the following occupations:

- → Geoscientists and Oceanographers (NOC 0211)
- → Other Professional Engineers (NOC 2148)
- → Engineering Inspectors and Regulatory Officers (NOC 2262)

It was specifically noted that Project Management, Fire and Safety, Environmental Responsibilities and Hydrography were missing from the NOC descriptions for the above-mentioned occupations.

Workplace and Line of Business Structure

This study looked to determine standard ratios of engineers and technologist/technician teams. The respondents did not report a standard ratio or organizational structure. Respondents identified that design and development work would lean towards more Engineers on a team comprised of both Engineers and Technologist and Technicians, and operational production and maintenance work would lean towards teams with more Technologists and Technicians.

New Entrants

20% of Technologists and Technicians enter the workforce without previous work experience. The 2015 labour market forecast overestimated the New Supply of New Entrants in these occupations by 30% (50%).

It is also likely that the Skills Table's LMI model that created the 2015 forecast underestimated the flow of workers from other occupations into the supply of this workforce.

Engineers in Training (EITs) have gained significant work experience over their student counterparts. 18% of EITs enter the workforce without previous work experience, which means the current Engineering labour market forecast estimate of the New Supply of Engineers as New Entrants (50%) is also an overestimate by as much as 30%. It is also likely that the 2015 LMI model underestimated the flow of workers from other occupations into the supply of this workforce.

Only 10% of Geoscientists in Training (GITs) enter the workforce without previous work experience. The labour market forecast for Geoscientists is overestimated at 50% New Entrants in the new supply. It is also likely that the 2015 LMI model is again underestimating the flow of workers from other occupations into the supply of this workforce.

Respondents identified that EITs and GITs have difficulty finding employment because they have limited work experience. Nearly 2 in 5 EITs and GITs have not worked at all prior to beginning their education in their fields. Given the feedback about the difficulties for EITs and GITs to find employment, it may be valuable to examine the relationship between previous work experience and the employability of EITs and GITs.

Employers interviewed stated they are looking for experienced professionals with five to 15 years of work experience. They are less interested in training EITs, GITs and newly trained Technologists and Technicians.

For employers with comprehensive training programs, concern was expressed about the investment compared to the long-term retention rate of those they train and many tended to hire experience versus training new graduates.

Location of Worker vs. Location of Work

More than one in three EGTT professionals along with employers said they work on projects outside of BC., which supports the anecdotal evidence in the community and from other studies that about one third of revenues from EGTT companies are generated in the rest of Canada and internationally.

Respondents did not feel that there was a lot of BC-based work being done by professionals from outside of BC, the majority indicating this is less than 10% of the total work in BC. During focus groups, there was initial surprise at how small this was reported to be. However, it became clear that the expectation that BC work was being offshored was inaccurate. Offshoring is seen much more commonly in projects led by BC companies that are based outside of BC, largely in developing economies.

Next Steps

The expectation is that study's findings will be highly useful in fine-tuning future EGTT labour market forecasts to more accurately predict the conditions facing employers in BC. The study will support employers to hire and retain EGTT professionals and will provide them with a better understanding of the flow of workers into these occupations.

For government, the study confirms the validity of the current NOC descriptions and allocations. The study highlights NOC descriptions that would benefit from fine-tuning descriptions of work performed in these occupations.

The study is also intended to be used by partners and industry associations in BC and across the APG to help build a broader and deeper understanding of the work environment, team structures and professional demands faced by EGTT professionals.

BACKGROUND

The Asia Pacific Gateway Skills Table (Skills Table), in partnership with the Association of Consulting Engineering Companies British Columbia (ACEC-BC), Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), and Applied Science

Technologists and Technicians of British Columbia (ASTTBC) undertook this labour market research project to better understand the four significant differences between the information from the Skills Table's Labour Market Model assumptions and outputs and the understanding and experience of experts in the EGTT occupations.

As background, in 2015, the Skills Table delivered a 10-year labour market forecast for 31 Engineering, Geoscientist, Technologist and Technician (EGTT) occupations in 5 regions of BC. These reports can be found at http://www.lmionline.ca/projects/egtt/ . This detailed regional forecast was the first of its kind for the community and positively received.

During this work, it became clear that there were several areas of investigation that would enable a better understanding of the workers in these occupations, employers' needs and expectations in the labour market, as well as support improvements in the methodologies and processes used to model labour market changes for these essential workers in the Canadian economy.

This research study aims to fill in the information gaps in the areas of:

→ *Occupation vs. Discipline* - understanding the dispersion of disciplines across a range of occupations
→ *Workplace and Line of Business Structure* - understanding the ways in which engineers, technologists and technicians work together in teams
→ *New Entrants* - understanding new entrants, as defined by Statistics Canada, entry to the workforce
→ *Location of Worker vs. Location of Work* - understanding the extent of BC workers completing work for projects outside of BC and the extent that work on BC projects is being completed outside of BC

The findings will help employers recruit and retain workers and will positively impact the productivity and profitability of their businesses, as well as better equip industry organizations, regulators, and government in their decision making regarding the EGTT labour market.

RESEARCH SCOPE

The research objective was to better understand the four significant differences between the Skills Table's Labour Market Model assumptions and outputs and the understanding and experience of experts in the EGTT occupations. Below are the four areas of investigation undertaken with the overall goal of strengthening the Labour Market Model and enhancing knowledge to support employers' recruitment activities.

RESEARCH AREA 1: OCCUPATION VS. DISCIPLINE

The National Occupational Code (NOC) is expected to count workers who have the skills and work in each specific occupation; however, during our work, our experts began to question the extent to which there was a difference between occupation (as defined by the NOC structure) and discipline (as defined by the area of specialty and/or training in the ASTTBC and APEGBC databases). For example, Civil Engineering Technologists and Technicians (NOC 2231) may work in jobs ranging from Drafting Technologist to Architectural Technician to Project Manager or Construction Inspector, each of which has different responsibilities and thus different recruiting activities. In the 2015 EGTT LMI project, it became very clear that understanding the dispersion of disciplines across a range of occupations is needed to fully understand the impact of EGTTs in the economy and across industries.

Our expectation is that research findings will:

- → Provide insight into the occupational pathways of Engineers, Geoscientists, Technologists and Technicians to better forecast labour demand and supply flows for the NOC Occupations and create a more accurate picture of the need for, and source of, new supply.
- → Provide compelling information to inform the next NOC revisions and the Labour Force Survey (LFS) collection process to improve overall Labour Market data and forecasts.
- → Confirm our understanding of the make-up of the employment numbers in the forecast.
- → Inform the possibility of developing a viable allocation model to report by discipline as well as occupation.
- → Assess any differences in reporting behaviour between Technologists and Technicians and Engineers and Geoscientists.

The purpose of this research question was threefold:

1. To assess the extent to which the NOC Occupations captured the scope of disciplines of Certified Technologists and Technicians, Professional Engineers and Professional Geoscientists and therefore the implied accuracy or representativeness of the LMI forecasts.
2. To assess the extent to which the NOC occupation descriptions capture the scope of work in the Labour Market.
3. To examine if the degree of connection between discipline and NOC Occupation differ measurably between the three groups of professionals.

RESEARCH AREA 2: WORKPLACE AND LINE OF BUSINESS STRUCTURE

The 2015 EGTT Labour Market Outlook clearly suggests that overall demand for EGTTs is generated more by the ongoing economic activities (maintenance, infrastructure replacements, exploration and development) than by large-scale projects. However, it also challenges the long held understanding of the ways in which Engineers, Technologists and Technicians work together. This is related particularly to the expected 3:1 ratio of Technologists and Technicians to Engineers. The data in the 2015 study, as well as a high level anecdotal investigation into employer practice, implied that this ratio is not the dominant model of work. Research was needed to establish if the ratio existed, and to quantify the ratio. The areas of specialization/lines of business that were focused on in this question included: mechanical, civil, electrical, electronics, environmental, structural, architectural and utility.

Our expectation is that research findings will:

→ Improve the labour market information by refining and adjusting predictive models of employment structures.

→ Provide better information about workplace opportunities and roles.

→ Allow us to provide a more comprehensive view of the various business models used in a variety of lines of business (mechanical, civil, electrical, electronics, environmental, structural, architectural, and utility).

→ Confirm our understanding of the workplace relationships between Engineers and Technologists and Technicians and where there are or are not standards and/or set proportions.

The purpose of this research question was twofold:

1. To determine if there are standard ratios of Technologists and Technicians to Engineers either by line or type of business.

2. To assess the usefulness of such a ratio to the Labour Market Forecast Models.

RESEARCH AREA 3: NEW ENTRANTS

The *New Entrants* definition in LMI modeling is currently a complex mathematical construct that estimates the flow of workers' first entrance into the labour force. The New Entrants are not graduates, as graduates do not all move into the labour force and some have already been in the labour force. The 2015 forecast estimates the flow of New Entrants into each occupation and overall expects that more than half of the New Supply[1] for these occupations will be from workers who are new to the labour force – they have never worked, in any capacity, before entering these occupations. However, there is some question about the extent to which this is a reflection of the real world behaviour of EGTTs in the workforce before, during and after training. Creating a clearer picture of the actual flows of New Entrants into these occupations will help to create a stronger supply flow forecast – often the information of most interest – and to test the anecdotal and experiential assumptions of the industry around the flow of new entrants into the workforce.

1 New Supply is the number of workers who enter an occupation, from all sources, in a forecast year.

Our expectation is that research findings will:

→ Create a clearer picture of the actual flows of these workers to refine and improve the forecast model so that the supply forecast includes an accurate reflection of the extent and scope of New Entrants into these Occupations.

→ Test the anecdotal and experiential assumptions of industry around the flow of new entrants into the workforce.

The purpose of this research question was threefold:

1. To understand the extent to which these professionals have participated in the workforce before they began to train (study) in their field.

2. To determine if there are any differences between the groups in their previous work experience.

3. To determine if the forecast model needs to adjust its expectation of the scope of New Entrants in filling the New Supply of workers.

RESEARCH AREA 4: LOCATION OF WORKER VS. LOCATION OF WORK

Particularly for Engineers, the examination of job openings and supply flow opened a dialogue about the nature of the work done and the extent to which these workers can be resident in other provinces or countries while completing work for BC projects. This also led to questions about the extent to which BC engineers are performing work in other regions, provinces and countries. The APGST LMI Forecast model has variables that consider the 'export' of this work; however, it is clear that this is a growing portion of the work of these professional groups and a better understanding needs to be built to both increase the accuracy of the forecast model and help industry, employers, and regulators understand the role of expertise 'exports and imports' in the overall economy.

Our expectation is that research findings will:

→ Begin to paint a more extensive picture of the extent to which BC engineers are performing work in other provinces and countries while living and going to a workplace in BC.

The purpose of this research question was twofold:

1. To assess the extent to which these professionals in BC lend their expertise to project and programs outside of the province.

2. To assess the extent to which professionals who live outside of BC provide support and expertise to projects and programs in BC.

Overall, the intention of this research is to generate information that can enhance the ability of the LMI forecast tools to create a realistic and valid picture of labour market conditions employers will face over the next decade. The more realistic the model, the more useful the information; the more adaptable the market, the stronger the economy.

FINDINGS

RESEARCH AREA 1 - OCCUPATION VS. DISCIPLINE

What are the occupational pathways of Engineers, Geoscientists, Technologists and Technicians?

To answer this question, we asked respondents about their 'registered' discipline[2] – that is, which discipline they are registered in with their respective professional association. We also asked them, of the NOC Occupations listed, which was the best fit for the work they are currently doing. This allowed for an analysis of the extent to which the NOC occupations[3] and disciplines overlap.

80% of Certified Technologists and Technicians trained in the civil, mechanical, electrical, electronics, and building disciplines[4] and there appears to be a change in preferences, as students are increasingly more likely to be training in the Environmental discipline as well as Mining. The Civil discipline remains the most frequently studied, but has fallen to 18% of all student respondents and is equaled by the Environmental and Mechanical disciplines.

77% of Certified Technologists and Technicians report in 5 of the 22 NOC Occupations, included in the scope of this study, that captures the work of Technologists and Technicians in the labour market. From the top 5 disciplines, 80% or more report their NOC occupation is the same as their discipline.

80% of Professional Engineers trained in the civil, mechanical, electrical, structural and chemical disciplines[5]. Of the respondents, there appears to be a shift in focus as a higher proportion of EITs trained as Mechanical and Electrical Engineers and, along with the student responses, show the Environmental Discipline as one of the top 5 disciplines. Regardless of the type of respondent, the Civil discipline remains the most frequently chosen area of specialization.

75% of all Professional Engineer respondents report in 5 of the 16 NOC Occupations included in this study that currently reflect the work of Engineers. From the top 5 disciplines, more than two thirds (67-75%) report their occupation is the same as their discipline, just over 10% report as a Manager, and fewer than 10% report their occupation as Other Professional Engineers, n.e.c.[6] suggesting that 1 in 10 engineers do not see their work reflected in the more clearly defined NOC Occupations.

87% of Professional Geoscientists trained in the geology, environmental geoscience, geological, geotechnics, environmental, and mining disciplines[7]. As with Engineers and Technologists and Technicians, there is a change in preferences as a higher proportion of GITs and geoscience students are training in Geology and Environmental Geoscience and a lower proportion in Mining and Geotechnics.

86% of Professional Geoscientists report as Geoscientists and Oceanographers (NOC 2113) and just over 2% report as an Engineering Managers. Those who trained in the Geotechnics discipline report as engineer NOC Occupations and Engineering Managers (NOC 0211) more than the other disciplines.

2 Both ASTTBC and APEGBC require an individual to choose a primary discipline, or area of specialization such as Civil or Mechanical, as a part of the registration process.

3 The National Occupational Classification (NOC) is the nationally accepted reference on occupations in Canada. It organizes over 40,000 job titles into 500 occupational group descriptions. The NOC provides a standardized framework for organizing the world of work in a coherent system. It is used to manage the collection and reporting of occupational statistics and to provide understandable labour market information.

4 See Appendix D for a list of the ASTTBC Disciplines

5 See Appendix E For a list of the APEGBC Disciplines

6 n.e.c. is 'not elsewhere classified'

7 See Appendix D for a list of the ASTTBC Disciplines

What have we learned about Engineers, Geoscientists, Technologists and Technicians that can inform the next NOC revisions and the Labour Force Survey (LFS)[8] collection process?

To answer this question, we asked respondents to assess the NOC description for the occupation they chose as most representative of the work they currently do. If they stated it was inaccurate, they were asked to explain why.

For the majority of these EGTT professionals, the NOC descriptions were seen as reasonable and accurate. However, there are a few notable exceptions to this.

8 The Labour Force Survey is a data collection tool used by Statistics Canada, which forms the foundation of information for the majority of labour market forecasts. It allows for annual adjustments to reflect the current behaviour of the labour force by occupation, region and other demographic factors.

Table 1 - Perceived Inaccuracy of the NOC to Current Workplace Scope of Professionals

Occupation Title	Respondent Group									
	Engineers		EITs		Technologists & Technicians		Geoscientists		GITs	
	%[9]	Count[9]	%[9]	Count[9]	%[9]	Count[9]	%[9]	Count[9]	%[9]	Count[9]
Aircraft instrument, electrical and avionics mechanics, technicians and inspectors (NOC 2244)					50%	1				
Chemical technologists and technicians (NOC 2211)					25%	2				
Computer engineers (except software engineers and designers) (NOC 2147)	33%	2	50%	1						
Computer network technicians (NOC 2281)					50%	1				
Engineering inspectors and regulatory officers (NOC 2262)					47%	8				
Geoscientists and oceanographers (NOC 2113)	17%	1					18%	30	15%	12
Metallurgical and materials engineers (NOC 2142)	27%	3								
Natural and applied science policy researchers, consultants and program officers (NOC 4161)					24%	9				
Other professional engineers, n.e.c. (NOC 2148)	51%	36	42%	36			80%	4	50%	2
Petroleum engineers (NOC 2145)	40%	2								
Petroleum, gas and chemical process operators (NOC 9232)					37%	7				
Software engineers and designers (NOC 2173)	8%	1			25%	2				
User support technicians (NOC 2282)					50%	3				

9 Of respondents who chose this occupation

Most emphatically, Other Professional Engineer n.e.c. (NOC 2148) was seen by half of those who chose it as inaccurate. Given the nature of this occupation (i.e., it is for those workers who do not see themselves in any of the other more specific occupations), this finding is not startling.

The Engineering Inspectors and Regulatory Officers occupation (NOC 2262) is also seen as inaccurate by close to half of those who chose it as their current occupation.

The most likely NOC occupation for Geoscientists, Geoscientists and Oceanographers (NOC 2113), is seen as inaccurate by almost 20% of those who chose it.

It is important to note that almost universally the reason given for an occupation description being inaccurate was the omission of information, such as Project Management, Fire and Safety, Environmental roles and some aspects of Hydrography, rather than the content being incorrect. The level of confidence in the NOC descriptions adds to the validity of the NOC-based LMI Forecast model. For those where substantive feedback was received, it is our hope this information will be useful to the next iteration of the National Occupational Classification (NOC) System.

Do we have an accurate understanding of the make-up of the employment numbers[10] in the forecast?

10 Employment is also defined as the demand for workers or the number of jobs in the economy.

To answer this question, we asked respondents which discipline they are registered in with their respective professional association and which of the NOC Occupations best described the work they are currently doing.

The NOC Occupation survey responses closely reflected the overall population's choices, as reflected in the LFS and the Skills Table LMI forecast model; this strongly suggests that the LFS and forecast information are a good representation of these professionals' occupations. However, there are several disciplines in each group that do not have an NOC parallel; these professionals tend to report in a wide range of NOC Occupations. For some, such as Structural Engineers and Building Technologists and Technicians, this was a source of frustration as their scope of work was not reflected in the NOC structure. This may be an area for further discussion with Statistics Canada and for development of the next iteration of the NOC Occupation structure.

