ENGINEERS AND GEOSCIENTISTS BRITISH COLUMBIA

JANUARY/FEBRUARY 2020

INNOVATION

CELEBRATING 100 YEARS OF ETHICS, EXCELLENCE, AND INNOVATION

CENTENNIAL
COLLECTOR'S EDITION

100 YEARS

ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA

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