Is a discipline-based allocation model viable and/or useful?

This question was generated by a concern that the occupation-based LMI forecast model could be inaccurate related to some of the disciplines that were believed to be spread widely throughout the NOC Occupations. It was proposed that a discipline-based forecast might be a better reflection of these professions' labour force activities.

However, the survey responses confirmed that the NOC Occupation descriptions accurately capture the scope of disciplines for most in these EGTT professions and their labour market activities. There is no significant value to the APGST LMI model to be gained from developing a parallel discipline-based forecast.

Are there differences in reporting behaviour between Technologists and Technicians, Engineers and Geoscientists?

Geoscientists have the greatest connection between their disciplines and the NOC Occupations, largely owing to the small number of occupations that reflect their scope of work (11 disciplines to 8 NOC options). It is important to note that this group also has the lowest satisfaction overall with the NOC Occupation descriptions noting that many aspects of their work are simply not captured and the geoscientist scope of work is forced in 8 NOCs.

Technologists and Technicians also have a high degree of connection between their disciplines and the NOC Occupations, though the absence of Project Management and Fire and Safety options is seen as reason for dissatisfaction with the NOC Occupations. It is also important to note that where the connection between discipline and occupation is not reported, the range of other occupations chosen is much larger than engineers and geoscientists.

Engineers have the lowest degree of connection between their disciplines and the NOC Occupations, but at least two thirds will choose the NOC Occupation most closely paired with their discipline. Again, the lack of Project Management was a factor for this group. As well, more than half who chose Other Professional Engineers, n.e.c. saw it as inaccurate, due to missing information.

OCCUPATION VS. DISCIPLINE - WHAT ELSE WE LEARNED

Most Common Disciplines

As a part of the registration process with ASTTBC or APEGBC, each professional is required to choose a primary 'discipline' or area of expertise. This allows an understanding of the scope and breadth of expertise in each field. From a labour market forecasting perspective, having an understanding of where there is a mismatch or overlap between discipline and NOC occupation allows for a more fulsome understanding of the range of skills and abilities in the market as a whole.

Certified Technologists and Technicians

Table 2 - Top 5 Certified[11] Technologist and Technician Disciplines

ASTTBC Discipline	Count of Respondents	Percent of Respondents
Civil	387	38%
Mechanical	130	13%
Electrical	106	10%
Electronics	98	10%
Building	91	9%

11 Of the 17 Technologist and Technician Disciplines offered with ASTTBC

80% of Certified Technologists and Technicians trained in the civil, mechanical, electrical, electronics, and building disciplines. There appears to be a change in preferences, as the survey shows that students are increasingly training in the Environmental and Mining disciplines. The Civil discipline remains the most frequently studied, but it has fallen to 18% of all student respondents and is equaled by the Environmental and Mechanical disciplines.

Professional Engineers

Table 3 - Top 5 Professional[12] Engineering Disciplines

APEGBC Discipline	Count of Respondents	Percent of Respondents
Civil	193	26%
Mechanical	190	25%
Electrical	103	14%
Structural	62	8%
Chemical	49	7%

12 Of the 31 Disciplines available to Engineers registering with APEGBC

80% of Professional Engineers trained in the civil, mechanical, electrical, structural and chemical disciplines (19% of the 31 APEGBC disciplines). There appears to be a change in preferences as the surveys show EITs (i.e., engineers who have completed their post-secondary education and are in the process of getting the work experience necessary to receive their designation as a Professional Engineer (P.Eng.)), have high proportion of respondents trained as Mechanical and Electrical Engineers, and engineering students show the Environmental Discipline as one of the top 5 (it is 8th for the Professionals). Regardless of the type of respondent, the Civil discipline remains the most frequent area of specialization.

Professional Geoscientists

Table 4 - Top 5 Professional[13] Geoscience Disciplines

APEGBC Discipline	Count of Respondents	Percent of Respondents
Geology	91	47%
Environmental Geoscience	30	16%
Geological	24	12%
Geotechnics	12	6%
Environmental	10	5%
Mining	10	5%

13 Of the 11 Disciplines studied by Geoscientists registering with APEGBC

87% of Professional Geoscientists trained in the geology, environmental geoscience, geological, geotechnics, environmental, and mining disciplines (45% of 11 APEGBC disciplines). Similar to the Engineers and Technologists and Technicians, there is a change in preferences as the survey shows an increasing proportion of GITs (i.e., geoscientists who are in the process of earning their professional designation) and geoscience students training in Geology and Environmental Geoscience and a lower proportion in Mining and Geotechnics.

Most Common Occupations

The Skills Table's Labour Market Outlooks are based largely on the results of the Labour Force Survey, which asks participants to choose the NOC Occupation that is the best fit for their current work. We mirrored this process in the surveys.

Table 5 - Top 5 Certified Technologist and Technician NOC Occupations

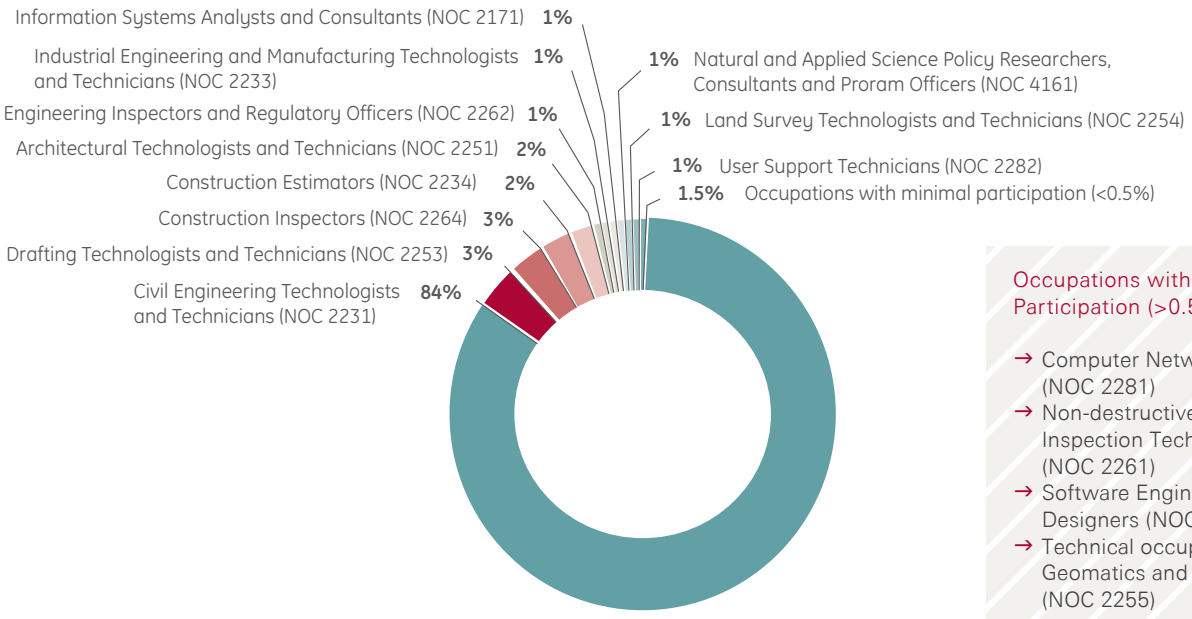
NOC[14] Occupation Title	Count of Respondents	Percent of Respondents
Civil Engineering Technologists and Technicians (NOC 2231)	364	36%
Electrical and Electronics Engineering Technologists and Technicians (NOC 2241)	195	19%
Mechanical Engineering Technologists and Technicians (NOC 2232)	123	12%
Architectural Technologists and Technicians (NOC 2251)	61	6%
Natural and Applied Science Policy Researchers, Consultants and Program Officers (NOC 4161)	38	4%

14 National Occupational Classification, Statistics Canada Occupational definition standards

Certified Technologists and Technicians

77% of Certified Technologists and Technicians report in 5 of the 22 NOC Occupations within the scope of the study that currently reflect the work done by Technologists and Technicians throughout the economy. Of those in the top 5 ASTTBC disciplines, 80% or more report their occupation as the same as their discipline. However, where the discipline and occupation differ, the scope of occupations is wider (between 10-15 occupations per discipline) than the other groups of respondents. Figure 1 illustrates this with the 16% of respondents with a Civil discipline, who do not identify as Civil Engineering Technologists and Technicians spread amongst 14 other NOC Occupations.

Figure 1 – Civil Discipline Certified Technologist and Technician NOC Occupations



Occupations with Minimal Participation (>0.5%)

- → Computer Network Technicians (NOC 2281)
- → Non-destructive Testers and Inspection Technicians (NOC 2261)
- → Software Engineers and Designers (NOC 2173)
- → Technical occupations in Geomatics and Meteorology (NOC 2255)

Also of note is the significant proportion of Technologists and Technicians who work in occupations that are not strictly Technologist and Technician roles, such as Construction Inspectors (NOC 2264). 12 of the 22 NOC Occupations are described as being specifically Technologist and Technician. About 15% of the Technologists and Technicians surveyed chose one of the 10 NOC Occupations that has a wider scope than only Technologists and Technicians professionals.

Professional Engineers

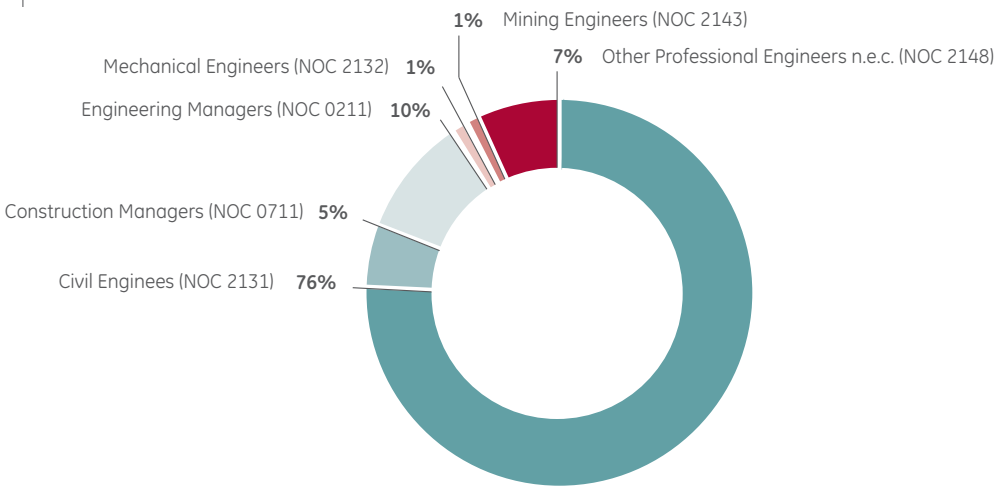
Table 6 – Top 5 Professional Engineer NOC Occupations

NOC Occupation Title	Count of Respondents	Percent of Respondents
Civil Engineers (NOC 2131)	201	27%
Mechanical Engineers (NOC 2132)	119	16%
Engineering Managers (NOC 0211)	101	13%
Electrical and Electronics Engineers (NOC 2133)	81	11%
Other Professional Engineers, n.e.c. (NOC 2148)	66	9%

75% of Professional Engineers report in 5 of the 16 NOC Occupations included in this study that currently reflect the work done by Engineers throughout the economy. From the top 5 APEGBC disciplines, more than two thirds (67-75%) report their occupation is the same as their discipline. Just over 10% report as a Manager, regardless of discipline, and just under 10% report their occupation as Other Professional Engineers, n.e.c[15], which implies that 1 in 10 Engineers do not see their work reflected in the 15 defined NOC Occupations.

15 *n.e.c. is 'not elsewhere classified'*

Figure 2 – Civil Discipline Professional Engineers NOC Occupations



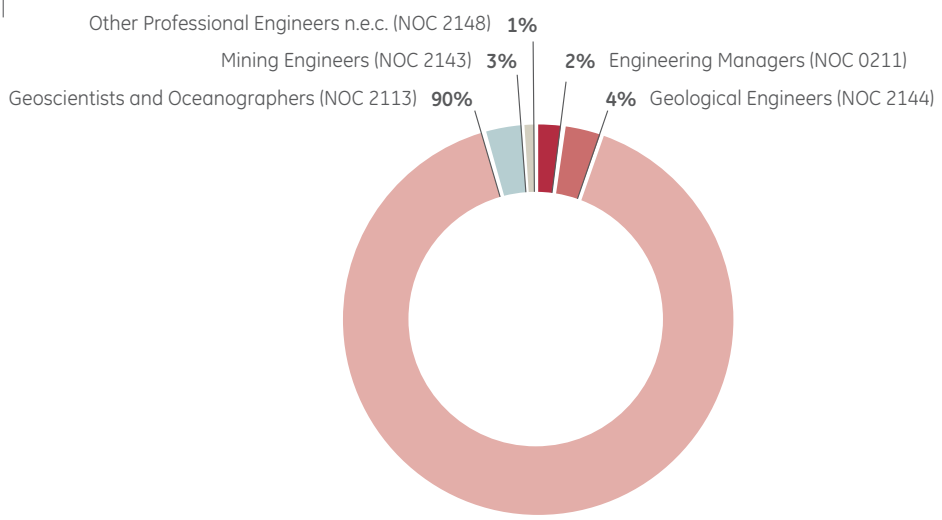
Professional Geoscientists

Table 7 – Top 5 Professional Geoscientist NOC Occupations

NOC Occupation Title	Count of Respondents	Percent of Respondents
Geoscientists and Oceanographers (NOC 2113)	165	86%
Geological Engineers (NOC 2144)	11	6%
Mining Engineers (NOC 2143)	5	3%
Engineering Managers (NOC 0211)	4	2%
Other Professional Engineers, n.e.c. (NOC 2148)	4	2%

The majority (86%) of Professional Geoscientists report in one NOC Occupation (Geoscientists and Oceanographers NOC 2113) and just over 2% report as an Engineering Managers (NOC 0211). Those in the Geotechnics discipline report in engineering NOC Occupations and as Engineering Managers (NOC 0211) more than those in the other disciplines.

Figure 3 – Geography Discipline Professional Geoscientists NOC Occupations



Accuracy of the NOC to Current Workplace Scope of Professionals

Certified Technologists and Technicians

4 of the top 5 Technologists and Technicians NOC Occupations – Civil Engineering Technologists and Technicians (NOC 2231), Electrical and Electronics Engineering Technologists and Technicians (NOC 2241), Mechanical Engineering Technologists and Technicians (NOC 2232) and Architectural Technologists and Technicians (NOC 2251) – are seen as accurate reflections of the occupations by almost 90% of respondents.

Natural and Applied Science Policy Researchers, Consultants and Program Officers (NOC 4161) is seen as inaccurate by 1 in 4 of the respondents who chose it as their current occupation.

9 of the 22 Technologists and Technicians NOC Occupations included in the study are seen as poorly described[16] by at least 25% of respondents, with 3 occupations closer to 50%. However, in most cases the absolute number of respondents is too small to determine if the issue is specific to the respondent or more generally applicable. In the open ended responses overall, the reason stated for viewing the NOC description as inaccurate relate to missing information rather than incorrect content. The scope of the occupation is too narrow to capture the scope of work done by these certified professionals. Often mentioned was the omission of Project Management, Environmental roles and Fire and Safety Inspection.

16 See Appendix C for the list of NOC Occupations and percent and count of respondents who saw them as inaccurate.

Engineers[17]

4 of the top 5 Engineering NOC Occupations[18] – Civil Engineers (NOC 2131), Mechanical Engineers (NOC 2132), Engineering Managers (NOC 0211) and Electrical and Electronics Engineers (NOC 2133) are seen as accurate reflections of the occupations by almost 90% of respondents.

The 'Other Professional Engineers, NEC (NOC 2148)' is seen as largely inaccurate (51%) by Professional Engineers, EITs and Engineering Students as well as by Geoscientists. Although, given the nature of this occupation, essentially an 'other' category for those who do not find their work reflected in the other 15 occupations, this finding is not startling.

Overall, 13 of the 16 NOC Occupations included in this study are considered accurate by all groups of engineering respondents.

The other two occupations seen as poorly described are Petroleum Engineers (NOC 2145) and Computer Engineers (NOC 2147), 40% and 33% respectively.

In most cases, the reason stated for the inaccuracy related to missing information, such as Project Management or Hydrography, rather than incorrect content.

17 This includes analysis of the Professional Engineers, EITs and Student Engineers, so the Professional Engineer title is not used.

18 Civil Engineers (NOC 2131), Mechanical Engineers (NOC 2132), Engineering Managers (NOC 0211), Electrical and Electronics Engineers (NOC 2133), and Other Professional Engineers, n.e.c. (NOC 2148)

Geoscientists[19]

Overall, Geoscientists are much less satisfied with the NOC Occupations than the other professionals. 6 of the 8 occupations are seen as inaccurate by 20% or more of the respondents, including Geoscientists and Oceanographers (NOC 2113), which represents more than 85% of the professionals. Again, the reasons for the inaccuracy largely relate to missing information and a too narrow scope of work.

19 This includes analysis of the Professional Geoscientists, GITs and Student Geoscientists, so the Professional Geoscientist title is not used.

RESEARCH AREA 2 - WORKPLACE AND LINE OF BUSINESS STRUCTURE

Labour market forecasts are based on defined relationships in the economy. Where there is a predictive structure in the workplace it can be used to improve the accuracy and validity of the forecast. There is some historical belief that there are standard ratios of Technologists and Technicians. We tested this in the surveys by asking about the structure of workplace teams.

Can we refine or adjust the predictive models of employment structures (the labour market forecast model) based on consistent structures in the workplace?

Based on the surveys and employer interviews, there is no standard or consistent ratio of Technologists and Technicians to Engineers in the workplace, regardless of line of business. Table 8 illustrates there is no consistency on the reported ratios either by respondent group or by line of business. For example, Engineers in the Electrical Line of Business report a ratio of 1 Technologist and Technicians to 1 Engineer, while Employers report a ratio of 0.5 Technologists and Technicians to one Engineer and Technologists and Technicians report a ratio of nearly 3 Technologists and Technicians to 1 Engineer.

Table 8 – Workplace Ratios of Technologists/Technicians to Engineers by Professional Group and Line of Business

Respondent Group	Line of Business							
	Architectural	Civil	Electrical	Electronics	Environmental	Mechanical	Structural	Utility
Engineers[20]	5.6 : 1.0	0.8 : 1.0	1.0 : 1.0	2.8 : 1.0	0.8 : 1.0	0.8 : 1.0	0.5 : 1.0	0.6 : 1.0
Technologists & Technicians	2.6 : 1.0	1.0 : 1.0	2.8 : 1.0	1.7 : 1.0	2.3 : 1.0	1.6 : 1.0	1.2 : 1.0	3.1 : 1.0
Employers	--	1.7 : 1.0	0.5 : 1.0	1.0 : 1.0	4.6 : 1.0	1.3 : 1.0	1.2 : 1.0	1.4 : 1.0

Ratio of around 0.5 to 1.0

Ratio of around 1.0:1.0

Ratio of around 1.5:1.0

Ratio of around 2.0:1.0

Ratio of around 2.5:1.0 or higher

20 The total of reported professionals includes Registered and unregistered Engineers and Certified and uncertified Technologists and Technicians.

There is no ratio of Technologists and Technicians to Engineers that emerges as a standard in any of the lines of business or among the professional groups. The table shows that each group has a different perception not only of each line of business, but also of the proportion of each profession in the workplace.

It is important to note that the ratios above include both Certified and non-certified Technologists and Technicians. Certification is not required for Technologists and Technicians in the same way that licensure is for Engineers and Geoscientists. About half of those professionals reported here as Technologists and Technicians are reported as certified, so limiting this analysis to only those certified would significantly underreport the number of Technologists and Technicians and, therefore, the ratios. They also include those working in an engineering capacity who are not registered as Professional Engineers; however, this is a much smaller proportion and has little impact on the overall ratios.

Can we provide better information about workplace opportunities and roles?

If standardized ratios existed, it could be communicated during recruitment and professional development conversations.

However, no standard ratio or organizational structure was determined. It was widely acknowledged that design and development work would lean towards having a higher proportion of Engineers on a team comprised of both Technologists and Technicians and Engineers, and production operations and maintenance teams would lean towards having a higher proportion of Technologists and Technicians.

Can we provide a more comprehensive view of the various business models used in a variety of lines of business (mechanical, civil, electrical, electronics, environmental, structural, architectural, and utility)?

It is clear that each employer/firm had its own model and organizational priorities. With the exception of unionized environments where collective agreements influence the structure of the workplace, the workplace and team structures vary with the type of work in which the enterprise is currently engaged. It is also clear that the vast majority of Engineers (87%) work in a team environment with Technologists and Technicians.

Does our understanding of the workplace relationships between Engineers and Technologists and Technicians reflect their experience?

Counter to many expectations, there is no stable ratio or standard team design, regardless of the line of business that would allow for an improvement and/or refining of the current labour market forecast model.

WORKPLACE AND LINE OF BUSINESS STRUCTURE - WHAT ELSE WE LEARNED

Employers' Perceptions of Ratios

In the employer interviews, which had a high proportion of large employers participate, most participants expressed the idea that there is no real standard in any of the business lines and that any Technologists and Technicians to Engineers ratio changes frequently and is dependent on both the technology environment of the day and the type of work of the team. Where the work is focused on design or development, there is a need for more Engineers on a team. Where more work is post-design and development, the need for Technologists and Technicians on the team is higher.

Employers interviewed commented on the impact of technology and automation on their workplaces and their team make-up. In general, they saw technological solutions having more impact on the

work and need for Technologists and Technicians than for Engineers. However, where an employer was more focused on post-design and development activities, the reverse was true, with the need for on-the-ground technical expertise growing and being expanded by changing technology.

The economic cycle and the need to look more broadly for new opportunities have a big impact on the need for Engineers compared to Technologists and Technicians. Design and project development work is seen as more the purview of Engineers. Most of the employers interviewed did not have a standard or consistent ratio of Engineers to Technologists and Technicians.

Company Structures

Overall, the surveys indicate that there is a dichotomy of experience for BC EGTT professionals, with close to a third working in very large companies (over 1000 employees worldwide) and the next largest portion working in companies with less than 10 employees. It is also true that more than 4 in 5 Engineers and 2 in 3 Geoscientists work on a team that includes Technologists and Technicians. This reinforces the essential partnership that these professions have in the workplace.

- → 30% of Technologists and Technicians, 34% of Engineers and 33% of Geoscientists work in companies with over 1000 employees.

- → 17% of Technologists and Technicians, 23% of Engineers and 40% of Geoscientists work in companies with less than 10 employees.

- → About 30% of Technologists and Technicians and 25% of Engineers work in the Civil Line of Business, while 68% of Geoscientists work in the Environmental Line of Business.

- → 87% of Technologists and Technicians work on a team that includes Engineers and 86% of Engineers work on a team that includes Technologists and Technicians, while 68% of Geoscientists work on a team that includes Technologists and Technicians. This reinforces the essential partnership between these professionals and the extent to which their effectiveness is linked together in many organizations.

- → About half of the Technologists and Technicians in these businesses are reported as ‘Certified’.

RESEARCH AREA 3 - NEW ENTRANTS

In the Skills Table's 2015 EGTT Labour Market forecast[21], the New Supply was largely dependent on New Entrants (Table 9). A New Entrant is defined as a worker entering an occupation who is new to the labour force, having never worked in any capacity prior to entering this occupation and is between the ages of 15 and 35. So this implied that more than half of the workers entering these occupations would do so with no prior workforce experience, a significant concern for employers.

21 http://www.lmionline.ca/projects/egtt/

In many of our focus groups and industry discussions validating the forecasts, we were told that this seemed too high and it was more likely that new workers were entering these occupations from other parts of the labour force. To assess the accuracy of this aspect of the forecast, we asked all of the respondent groups about their previous work experience.

Table 9 – EGTT 2015 Labour Market Forecast - Sources of New Supply 2015-2024

Region	New Entrants	New to Canada	From other provinces & regions	From other Occupations
British Columbia	52	40	-1	7
Lower Mainland	49	48	-5	8
North	95	0	6	0
Southeast	65	3	33	-1
Vancouver Island Coast	61	2	30	6

What are the actual flows of New Entrants into these Occupations?

As opposed to the forecasted 48%, almost 4 in 5 (78%) of Technologists and Technicians have worked in the labour market and have held full-time work before they began training in their current field. This is more than in the other two occupational groups[22].

22 63% of Engineers and 75% of Geoscientists

Again, more Professional Engineers had work experience before they began their careers (82%) and began their engineering education (63%) with some workforce experience than was forecast by the model in 2015.

Another area of discussion around New Entrants relates to the 4 years of work experience that Engineers must undertake to become Professional Engineers. While this registration is not required to be included as a skilled worker in these NOC Occupations, it certainly increases the number of workers who will enter these occupations with work experience and supports the need to reduce the expectation of New Entrants filling the supply gap.

It is also clear that EITs and GITs gain a significant amount of work experience over their student counterparts, decreasing the portions who have not worked from 37% and 25% to 18% and 10% respectively.

On the whole, Technologists and Technicians tend to have worked more jobs and more full-time jobs before they began their professional careers. They also tend to be older and have strong interest in pursuing further education.

Is the industry feedback, that the New Entrant Forecast is too high, reflected in the experience of these EGTTs?

Given that about 20% of Technologists and Technicians enter their training without previous work experience, the APGST LMI EGTT forecast estimate of more than 50% New Entrants implies we are overestimating New Entrants and likely underestimating the flow of workers from other occupations.

The shift in the extent of work experience from students to EITs indicates that students are gaining work experience while they study to become engineers and, as with Technologists and Technicians, indicates that the proportion of New Entrants is overstated at over 50% of the new supply. This suggests that here there is an underestimation of the flow of workers from other occupations.

NEW ENTRANTS - WHAT ELSE WE LEARNED

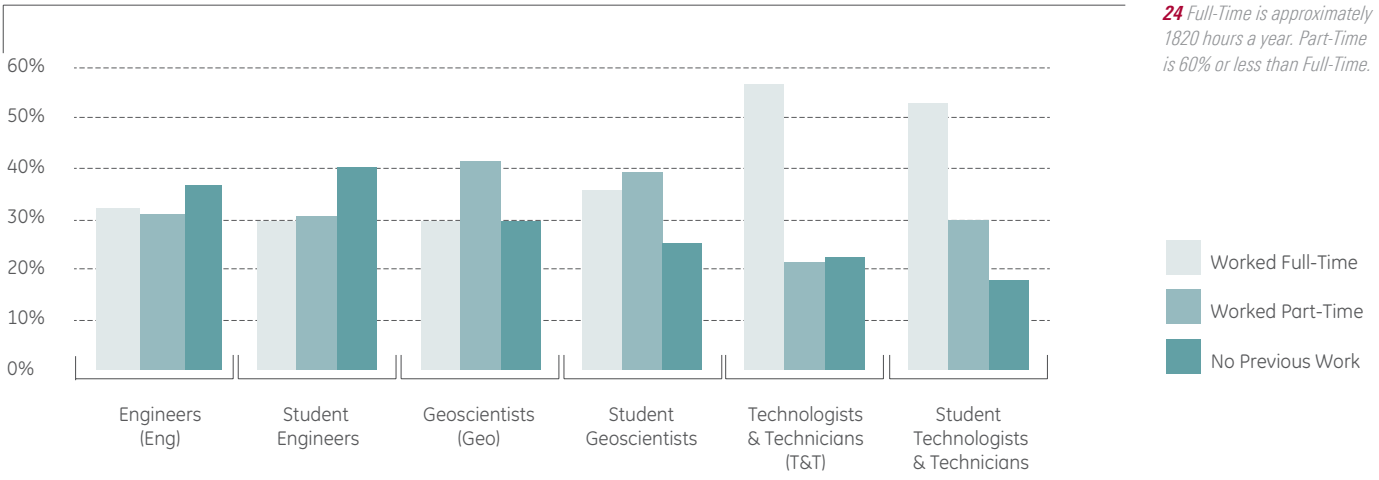
Previous Work Experience[23,24] of Professionals

In the surveys, participants were asked about their work experience prior to entering their degree/diploma education programs.

23 Work History before training in current profession or before beginning current training, except EITs and GITs. For these groups, it is work history before beginning work as an EIT/GIT.

24 Full-Time is approximately 1820 hours a year. Part-Time is 60% or less than Full-Time.

Figure 4 – Work History of Respondents – Professionals



37% of Engineers and 40% of Engineering Students had not worked in any capacity before they began their post-secondary education (Figure 4). In the focus groups validation of this material, this was a surprise to participants; however, as the discussions unfolded most of the professionals consulted actually confirmed this information as similar to their own experiences. Given that employers express a strong preference in hiring workers with at least 5 years' experience, this implies that there is a mismatch between students' behaviours and employers' expectations.

For EITs, respondents were asked about work experience before they entered the engineering profession; only 18% had no previous work experience. It can be implied, given the proportion of Professional Engineers with no work experience shrinks from 37% to 18% once they are EITs, that many of these professionals begin their working lives during their engineering education programs,

some as a part of the growing range of co-op opportunities. However, this still shows 1 in 5 (20%) Engineers complete their schooling without previous work experience, which is a considerable concern to their potential employers.

29% of Professional Geoscientists and 25% of Geoscience students had not worked in any capacity before they began their respective careers and education. For GITs who were asked about work experience when they entered the workforce after completing their post-secondary education, only 10% had no previous work experience. Similar to Engineers, given the proportion of Geoscientists with no work experience shrinks from 29% to 10% once they are GITs, it can be implied that many of these professionals begin their working lives while in their training programs, some as a part of the growing range of co-op opportunities.

22% of Technologists and Technicians and 18% of students had not worked in any capacity before they began their careers/training (Figure 5).

Engineers and Geoscientists in the 31-40 age range had the most previous work experience (before they began their professional education) among their peers, while Technologists and Technicians over the age of 60 had the least, again among their peers (Figures 5 and 6). While those in the

Figure 5 – Percent of Respondents without Previous Work Experience by Current Age Range – Professionals

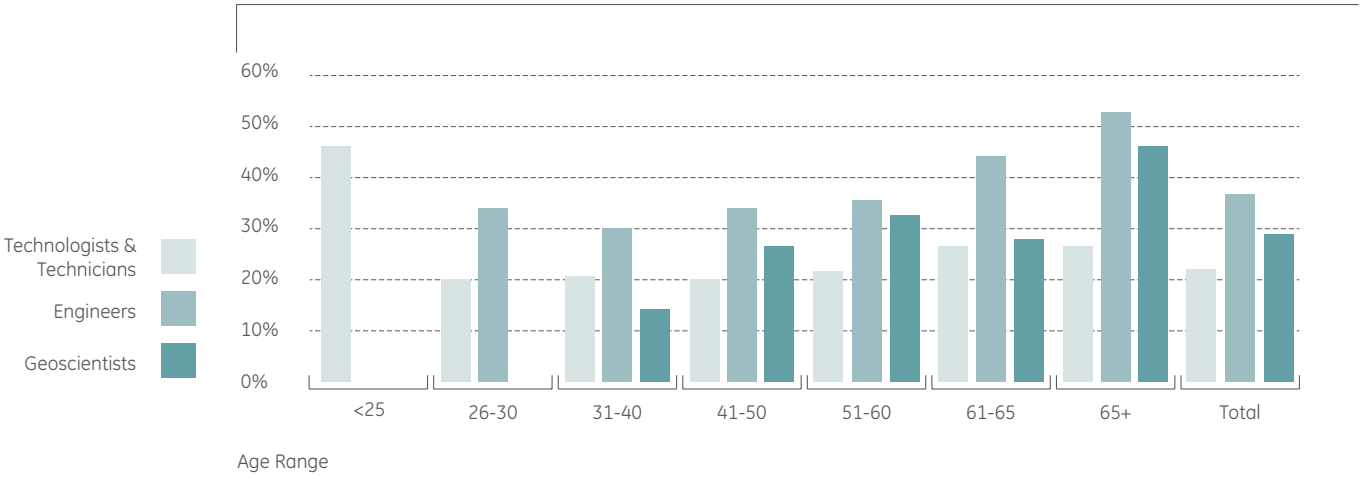
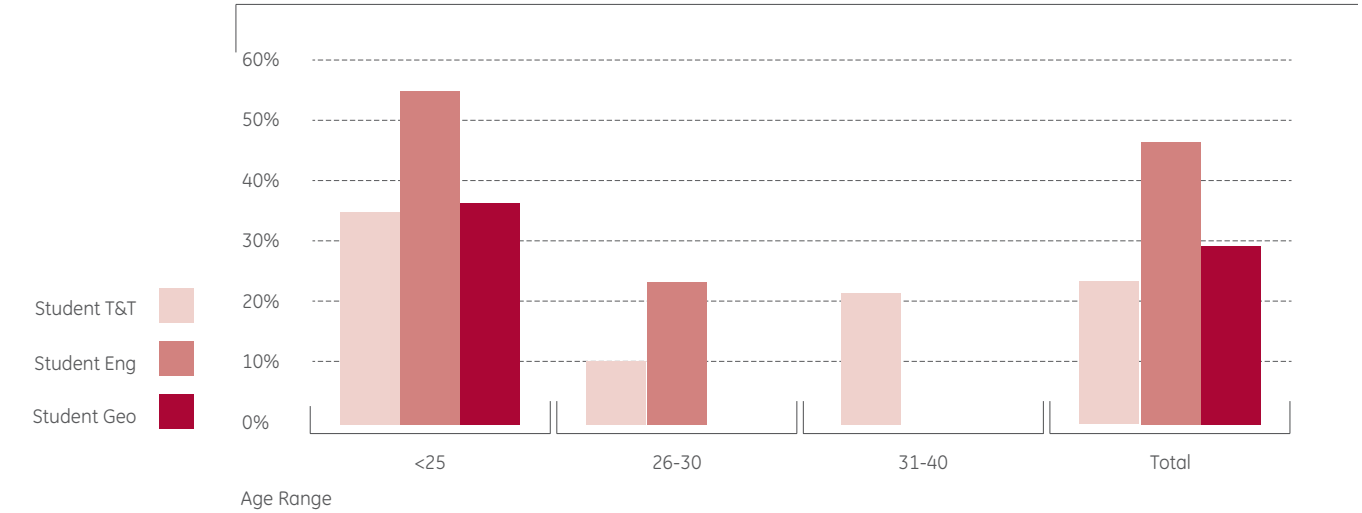


Figure 6 – Percent of Respondents without Previous Work Experience by Current Age Range – Students



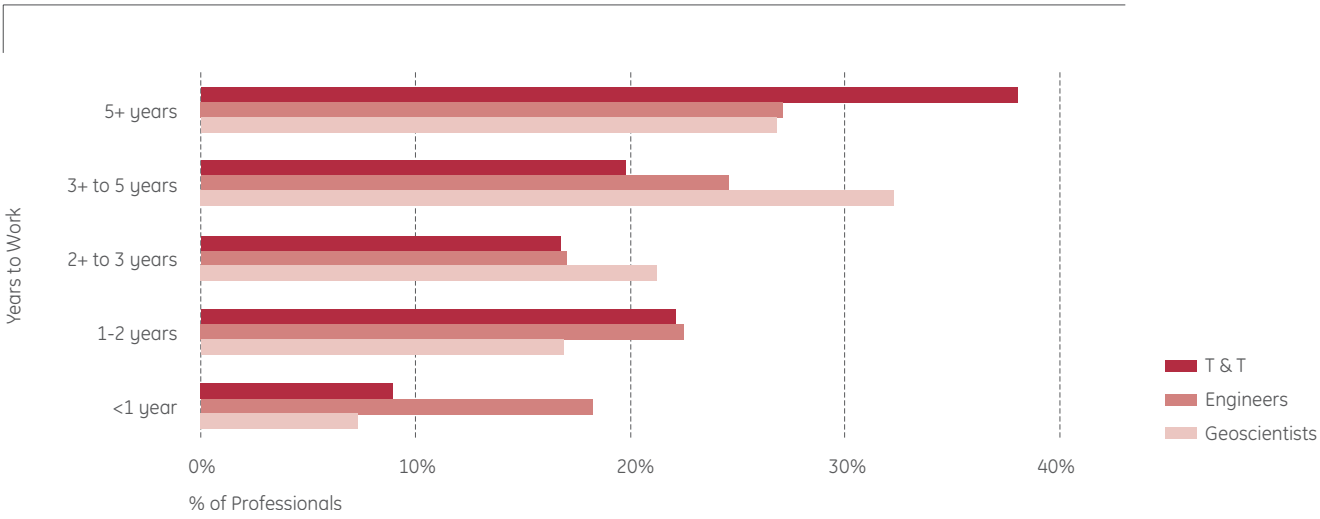
youngest age ranges have less work experience than those in the middle age ranges, regardless of profession, after age 40 the amount of work experience declines continuously.

About 75% of Professional Engineers and Geoscientists had worked between 1-2 jobs, in most cases 2. Of those Technologists and Technicians, more than 30% had 3 or more jobs.

Of those who worked, 33% of the Student Technologists and Technicians and 38% of the Certified Technologists and Technicians worked more than 5 years before they began their education (Figure 7). Meanwhile, 32% of Professional Geoscientists and 24% of Geoscience Students worked between 3-5 years before they began their education. More than 50% of the Professional Engineers had worked 3 or more years and 30% of Engineering Students worked 1-2 years.

Engineers and engineering students overall have less work experience, have worked less full-time jobs, tend to be younger and report less interest in pursuing further education. Certified Technologists and Technicians tend to have worked more jobs and more full-time jobs before they began their professional careers; they also tend to be older and have strong interest in pursuing further education.

Figure 7 – Years of Full- or Part-Time Work Before Education



RESEARCH AREA 4 - LOCATION OF WORKER VS. LOCATION OF WORK

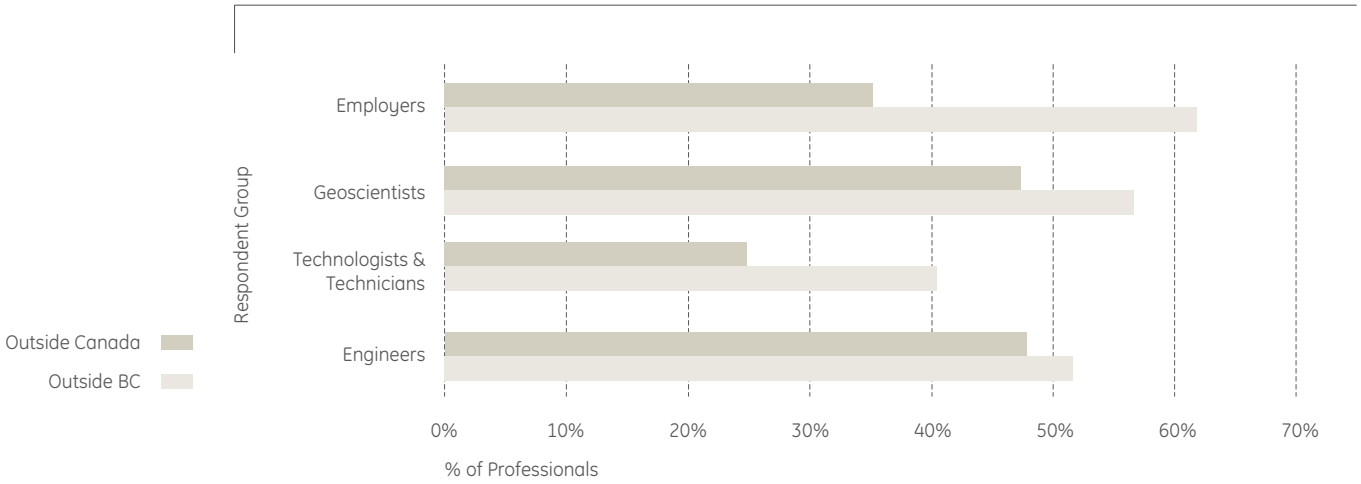
The extent and scale of work done by BC EGTT professionals on projects outside BC impacts the overall demand for EGTT professionals, though it is not generated by economic factors inside BC. Conversely, the extent to which work in BC is done by external professionals not only impacts the overall demand for BC EGTT professionals but also creates concerns about the professional standards these experts must meet.

To gather insight into these questions we asked respondents about the extent to which they work on projects outside of BC and the extent they see BC work done by external professionals

What is the extent to which these professionals, living and working in BC, lend their expertise to projects and programs outside of the province?

Close to half of the EGTT professionals working in BC and more than half of BC employers surveyed report working on programs and projects based outside of BC. It appears that Engineers, Geoscientists and Technologists and Technicians are all exporters of their expertise, as are many of the BC-based employers interviewed.

Figure 8 – Proportion Reporting BC-based Professionals on External Projects



What is the extent to which these EGTT professionals, living and working outside of BC, provide support and expertise to projects and programs in BC?

The survey responses suggest that a small portion of BC-based work is being done outside of the province. A large proportion of the Professional Engineers (54%) and Certified Technologists and Technicians (62%) and employers (42%) work with experts based outside of BC and Canada. However, with the exception of Geoscientists, the portion of work is seen by most as less than 10%, with only about 1 in 20 reporting that 75% or more of BC work is done outside of BC. Nearly 1 in 4 Professional Geoscientists see between 10-25% of BC work done outside of the province. Furthermore, 1 in 5 see between 25-50% of BC work going to professionals outside of BC.

Overall, whether in the surveys or the employers' interviews, there was very little concern expressed by respondents about BC work leaving BC. For the most part respondents, especially employers, stated that BC has the expertise and scope of professionals needed to do the work in the province. At the same time, there was a broad acknowledgement that many of the small and medium enterprises who hire Engineers, Geoscientists and Technologists and Technicians are being absorbed by large multinational enterprises. Given the BC offices are maintained, the general feeling is the work is being done by BC-based companies. The issue of BC work done by professionals based outside of BC is of more concern to the regulatory agencies, who are responsible for ensuring that BC work is completed and approved by properly licensed professionals.

LOCATION OF WORKER VS. LOCATION OF WORK - WHAT ELSE WE LEARNED

BC Professionals Working on Projects Outside of BC

Based on the surveys and the employer interviews, it is clear that EGTT professionals, living and working in BC, are providing their expertise to a wide range of projects outside of the province. In the interviews employers were clear that the expertise of BC professionals was of high value to projects and operations outside of the province.

40% of Technologists and Technicians work on Projects outside of BC, 25% outside of Canada. For Engineers, the proportion is higher at 52% working on Projects outside of BC, 41% outside of Canada. 62% of Employers say they provide service to projects outside of BC, 35% outside of Canada.

The most frequently reported regions[25] in Canada are Alberta, Ontario and Saskatchewan; internationally they are United States, Europe and South America.

25 These are in rank order

In the interviews, employers stated that they would have their BC workers assigned to other regions most often because of a need for their expertise. However, for some this was as a means to balance work across the company and in a small number of cases there was a company requirement to lend a small percentage (<10%) of local resources to other corporate offices.

BC Projects Supported by Professionals Outside of BC

Engineers working for larger firms which have offices in other provinces and/or countries see more BC work being done in their offices located outside BC (42%) and outside Canada (54%) than Technologists and Technicians (39% and 29%). However, nearly half report the amount as below 10% and only 1 in 20 see the proportion as more than 75%.

The survey results clearly show that there is collaboration as 54% of all Engineer respondents work on BC projects with Engineers outside of BC, 30% outside of Canada (Figure 9). A smaller proportion of all Technologist and Technician respondents (38%) work on BC Projects with Technologists and Technicians outside of BC and outside of Canada (12%) (Figure 10).

54% of all Geoscientist respondents work on BC projects with Geoscientists outside of BC, 34% outside of Canada (Figure 11). This is higher than for Engineers and Technologists and Technicians.

Figure 9 – BC Projects Supported by Professionals Based Outside BC – Professional Engineers

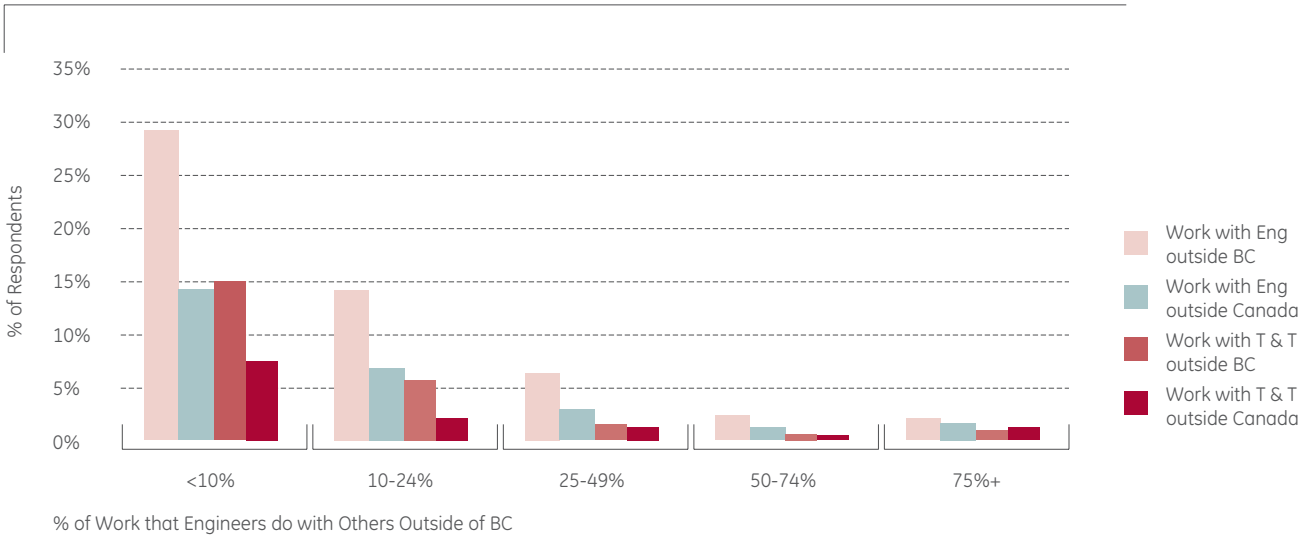


Figure 10 – BC Projects Supported by Professionals Based Outside BC – Technologists and Technicians

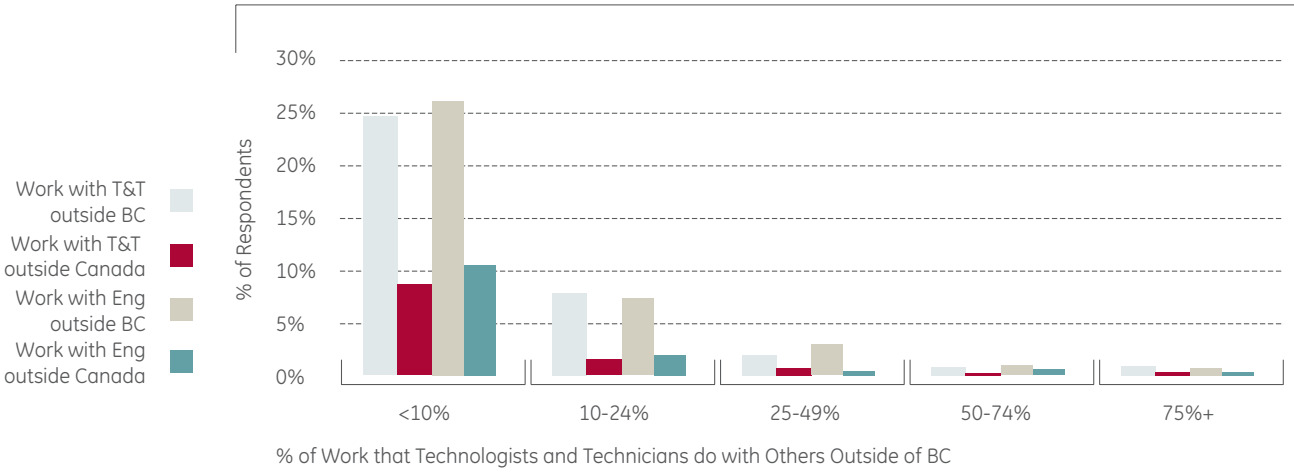
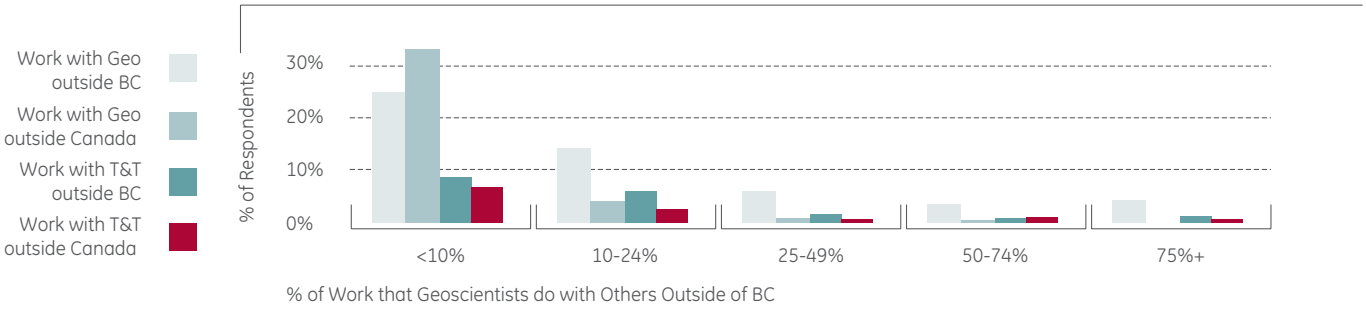


Figure 11 – BC Projects Supported by Professionals Based Outside BC – Geoscientists

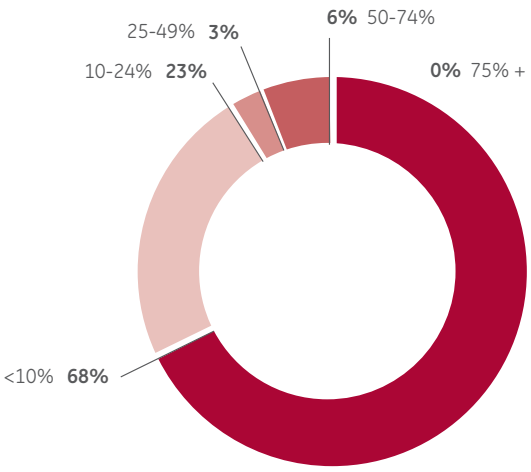


The Changing BC Marketplace

All of the groups surveyed and interviewed saw the vast majority of BC opportunities awarded to BC companies. The BC market for EGTT occupations has globalized significantly in the last 5-10 years, yet by maintaining a BC presence, the market sees these global organizations as BC businesses. Employers interviewed noted a growing trend for large, international companies to purchase small- and medium-sized enterprises in BC and maintain the BC offices. To underline this trend, 39% of Professional Engineers, 29% of Certified Technologists and Technicians and 35% of employers say they have offices outside of Canada; this is likely an indication of the extent of globalization of the BC market. Many of the employers interviewed stated that there is no need to bring in expertise to BC as the needed skills exist in good supply in the current market. For those who did bring workers from outside of BC, it often related to a developing market (e.g. Liquid Natural Gas Plants and Pipelines).

The significant portion of the efforts of BC workers on projects outside of BC is also seen more broadly across the BC economy and it has been recognised in the overall labour market forecasting by creating the export category for professional expertise. The impact on the labour market is the increase of overall demand. This also supports a more stable workforce as generally a broader range of markets enables a company to weather economic cycles more effectively.

Figure 12 – Employers – Percent of BC Opportunities Going to International Companies



CONCLUSION

This project was launched to answer questions raised by the 2015-24 Labour Market forecast. It was hoped that we could create a deeper understanding of the behaviour of EGTT professionals and assess the strength of the forecast in predicting their behaviour.

It was found that the reporting behaviour of these professionals aligned their disciplines well with the NOC Occupations and that no changes were needed to enhance or improve the APGST LMI model. There are a small number of NOC occupation descriptions that are seen by those who chose them as 'their' occupation, as missing key areas of the scope of their work. These are the occupations that the Associations on this project can take to the responsible organization to assist in improving the NOC descriptions over the next 5 year review cycle.

It was found that there is no standard of organization (ratio) between Engineers and Technologists and Technicians, regardless of the line of business, which would enhance or improve the labour market forecast model.

It was also made clear that, there are consistent and significant differences in the composition of these teams of workers depending on the type of work the enterprise was focused on. More design or development focus means a higher portion of Engineers, more operation or implementation work means a higher portion of Technologists and Technicians. While this is not something that can be used in a labour market forecast model, this information is useful in putting broader context around the conditions employers can face in recruiting and retaining these professional groups.

Significant differences in the work experience history of these professionals and the labour market forecast's prediction of the supply of New Entrants were found. Given the current definition of this term, "new to the labour market, never worked in any capacity", it is clear from the data that this can

represent no more than 20% of the New Supply of workers, not the currently predicted 50%. This will require significant changes in the supply portion of the APGST LMI model to more accurately reflect the conditions of this group of professionals.

It was found that these EGTTs in BC do a significant amount of work for projects outside of the province and work in an increasingly globalized environment. However, we also found that these professionals and their employers believe that BC work is largely done by BC-based companies and only a small portion is done by professionals based outside of BC. To stay competitive in the global economy, engineering firms in BC will need to strategically manage their workforce to ensure the right people with the right skills and training are available when they need it.

It is expected that this information will be highly useful in fine-tuning labour market forecasts to more accurately predict the conditions employers in BC will face in hiring and retaining these essential professionals and in gaining a better understanding of the flow of workers into these occupations. For government, it both validates the validity of the current NOC descriptions and allocations as well as highlights some which would benefit from more fine-tuning in relation to the work that is actually being done by these occupations. It will also be used by the key associations to help build a broader and deeper understanding of the work environment, team structures and professional demands faced by this group of BC-based professionals.

APPENDIX A – RESEARCH METHODOLOGY

The research for this study was conducted using a variety of established methods, including review and analysis of existing membership data; interviews with employers; and survey of the EGTT workforce, full spectrum. Confidentially agreements with project partners were secured where necessary.

Throughout the research process, the Project Committee served as a sounding board providing advice and direction on the research steps, and critical support with the deployment of the survey and recruitment for employer interviews. Additionally, the Project Committee provided validation of the preliminary research findings and offered comment on the draft final report.

NOC OCCUPATIONS

The following NOC occupations were included in the study's scope.

NOC	Occupation Title
0211	Engineering managers
0711	Construction managers
2113	Geoscientists and oceanographers
2131	Civil engineers
2132	Mechanical engineers
2133	Electrical and electronics engineers
2134	Chemical engineers
2141	Industrial and manufacturing engineers
2142	Metallurgical and materials engineers
2143	Mining engineers
2144	Geological engineers
2145	Petroleum engineers
2146	Aerospace engineers
2147	Computer engineers (except software engineers and designers)
2148	Other professional engineers, n.e.c.
2171	Information systems analysts and consultants
2173	Software engineers and designers
2211	Chemical technologists and technicians
2212	Geological and mineral technologists and technicians
2231	Civil engineering technologists and technicians
2232	Mechanical engineering technologists and technicians
2233	Industrial engineering and manufacturing technologists and technicians
2234	Construction estimators
2241	Electrical and electronics engineering technologists and technicians
2243	Industrial instrument technicians and mechanics
2244	Aircraft instrument, electrical and avionics mechanics, technicians and inspectors
2251	Architectural technologists and technicians
2253	Drafting technologists and technicians
2254	Land survey technologists and technicians
2255	Technical occupations in geomatics and meteorology
2261	Non-destructive testers and inspectors
2262	Engineering inspectors and regulatory officers
2264	Construction inspectors
2281	Computer network technicians
2282	User support technicians
2283	Systems testing technicians
4161	Natural and applied science policy researchers, consultants and program officers
9232	Petroleum, gas and chemical process operators

SECONDARY RESEARCH

The following administration data was reviewed to assess the extent to which we could stratify our samples and to ensure that we could compare our survey respondents on specific demographic measures and ensure that we had not obvious bias in our response group. We also wanted to ensure that there was a large enough population to gather the needed number of responses for statistical validity, if response rates were low (10%).

From APEGBC, registration datasets were reviewed on Professional Engineers and Geoscientists, engineers and geoscientists in training and engineering and geoscience students.

From ASTTBC, registration datasets were reviewed that contained Certified Technologists and Technicians and technologist and technician students.

The dataset analysis was helpful to ensure sample representativeness and stratification. It also revealed that they were very administrative in nature, used to support the communications and other work of the associations.

PRIMARY RESEARCH

Primary research has been collected through two methods: surveys with the EGTT workforce and interviews with employers. Preliminary findings were validated in regional focus groups.

Surveys

Separate surveys were developed and tested for each of the following populations:

- → Professional Engineers and Geoscientists
- → Certified Technicians and Technologists
- → Engineers and Geoscientists in training
- → Engineering and Geoscience students
- → Technologist and Technician students
- → Employers

Survey questions collected data on the workers' current work situation, work history, project location, and respondent demographics. Survey questionnaires can be obtained via request to the Skills Table.

Surveys were drafted, tested and revised prior to full deployment.

To obtain a statistically valid sample, the following respondent targets were set and responses received.

Audience	Population Sample	Responses Targets (10-30% response rate)	Responses Received
Professional Engineers	5850	400-1250	746
Professional Geoscientists	1020	100-350	192
Engineers in Training	2825	300-900	819
Geoscientists in Training	325	20-170	98
Engineering Students	500	50-150	145
Geoscience Students	65	13-55	28
Certified Technologists and Technicians	5830	400-1250	1016
Technologist and Technician Students	400	40-120	51
Employers	385	20-75	34

Using the dataset reviewed during the secondary research, the surveys were deployed through November and December 2016. Some survey respondents offered their feedback regarding the survey, with the largest number of comments from the Professional Engineers and Geoscientists.

Comments by Audience	#
Certified Technologists and Technicians	7
Engineers in Training	2
Geoscientists in Training	4
Professional Engineers & Geoscientists	27
Technologist and Technician Students	2
Total	42

Geoscientists were frustrated with the areas of specialization offered with the menu options, as it did not reflect their work. Professional Engineers in public service work found the survey not relatable. Professional Engineers, Technologists, and Technicians who worked part-time, were semi-retired or retired also did not relate to the survey.

Employer Interviews

We also interviewed employers that hired the EGTT workforce. Employers were referred by ACEC-BC, APEGBC, and ASTTBC. A total of 29 interviews were conducted (see the section 'Employers of EGTT' in Appendix B – Workforce Snapshots).

Focus Groups

Primary and secondary data was collected and analyzed. Preliminary findings were validated through a series of regional focus groups across BC.

- → Tuesday, January 24, 2017 – Burnaby
- → Tuesday, January 24, 2017 – Vancouver
- → Tuesday, January 31, 2017 – Victoria
- → Wednesday, February 1, 2017 – Kelowna

APPENDIX B – WORKFORCE SNAPSHOTS

Workforce Snapshots offer research highlights and the respondent profile for the EGTT workforce population analyzed.

- → Professional Engineers and Geoscientists
- → Certified Technicians and Technologists
- → Engineers and Geoscientists in Training
- → Geoscientists in Training
- → Engineering Students
- → Geoscience Students
- → Technologist and Technician Students
- → Employers of EGTTs

PROFESSIONAL ENGINEERS

HIGHLIGHTS FOR PROFESSIONAL ENGINEERS

Survey Responses	746
Sample Size	5848
Response Rate	13%

Occupations and Disciplines

- 80% trained in 5 (19%) of the 31 disciplines
  - Between 67% and 75% of them report their occupation the same as their discipline
  - Just over 10% report as a Manager, regardless of discipline
  - Just under 10% report their occupation as 'Other, NEC'
- EITs have a higher proportion of respondents trained as Mechanical and Electrical Engineers and a lower proportion of Civil, Structural and Chemical Engineers

Work Experience

- 37% of Engineers, 40% of Engineering Students had not worked in any capacity before they began their education.
- 18% of EITs had never worked before they began working in their profession
- About 75% of Registered Engineers, who had worked before they began working in their profession had between 1 and 2 jobs, in most cases 2
- Of those who worked:
  - 30% of Engineering Students and EITs worked 1-2 years
  - More than 50% of the Professional Engineers had worked 3 or more years
- Engineers and engineering students overall have less work experience than the other groups in this study, have worked less full time jobs, tend to be younger and have less interest in pursuing further education.

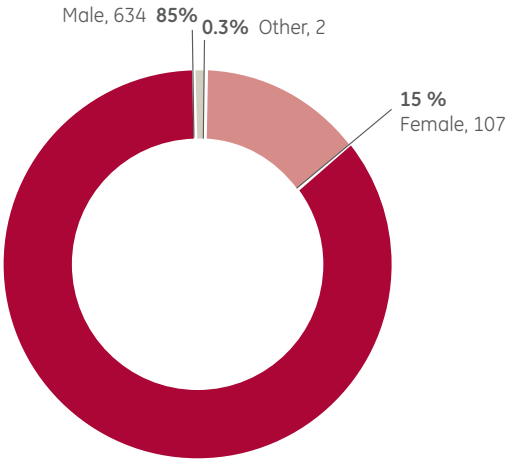
Organizations

- 34% of Engineers work in companies with more than 1000 employees, 23% in companies with less than 10.

Export and Import of Expertise

- 41% of BC Engineers work for companies that have offices outside of BC almost 75% of which also have offices outside of Canada
- 52% of Engineers work on Projects outside of BC, 41% outside of Canada
- 25% of Engineers work on BC projects with Technologists and Technicians outside of BC, 14% outside of Canada

Gender



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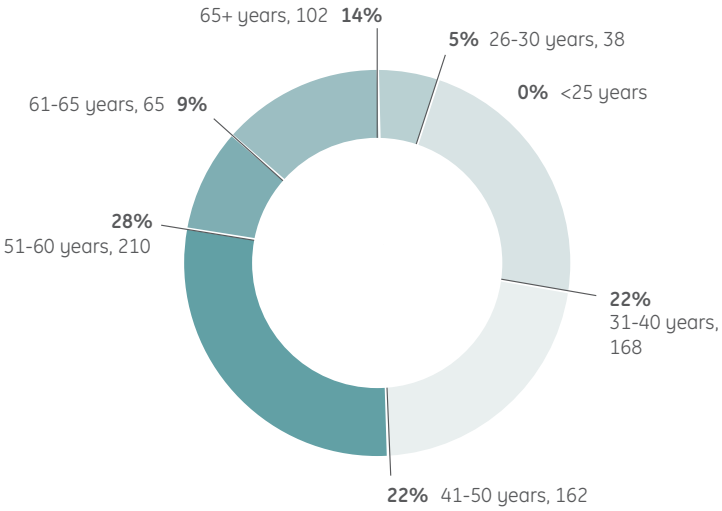


Top Disciplines

	Response Count	Response %
Civil	193	26%
Mechanical	190	25%
Electrical	103	14%
Structural	62	8%
Chemical	49	7%

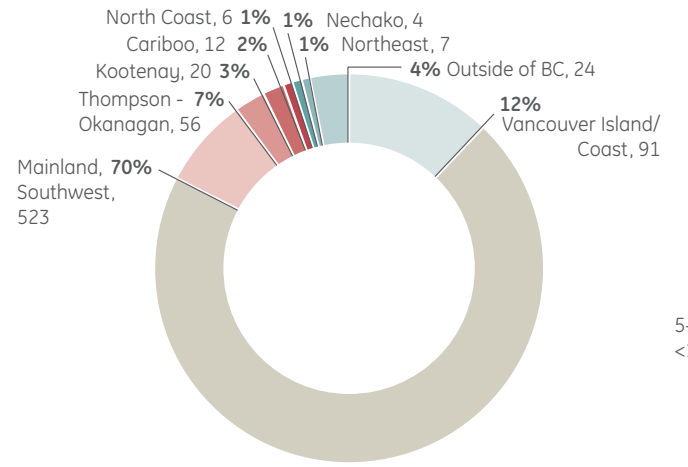
→ represents 80% of respondents

Top Occupations

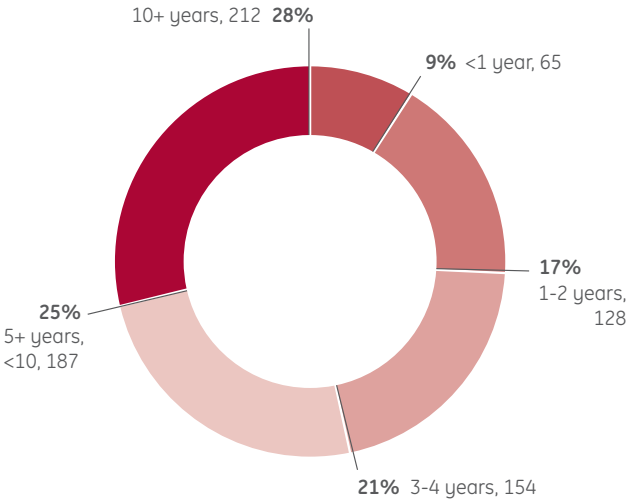
	Response Count	Response %
Civil engineers (NOC 2131)	201	27%
Mechanical engineers (NOC 2132)	119	16%
Engineering managers (NOC 0211)	101	14%
Electrical and electronics engineers (NOC 2133)	81	11%
Other professional engineers, n.e.c. (NOC 2148)	66	9%

→ represents 76% of respondents

Location in BC



Time in Current Position



Engineer Disciplines

APEGBC Discipline	Response Count	Response %
Agricultural and Bioresource	1	0.1%
Biomedical	6	0.8%
Bioresource	3	0.4%
Chemical	49	6.6%
Civil	193	25.9%
Computer	6	0.8%
Electrical	103	13.8%
Engineering Physics	6	0.8%
Environmental	17	2.3%
Forest	10	1.3%
Geological	23	3.1%
Geology	1	0.1%
Geomatics	1	0.1%
Geophysical	1	0.1%
Geotechnics	13	1.7%
Industrial	9	1.2%
Integrated	1	0.1%
Mechanical	190	25.5%
Mechatronics	1	0.1%
Metallurgical	8	1.1%
Mining	28	3.8%
Naval Architecture and Marine	5	0.7%
Petroleum	4	0.5%
Software Engineering	4	0.5%
Structural	62	8.3%
Surveying	1	0.1%
Grand Total	746	100%

Engineer NOC Occupations

NOC Occupation Title	Response Count	Response %
Aerospace engineers (NOC 2146)	7	0.9%
Chemical engineers (NOC 2134)	35	4.7%
Civil engineers (NOC 2131)	201	26.9%
Computer engineers (except software engineers and designers) (NOC2147)	5	0.7%
Construction managers (NOC 0711)	27	3.6%
Electrical and electronics engineers (NOC 2133)	81	10.9%
Engineering managers (NOC 0211)	101	13.5%
Geological engineers (NOC 2144)	22	2.9%
Geoscientists and oceanographers (NOC 2113)	6	0.8%
Industrial and manufacturing engineers (NOC 2141)	25	3.4%
Mechanical engineers (NOC 2132)	119	16.0%
Metallurgical and materials engineers (NOC 2142)	10	1.3%
Mining engineers (NOC 2143)	27	3.6%
Other professional engineers, n.e.c. (NOC 2148)	66	8.8%
Petroleum engineers (NOC 2145)	3	0.4%
Software engineers and designers (NOC 2173)	11	1.5%
Grand Total	746	100%

PROFESSIONAL GEOSCIENTISTS

HIGHLIGHTS FOR PROFESSIONAL GEOSCIENTISTS

Survey Responses	192
Sample Size	1017
Response Rate	19%

Occupations and Disciplines

- → 87% of Geoscientists trained in 5 (45%) of 11 disciplines
- → 86% of all respondents report as one Occupation (Geoscientists and Oceanographers)
- → Just over 2% report as an Engineering Manager
- → Those trained in Geotechnics report more as engineers and engineering managers than other disciplines

Work Experience

- → 30% of Geoscientists, 29% of Geoscience students had not worked in any capacity before they began their careers/training
- → 10% of GITs had never worked before they began working in their profession
- → Of those who worked
  - » 30% of Geoscientists and 25% of Geoscience Students worked between 3 and 5 years before beginning their training

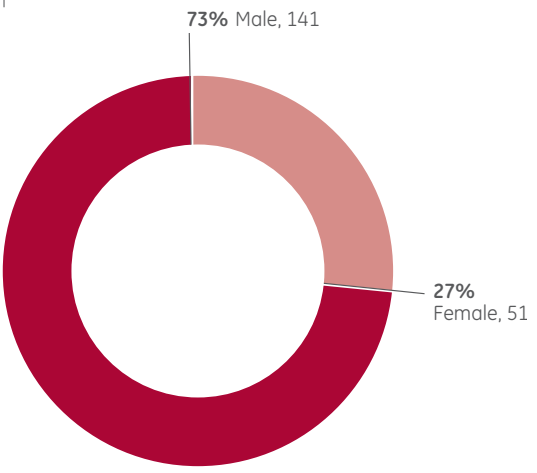
Organizations

- → 40% of Geoscientist work in companies with less than 10 employees, 33% in companies with more than 1000
- → 67% of Geoscientists work in the Environmental Line of Business

Export and Import of Expertise

- → 57% of Geoscientists work on Projects outside of BC, 47% outside of Canada, this is the highest proportion of the three professional groups
- → 30% of BC Geoscientists work for companies that have offices outside of BC almost 22% of which also have offices outside of Canada
- → 54% of Geoscientists work on BC projects with Geoscientists outside of BC, 39% outside of Canada

Gender



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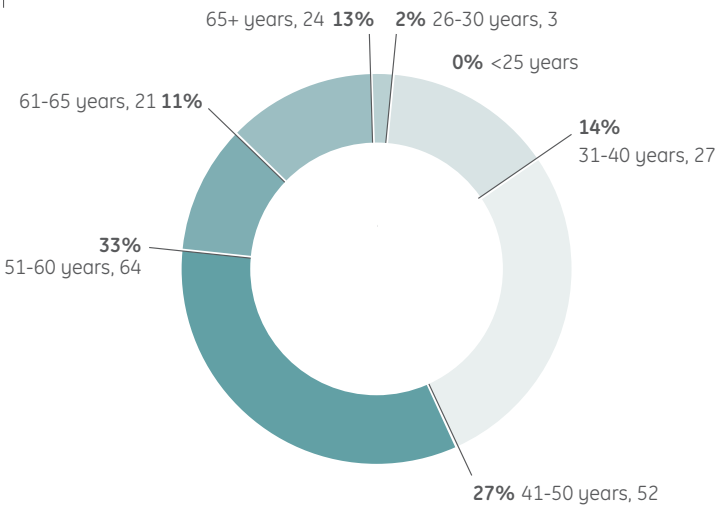


Top Disciplines

	Response Count	Response %
Geology	91	47%
Environmental Geoscience	30	16%
Geological	24	13%
Geotechnics	12	6%
Mining	10	5%

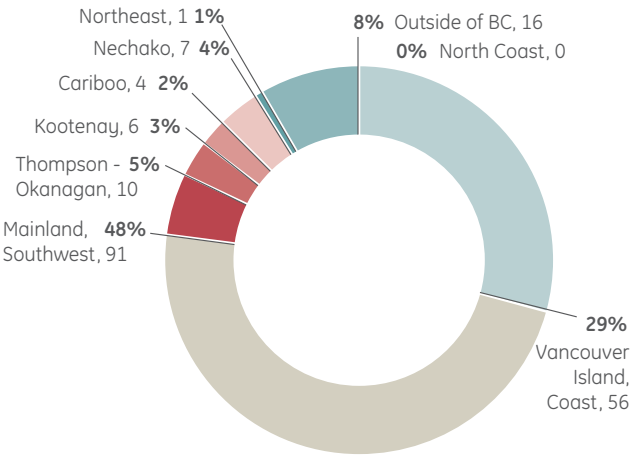
→ represents 87% of respondents

Top Occupations

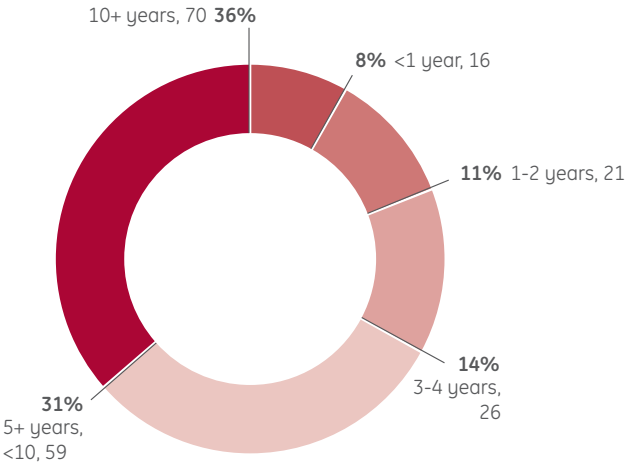
	Response Count	Response %
Geoscientists and oceanographers (NOC 2113)	165	86%
Geological engineers (NOC 2144)	11	6%
Mining engineers (NOC 2143)	5	3%
Engineering managers (NOC 0211)	4	2%
Other professional engineers, n.e.c. (NOC 2148)	4	2%

→ represents 98% of respondents

Location in BC



Time in Current Position



Geoscientist Disciplines

APEGBC Discipline	Response Count	Response %
Environmental	10	5.2%
Environmental Geoscience	30	15.6%
Geochemistry	5	2.6%
Geological	24	12.5%
Geology	91	47.4%
Geomatics	1	0.5%
Geophysical	1	0.5%
Geophysics	5	2.6%
Geotechnics	12	6.3%
Mining	10	5.2%
Petrolium	3	1.6%
Grand Total	192	100%

Geoscientist NOC Occupations

NOC Occupation Title	Response Count	Response %
Aerospace engineers (NOC 2146)	1	0.5%
Civil engineers (NOC 2131)	1	0.5%
Engineering managers (NOC 0211)	4	2.1%
Geological engineers (NOC 2144)	11	5.7%
Geoscientists and oceanographers (NOC 2113)	165	85.9%
Mining engineers (NOC 2143)	5	2.6%
Other professional engineers, n.e.c. (NOC 2148)	4	2.1%
Petroleum engineers (NOC 2145)	1	0.5%
Grand Total	192	100%

CERTIFIED TECHNOLOGISTS AND TECHNICIANS

HIGHLIGHTS FOR CERTIFIED TECHNOLOGISTS AND TECHNICIANS

Survey Responses	1016
Sample Size	5830
Response Rate	17%

Occupations and Disciplines

- → 80% trained in 5 (18%) of the 17 disciplines
  - » Between 80% of them report their occupation the same as their discipline
  - » The scope of other occupations is wider (between 10-15 occupations per discipline) for the 20% who report a different occupation
  - » Students are more likely to be training in Environmental disciplines and are less likely to be training in Civil or Electronics

Work Experience

- → 22% of Certified Technologists and Technicians and 24% of students had not worked in any capacity before they began their careers/training
- → About 30% of Certified Technologists and Technicians, who had worked before they began working in their profession had 3 or more jobs
- → Of those who worked:
  - » 25% of the Student Technologists and Technicians and 30% of the Certified Technologists and Technicians had worked more than 5 years full time before they began their training
- → Certified Technologists and Technicians tend to have worked more jobs and more full time jobs before they begin their professional careers

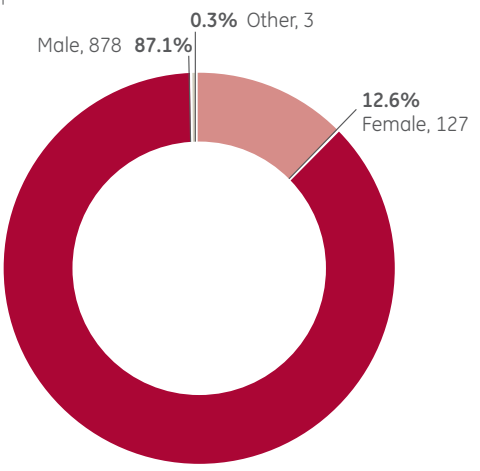
Organizations

- → 87% of Certified Technologists and Technicians work on a team that includes Engineers
- → 29% of Certified Technologists and Technicians work in companies with more than 1000 employees, 17% in companies with less than 10.

Export and Import of Expertise

- → 39% of BC Technologists and Technicians work for companies that have offices outside of BC, almost 65% of which also have offices outside of Canada
- → 40% of Technologists and Technicians work on Projects outside of BC, 25% outside of Canada
- → 38% of Technologists and Technicians work on BC Projects with Technologists and Technicians outside of BC, 12% outside of Canada

Gender



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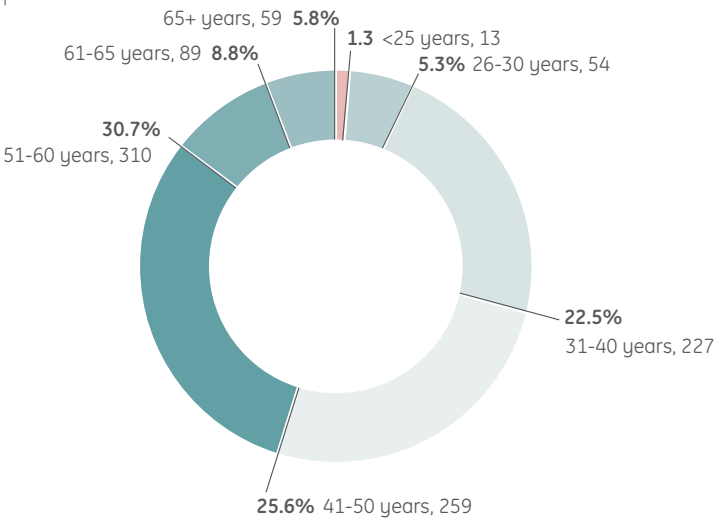


Top Disciplines

	Response Count	Response %
Civil	387	38%
Mechanical	130	13%
Electrical	106	10%
Electronics	98	10%
Building	91	9%

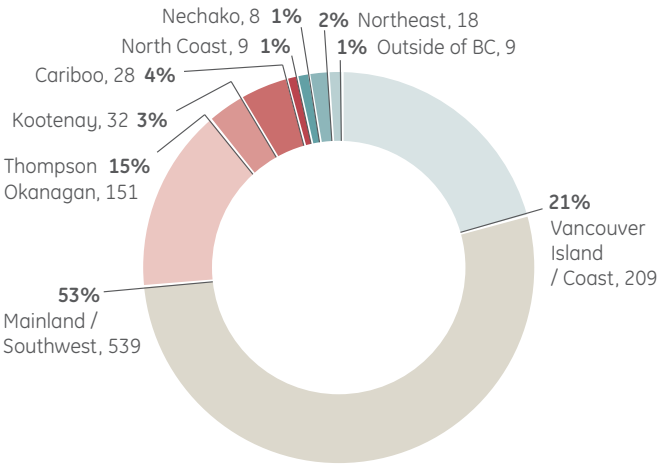
→ represents 80% of respondents

Top Occupations

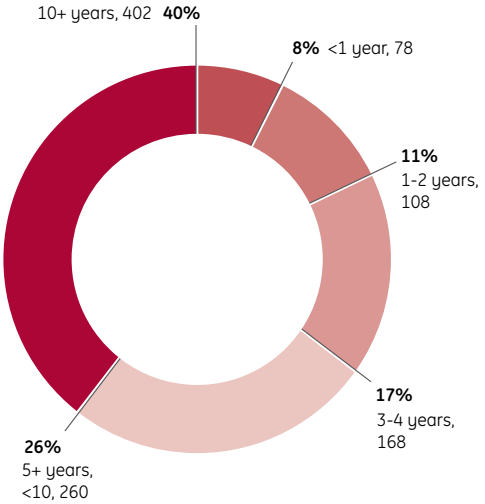
	Response Count	Response %
Civil engineering technologists and technicians (NOC 2231)	364	36%
Electrical and electronics engineering technologists and technicians (NOC 2241)	195	19%
Mechanical engineering technologists and technicians (NOC 2232)	123	12%
Architectural technologists and technicians (NOC 2251)	61	6%
Natural and applied science policy researchers, consultants and program officers (NOC 4161)	38	4%

→ represents 77% of respondents

Location in BC



Time in Current Position



Technologist and Technician Disciplines

ASTTBC Discipline	Response Count	Response %
Biological Sciences	11	1.1%
Biomedical	12	1.2%
Building	91	9.0%
Chemical	11	1.1%
Civil	387	38.1%
Electrical	106	10.4%
Electronics	98	9,6%
Environmental	40	3.9%
Forest Engineering	3	0.3%
Gas & Petroleum	28	2.8%
Geomatics	46	4.5%
Industrial	10	1.0%
Information Technology	5	0.5%
Instrumentation	18	1.8%
Marine	9	0.9%
Mechanical	130	12.8%
Metallurgical	5	0.5%
Mining	6	0.6%
Grand Total	1016	100%

Technologist and Technician NOC Occupations

NOC Occupation Titles	Response Count	Response %
Aircraft instrument, electrical and avionics mechanics, technicians and inspectors (NOC 2244)	2	0.2%
Architectural technologists and technicians (NOC 2251)	61	6.0%
Chemical technologists and technicians (NOC 2211)	8	0.8%
Civil engineering technologists and technicians (NOC 2231)	364	35.8%
Computer network technicians (NOC 2281)	2	0.2%
Construction estimators (NOC 2234)	25	2.5%
Construction inspectors (NOC 2264)	28	2.8%
Drafting technologists and technicians (NOC 2253)	31	3.1%
Electrical and electronics engineering technologists and technicians (NOC 2241)	195	19.2%
Engineering inspectors and regulatory officers (NOC 2262)	14	1.4%
Geological and mineral technologists and technicians (NOC 2212)	8	0.8%
ndustrial engineering and manufacturing technologists and technicians (NOC 2233)	31	3.1%
Industrial instrument technicians and mechanics (NOC 2243)	8	0.8%
Information systems analysts and consultants (NOC 2171)	13	1.3%
Land survey technologists and technicians (NOC 2254)	26	2.6%
Mechanical engineering technologists and technicians (NOC 2232)	123	12.1%
Natural and applied science policy researchers, consultants and program officers (NOC 4161)	38	3.7%
Non-destructive testers and inspection technicians (NOC 2261)	6	0.6%
Petroleum, gas and chemical process operators (NOC 9232)	18	1.8%
Software engineers and designers (NOC 2173)	7	0.7%
Technical occupations in geomatics and meteorology (NOC 2255)	3	0.3%
User support technicians (NOC 2282)	5	0.5%
Grand Total	1016	100%

ENGINEERS IN TRAINING (EIT)

HIGHLIGHTS FOR ENGINEERS IN TRAINING (EITs)

Survey Responses	819
Sample Size	2825
Response Rate	29%

Occupations and Disciplines

- → 77% trained in 5 (16%) of the 31 disciplines
  - » 70-80% of them report their occupation the same as their discipline
  - » EITs are more likely to be trained in Mechanical and Electrical Engineers and a lower proportion of Civil, Structural and Chemical Engineers

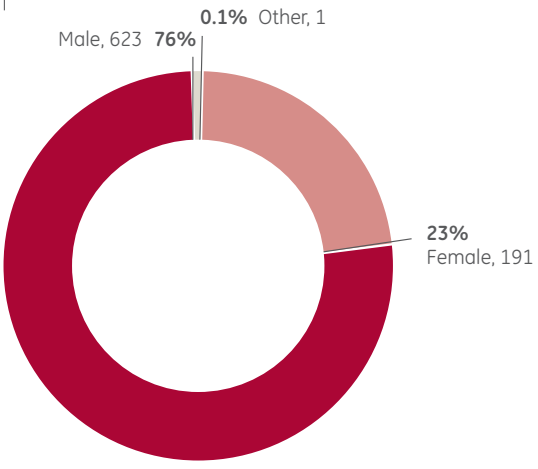
Work Experience

- → 19% of EITs had not worked in any capacity before they began their careers
- → About 56% EITs, who had worked before they began working in their profession had 1 or 2 jobs
- → Of those who worked:
  - » 9% had worked more than 5 years full time before they began their careers
  - » 17% had worked 1-2 years full time

Export and Import of Expertise

- → 23% of EITs plan to work outside of BC and 21 % plan to work outside of Canada

Gender



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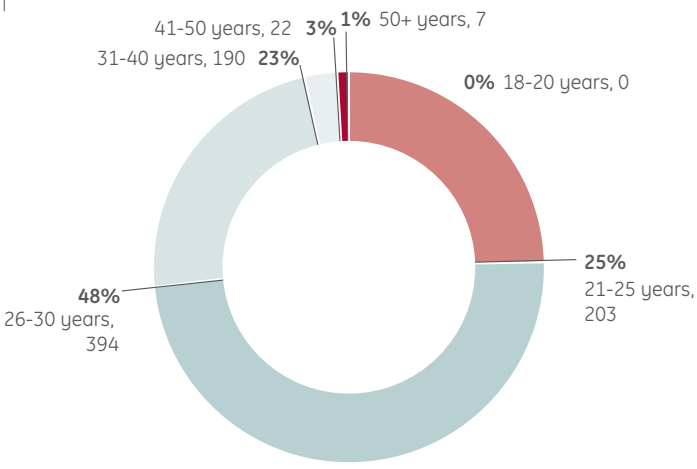


Top Disciplines (currently working in)

	Response Count	Response %
Civil	193	24%
Mechanical	193	24%
Electrical	137	17%
Structural	69	8%
Environmental	29	4%

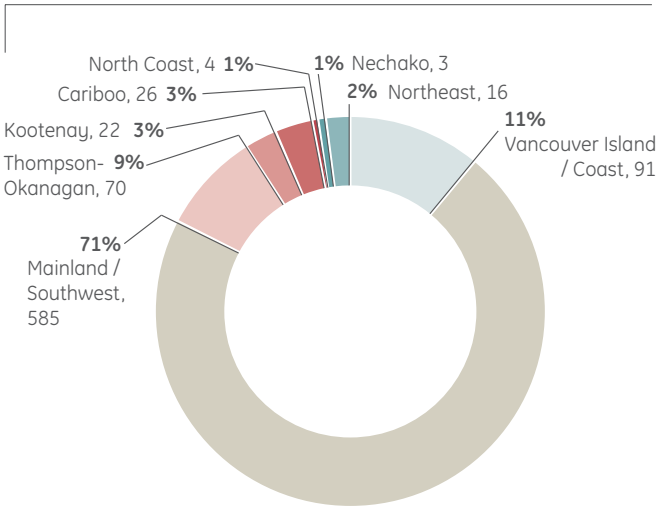
→ represents 76% of respondents

Top Occupations

	Response Count	Response %
Civil engineers (NOC 2131)	223	27%
Mechanical engineers (NOC 2132)	177	22%
Electrical and electronics engineers (NOC 2133)	131	16%
Other professional engineers, n.e.c. (NOC 2148)	78	10%
Construction managers (NOC 0711)	54	7%

→ represents 81% of respondents

Location in BC



EIT Disciplines

APEGBC Discipline	Response Count	Response %
Agricultural and Bioresource	4	0.5%
Biomedical	7	0.9%
Bioresource	2	0.2%
Chemical	37	4.5%
Civil	193	23.6%
Computer	8	1.0%
Electrical	143	17.5%
Engineering Physics	15	1.8%
Environmental	28	3.4%
Environmental Geoscience	1	0.1%
Forest	2	0.2%
Geological	24	2.9%
Geomatics	2	0.2%
Geotechnics	6	0.7%
Integrated	18	2.2%
Mechanical	212	25.9%
Mechatronics	16	2.0%
Metallurgical	19	2.3%
Mining	27	3.3%
Naval Architectural	1	0.1%
Naval Architecture and Marine	2	0.2%
Petroleum	2	0.2%
Software Engineering	5	0.6%
Structural	45	5.5%
Grand Total	819	100%

EIT NOC Occupations

NOC Occupation Title	Response Count	Response %
Aerospace engineers (NOC 2146)	4	0.5%
Chemical engineers (NOC 2134)	27	3.3%
Civil engineers (NOC 2131)	223	27.2%
Computer engineers (except software engineers and designers) (NOC2147)	2	0.2%
Construction managers (NOC 0711)	54	6.6%
Electrical and electronics engineers (NOC 2133)	131	16.0%
Engineering managers (NOC 0211)	17	2.1%
Geological engineers (NOC 2144)	22	2.7%
Geoscientists and oceanographers (NOC 2113)	3	0.4%
Industrial and manufacturing engineers (NOC 2141)	19	2.3%
Mechanical engineers (NOC 2132)	177	21.6%
Metallurgical and materials engineers (NOC 2142)	16	2.0%
Mining engineers (NOC 2143)	18	2.2%
Other professional engineers, n.e.c. (NOC 2148)	78	9.5%
Petroleum engineers (NOC 2145)	2	0.2%
Software engineers and designers (NOC 2173)	26	3.2%
Grand Total	819	100%

GEOSCIENTISTS IN TRAINING (GIT)

HIGHLIGHTS FOR GEOSCIENTISTS IN TRAINING (GITs)

Survey Responses	98
Sample Size	327
Response Rate	30%

Occupations and Disciplines

- → 98% trained in 5 (45%) of the 11 disciplines
  - » 85% of them report as Geoscientists and Oceanographers (NOC 2113)
  - » GITs have a higher proportion in Geology and Environmental Geoscience and a lower proportion in Mining and Geotechnics

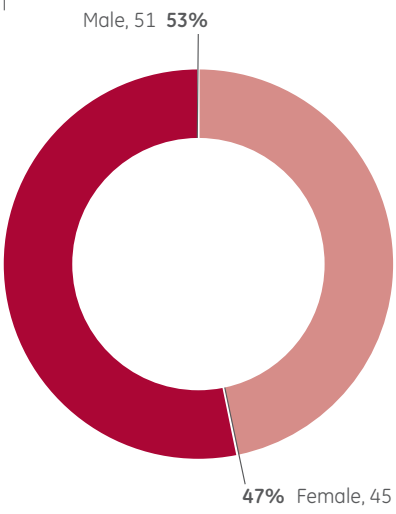
Work Experience

- → 10% of GITs had not worked in any capacity before they began their careers
- → About 52% GITs, who had worked before they began working in their profession had 1 or 2 jobs
- → Of those who worked:
  - » 34% had worked more than 5 years before they began their careers
  - » 10% had worked 1-2 years full time

Export and Import of Expertise

- → 49% of GITs plan to work outside of BC and 29% plant to work outside of Canada

Gender



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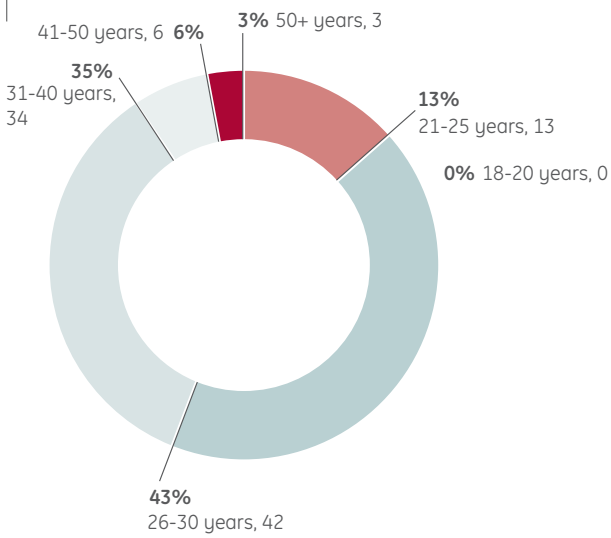


Top Disciplines (currently working in)

	Response Count	Response %
Environmental	29	30%
Geology	27	28%
Environmental	8	8%
Geotechnics	8	8%
Geophysics	6	6%
Mining	6	6%

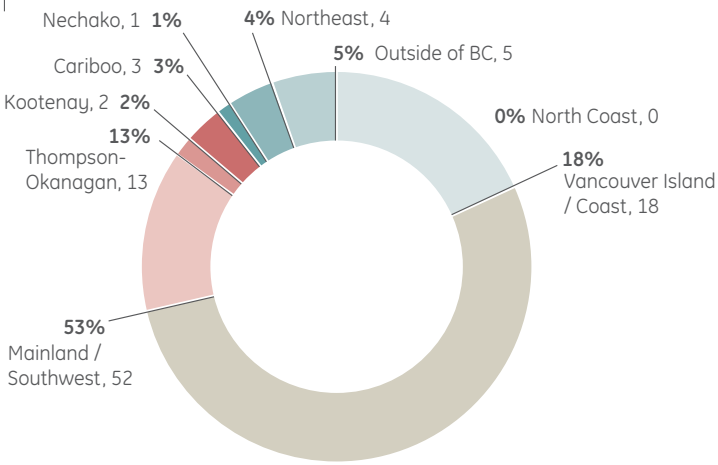
→ represents 86% of respondents

Top Occupations (self-identified)

	Response Count	Response %
Geoscientists and oceanographers (NOC 2113)	82	84%
Geological engineers (NOC 2144)	11	11%
Other professional engineers, n.e.c. (NOC 2148)	4	4%
Mining engineers (NOC 2143)	1	1%

→ represents 100% of respondents

Location in BC



GIT Disciplines

APEGBC Discipline	Response Count	Response %
Environmental	2	2.0%
Environmental Geoscience	25	25.5%
Geochemistry	4	4.1%
Geological	1	1.0%
Geology	61	62.2%
Geophysical	1	1.0%
Geophysics	4	4.1%
Grand Total	98	100%

GIT NOC Occupations

NOC Occupation Title	Response Count	Response %
Geological engineers (NOC 2144)	11	11.2%
Geoscientists and oceanographers (NOC 2113)	82	83.7%
Mining engineers (NOC 2143)	1	1.0%
Other Professional Engineers, n.e.c. (NOC 2148)	4	4.1%
Grand Total	98	100%

ENGINEERING STUDENTS

HIGHLIGHTS FOR ENGINEERING STUDENTS

Survey Responses	145
Sample Size	672
Response Rate	22%

Occupations and Disciplines

- → 74% trained in 5 (16%) of the 31 disciplines
  - » Students are more likely to be training as Mechanical Environments Engineers less likely as Civil, Structural and Chemical Engineers
- → 50% plan to continue their studies after they complete their current program, 31% in a different program (often Business)

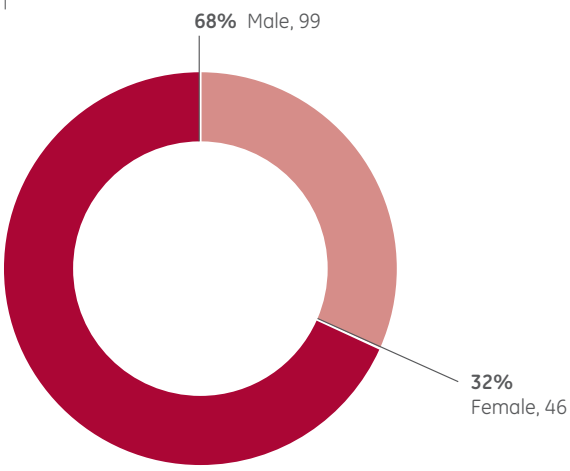
Work Experience

- → 47% of engineering students had not worked in any capacity before they began their studies
- → About 66% engineering students who had worked before they began working in their profession had 1 or 2 jobs
- → Of those who worked:
  - » 18% had worked more than 5 years before they began their studies
  - » 17% had worked 1-2 years full time

Export and Import of Expertise

- → 52% of engineering students plan to work outside of BC and 34 % plan to work outside of Canada

Gender



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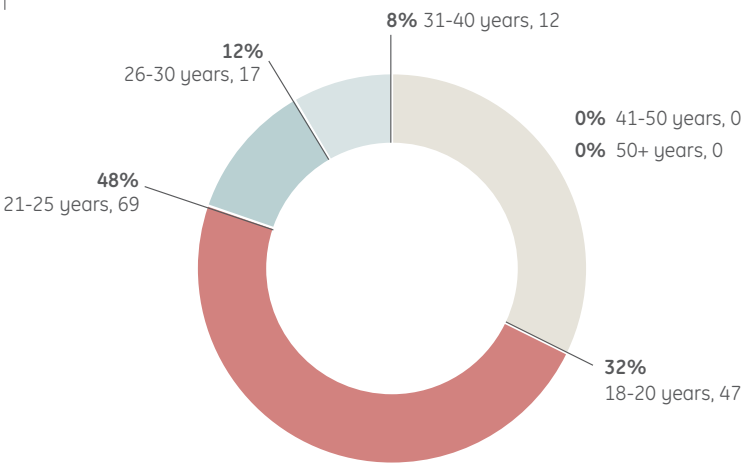


Top Disciplines (in training for)

	Response Count	Response %
Civil	39	27%
Mechanical	23	16%
Electrical	17	12%
Chemical	15	10%
Environmental	13	9%

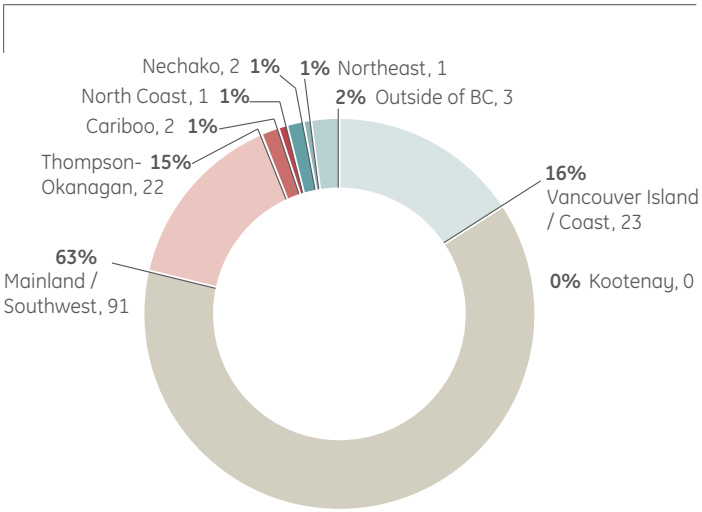
→ represents 74% of respondents

Top Occupations (once working)

	Response Count	Response %
Civil engineers (NOC 2131)	45	31%
Mechanical engineers (NOC 2132)	24	17%
Electrical and electronics engineers (NOC 2133)	17	12%
Other professional engineers, n.e.c. (NOC 2148)	17	12%
Chemical engineers (NOC 2134)	15	10%

→ represents 81% of respondents

Location in BC



Engineering Student Disciplines

APEGBC Discipline	Response Count	Response %
Agricultural and Bioresource	0	0.0%
Agriculture	0	0.0%
Biomedical	4	2.8%
Bioresource	0	0.0%
Chemical	15	10.3%
Civil	39	26.9%
Computer	5	3.4%
Electrical	17	11.7%
Engineering Physics	5	3.4%
Environmental	13	9.0%
Environmental Geoscience	0	0.0%
Forest	0	0.0%
Geochemistry	0	0.0%
Geological	7	4.8%
Geology	0	0.0%
Geomatics	0	0.0%
Geophysical	0	0.0%
Geophysics	0	0.0%
Geotechnics	0	0.0%
Industrial	0	0.0%
Integrated	5	3.4%
Mechanical	23	15.9%
Mechatronics	6	4.1%
Metallurgical	3	2.1%
Mining	1	0.7%
Naval Architectural	0	0.0%
Naval Architecture and Marine	0	0.0%
Petroleum	0	0.0%
Software Engineering	1	0.7%
Structural	1	0.7%
Surveying	0	0.0%
Grand Total	145	100%

Engineering Student NOC Occupations

NOC Occupation Title	Response Count	Response %
Aerospace engineers (NOC 2146)	3	2.1%
Chemical engineers (NOC 2134)	15	10.3%
Civil engineers (NOC 2131)	45	31.0%
Computer engineers (except software engineers and designers) (NOC2147)	5	3.4%
Construction managers (NOC 0711)	0	0.0%
Electrical and electronics engineers (NOC 2133)	17	11.7%
Engineering managers (NOC 0211)	1	0.7%
Geological engineers (NOC 2144)	6	4.1%
Geoscientists and oceanographers (NOC 2113)	0	0.0%
Industrial and manufacturing engineers (NOC 2141)	2	1.4%
Mechanical engineers (NOC 2132)	24	16.6%
Metallurgical and materials engineers (NOC 2142)	3	2.1%
Mining engineers (NOC 2143)	1	0.7%
Other professional engineers, n.e.c. (NOC 2148)	17	11.7%
Petroleum engineers (NOC 2145)	0	0.0%
Software engineers and designers (NOC 2173)	6	4.1%
Grand Total	145	100%

GEOSCIENCE STUDENTS

HIGHLIGHTS FOR GEOSCIENCE STUDENTS

Survey Responses	28
Sample Size	115
Response Rate	24%

Occupations and Disciplines

- → 100% trained in 5 (45%) of the 11 disciplines
  - » students have a higher proportion in Geology and Environmental Geoscience and none are in Mining and Geotechnics
- → 63% plan to continue their education after they complete their program of studies 89% in their current field

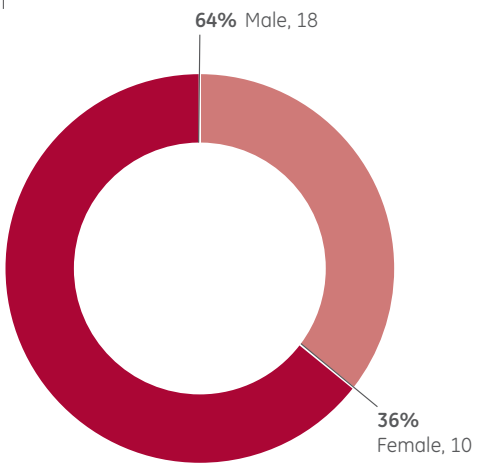
Work Experience

- → 29% of geoscience students had not worked in any capacity before they began their studies
- → About 45% student who had worked before they began their studies had 1 or 2 jobs
- → Of those who worked:
  - » 30% had worked more than 5 years before they began their careers
  - » 20% had worked 1-2 years full time

Export and Import of Expertise

- → 57% of geoscience students plan to work outside of BC and 21 % plan to work outside of Canada

Gender



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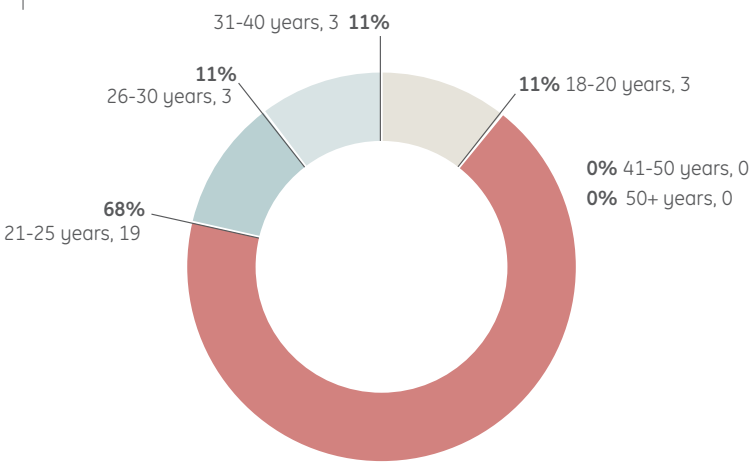


Top Disciplines (in training for)

	Response Count	Response %
Environmental	12	43%
Geology	10	36%
Geological	4	14%
Environmental	1	4%
Geophysics	1	4%

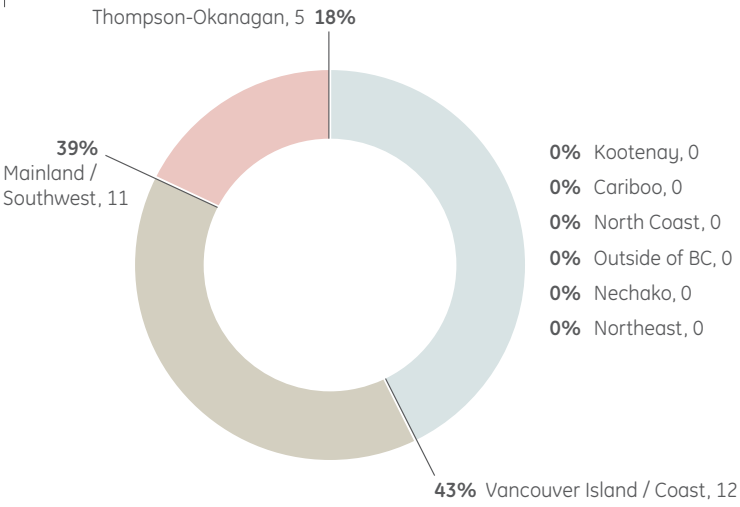
→ represents 100% of respondents

Top Occupations (once working)

	Response Count	Response %
Geoscientists and oceanographers (NOC 2113)	26	93%
Geological engineers (NOC 2144)	2	7%

→ represents 100% of respondents

Location in BC



Geoscience Student Disciplines

APEGBC Discipline	Response Count	Response %
Environmental	1	3.6%
Environmental Geoscience	12	42.9%
Geochemistry	0	0.0%
Geological	4	14.3%
Geology	10	35.7%
Geophysical	0	0.0%
Geophysics	1	3.6%
Grand Total	28	100%

Geoscience Student NOC Occupations

NOC Occupation Title	Response Count	Response %
Geological engineers (NOC 2144)	2	7.1%
Geoscientists and oceanographers (NOC 2113)	26	92.9%
Grand Total	28	100%

TECHNOLOGIST AND TECHNICIAN STUDENTS

HIGHLIGHTS FOR TECHNOLOGIST AND TECHNICIAN STUDENTS

Survey Responses	51
Sample Size	585
Response Rate	9%

Occupations and Disciplines

- → 72% trained in 5 (29%) of the 17 disciplines
- → 69% plan to continue their education after they complete their program of studies, 89% in their current field

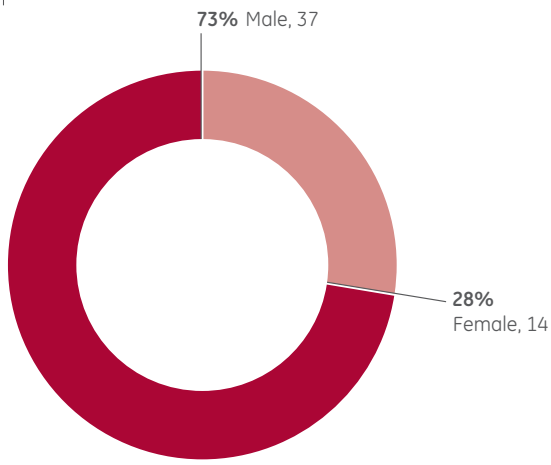
Work Experience

- → 24% of Technologist and Technician students had not worked in any capacity before they began their studies
- → About 60% students who had worked before they began their studies had 1 or 2 jobs
- → Of those who worked:
  - » 35% had worked more than 5 years before they began their careers o
  - » 30% had worked more than 5 years full time

Export and Import of Expertise

- → 37% of Technologist and Technician students plan to work outside of BC and 24% plan to work outside of Canada

Gender



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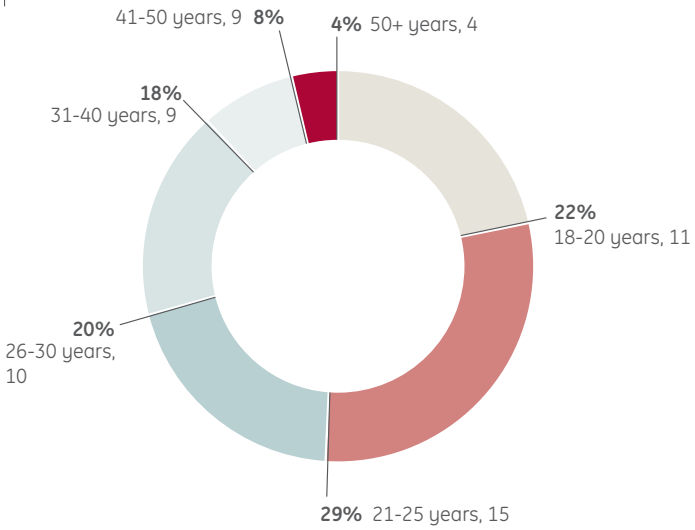


Top Disciplines (currently studying)

	Response Count	Response %
Civil	9	18%
Environmental	9	18%
Mechanical	9	18%
Electrical	6	12%
Building	4	8%

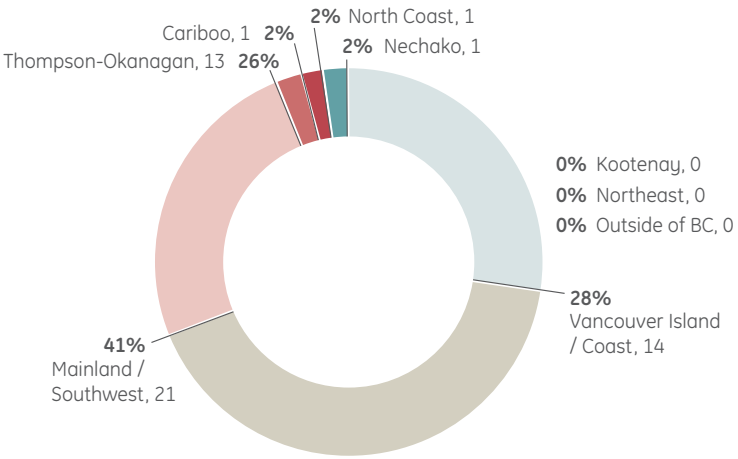
→ represents 73% of respondents

Top Occupations (once working)

	Response Count	Response %
Civil engineering technologists and technicians (NOC 2231)	10	20%
Electrical and electronics engineering technologists and technicians (NOC 2241)	9	18%
Mechanical engineering technologists and technicians (NOC 2232)	8	16%
Natural and applied science policy researchers, consultants and program officers (NOC 4161)	6	12%
Architectural technologists and technicians (NOC 2251)	4	8%

→ represents 74% of respondents

Location in BC



Technologist and Technician Student Disciplines

ASTTBC Discipline	Response Count	Response %
Biological Sciences	2	3.9%
Biomedical	0	0.0%
Building	4	7.8%
Chemical	2	3.9%
Civil	9	17.6%
Electrical	6	11.8%
Electronics	3	5.9%
Environmental	9	17.6%
Forest Engineering	0	0.0%
Gas & Petroleum	0	0.0%
Geomatics	2	3.9%
Industrial	0	0.0%
Information Technology	0	0.0%
Instrumentation	2	3.9%
Marine	0	0.0%
Mechanical	9	17.6%
Metallurgical	0	0.0%
Mining	3	5.9%
Grand Total	51	100%

Technologist and Technician Student NOC Occupations

NOC Occupation Title	Response Count	Response %
Aircraft instrument, electrical and avionics mechanics, technicians and inspectors (NOC 2244)	0	0.0%
Architectural technologists and technicians (NOC 2251)	4	8.0%
Chemical technologists and technicians (NOC 2211)	3	6.0%
Civil engineering technologists and technicians (NOC 2231)	10	20.0%
Computer network technicians (NOC 2281)	1	2.0%
Construction estimators (NOC 2234)	0	0.0%
Construction inspectors (NOC 2264)	0	0.0%
Drafting technologists and technicians (NOC 2253)	0	0.0%
Electrical and electronics engineering technologists and technicians (NOC 2241)	9	18.0%
Engineering inspectors and regulatory officers (NOC 2262)	1	2.0%
Geological and mineral technologists and technicians (NOC 2212)	3	6.0%
Industrial engineering and manufacturing technologists and technicians (NOC 2233)	0	0.0%
Industrial instrument technicians and mechanics (NOC 2243)	1	2.0%
Information systems analysts and consultants (NOC 2171)	0	0.0%
Information systems testing technicians (NOC 2283)	0	0.0%
Land survey technologists and technicians (NOC 2254)	2	4.0%
Mechanical engineering technologists and technicians (NOC 2232)	8	16.0%
Natural and applied science policy researchers, consultants and program officers (NOC 4161)	6	12.0%
Non-destructive testers and inspection technicians (NOC 2261)	0	0.0%
Petroleum, gas and chemical process operators (NOC 9232)	0	0.0%
Software engineers and designers (NOC 2173)	0	0.0%
Technical occupations in geomatics and meteorology (NOC 2255)	2	4.0%
User support technicians (NOC 2282)	0	0.0%
Grand Total	50	100%

EMPLOYERS

HIGHLIGHTS FOR EMPLOYERS

Survey Responses	34
Sample Size	204
Response Rate	17%

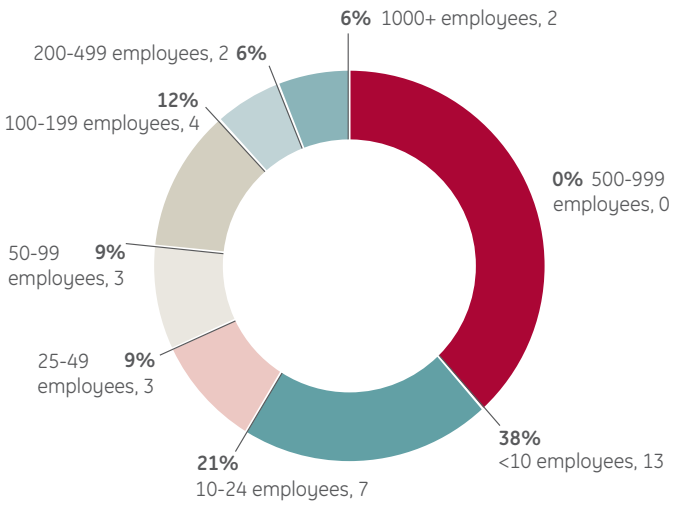
Organizational Components

- → 59% of the employers surveyed have less than 25 employees
  - » Most of the Employers interviewed had more than 500 employees
- → 30% have no EITs in their company
- → 79% of employers had teams comprised of engineers and TT

Export of Expertise

- → 62% of Employers say they provide service to projects outside of BC, 35% outside of Canada
  - » For 30% between 25-50% of their business is for projects outside of BC, 25% outside of Canada
  - » 68% see less than 10% of BC based opportunities going to companies outside of BC
- → 18% of BC employers have offices outside of BC, 6% outside of Canada

Company Size



Work Locations in BC - Surveyed

	Response Count	Response %
Mainland/Southwest	18	53%
Vancouver Island/Coast	15	44%
Thompson-Okanagan	12	35%
All locations listed	10	29%
Kootenay	8	24%
Cariboo	8	24%
North Coast	6	18%
Northeast	6	18%
Nechako	4	12%

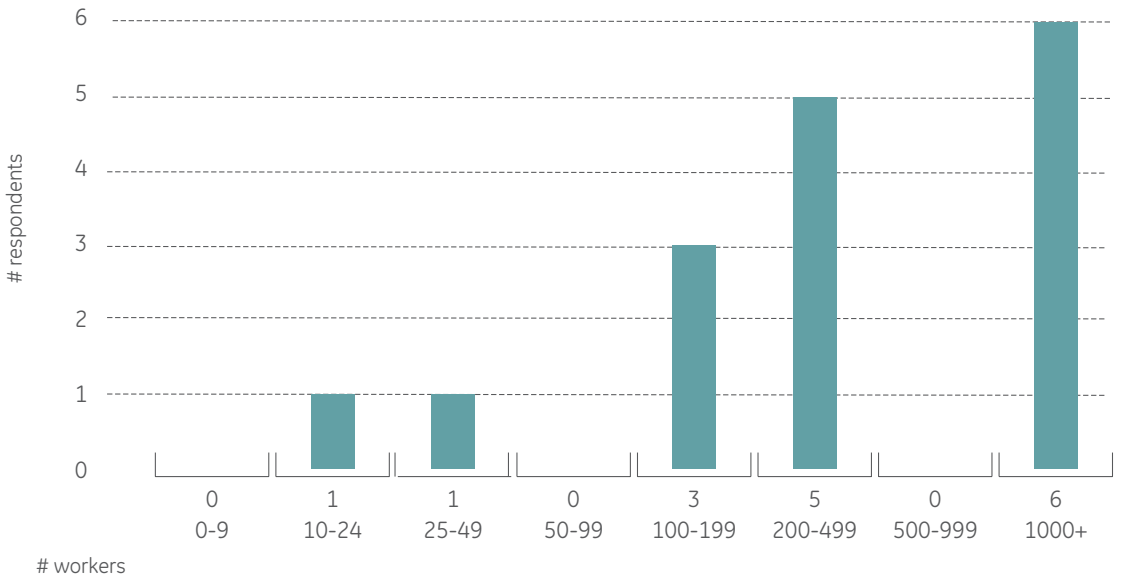
- → Respondents checked all regions that applied
- → 29% of respondents (4) worked in all locations
- → 35% respondents (12) only worked in 1 location
- → 12% of respondents worked in both Mainland/Southwest and Vancouver Island/Coast, the most common combination

Lines of Business - Surveyed

	Response Count	Response %
Consulting	16	47%
Civil	13	38%
Electrical	10	29%
Structural	10	29%
Mechanical	9	27%
Other	9	27%
Environmental	6	18%
Utility	2	6%
Electronics	1	3%
Architectural	0	0%

→ Respondents checked all regions that applied

Company Size - Employer Interviewed



→ Based on 16 of 29 pre-interview forms completed

Interviewees

29 completed

*** pre-interview forms completed**

Company
Acuren Group Inc.
Amec Foster Wheeler Americas Limited - Mining & Metal , Power and Process
Associated Engineering (BC) Ltd
Ausenco
BC Ferries
BC Hydro
BCIT
BC Safety Authority
BGC Engineering Inc.
CH2M Hill
City of Coquitlam
City of Vancouver
Fluor Canada Ltd.
FortisBC
Geoscientists Canada
Hedgehog Technologies
Intertek Testing Services
Klohn Crippen Berger Ltd.
Metro Vancouver
Opus
Read Jones Christofferson
RF Binnie & Associates Ltd
SRK
Teck
WSP Canada Inc.

APPENDIX C – PERCENT AND COUNT OF PROFESSIONALS WHO VIEW THEIR NOC AS INACCURATE

Percent and Count of Professionals Who View Their NOC as Inaccurate

Occupation Title	Respondent Group									
	Engineers		EITs		Technologists & Technicians		Geoscientists		GITs	
	%	Count	%	Count	%	Count	%	Count	%	Count
Aerospace engineers (NOC 2146)	14%	1								
Aircraft instrument, electrical and avionics mechanics, technicians and inspectors (NOC 2244)					50%	1				
Architectural technologists and technicians (NOC 2251)					16%	10				
Chemical engineers (NOC 2134)	3%	1	11%	3						
Chemical technologists and technicians (NOC 2211)					25%	2				
Civil engineering technologists and technicians (NOC 2231)					5%	20	18%	30	15%	12
Civil engineers (NOC 2131)	6%	13	2%	5			100%	1		
Computer engineers (except software engineers and designers) (NOC 2147)	33%	2	50%	1						
Computer network technicians (NOC 2281)					50%	1				
Construction estimators (NOC 2234)					16%	4				
Construction inspectors (NOC 2264)					18%	5				
Construction managers (NOC 0711)	15%	4	4%	2						
Drafting technologists and technicians (NOC 2253)					3%	1				
Electrical and electronics engineering technologists and technicians (NOC 2241)					6%	11				
Electrical and electronics engineers (NOC 2133)	15%	12	6%	8						
Engineering inspectors and regulatory officers (NOC 2262)					47%	8				
Engineering managers (NOC 0211)	12%	13	5%	1			25%	1		
Geological and mineral technologists and technicians (NOC 2212)					11%	1				

Percent and Count of Professionals Who View Their NOC as Inaccurate

Occupation Title	Respondent Group									
	Engineers		EITs		Technologists & Technicians		Geoscientists		GITs	
	%	Count	%	Count	%	Count	%	Count	%	Count
Geological engineers (NOC 2144)	16%	4	13%	3			29%	4		
Geoscientists and oceanographers (NOC 2133)	17%	1					18%	30	15%	12
Industrial and manufacturing engineers (NOC 2141)	8%	2	10%	2						
Industrial engineering and manufacturing technologists and technicians (NOC 2233)					9%	3				
Industrial instrument technicians and mechanics (NOC 2243)					22%	2				
Information systems analysts and consultants (NOC 2171)					8%	1				
Land survey technologists and technicians (NOC 2254)										
Mechanical engineering technologists and technicians (NOC 2232)					7%	9				
Mechanical engineers (NOC 2132)	10%	12	6%	11						
Metallurgical and materials engineers (NOC 2142)	27%	3								
Mining engineers (NOC 2143)	7%	2					20%	1		
Natural and applied science policy researchers, consultants and program officers (NOC 4161)					24%	9				
Non-destructive testers and inspectors (NOC 2261)					14%	1				
Other professional engineers, n.e.c. (NOC 2148)	51%	36	42%	36			80%	4	50%	2
Petroleum engineers (NOC 2145)	40%	2								
Petroleum, gas and chemical process operators (NOC 9232)					37%	7				
Software engineers and designers (NOC 2173)	8%	1			25%	2				
Systems testing technicians (NOC 2283)					-	-				
Technical occupations in geomatics and meteorology (NOC 2255)					20%	1				
User support technicians (NOC 2282)					50%	3				

APPENDIX D – ASTTBC DISCIPLINES

1. Biological Sciences
2. Biomedical
3. Building
4. Chemical
5. Civil
6. Electrical
7. Electronics
8. Environmental
9. Forest Engineering
10. Gas & Petroleum
11. Geomatics
12. Industrial
13. Information Technology Instrumentation
14. Marine
15. Mechanical
16. Metallurgical
17. Mining

APPENDIX E – APEGBC DISCIPLINES

1. Agricultural and Bioresource
2. Agriculture
3. Biomedical
4. Bioresource
5. Chemical
6. Civil
7. Computer
8. Electrical
9. Engineering Physics
10. Environmental
11. Environmental Geoscience
12. Forest
13. Geochemistry
14. Geological
15. Geology
16. Geomatics
17. Geophysical
18. Geophysics
19. Geotechnics
20. Industrial
21. Integrated
22. Mechanical
23. Mechatronics
24. Metallurgical
25. Mining
26. Naval Architectural
27. Naval Architecture and Marine
28. Petroleum
29. Software Engineering
30. Structural
31. Surveying

ASIA PACIFIC GATEWAY
SKILLS TABLE

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www.apgst.ca
www.lmionline.ca

Digging Deeper:Understanding the Engineering, Geoscientist, Technologist and Technician Labour Market in the Asia Pacific Gateway

—

Final Report

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Prepared by
Asia Pacific Gateway Skills Table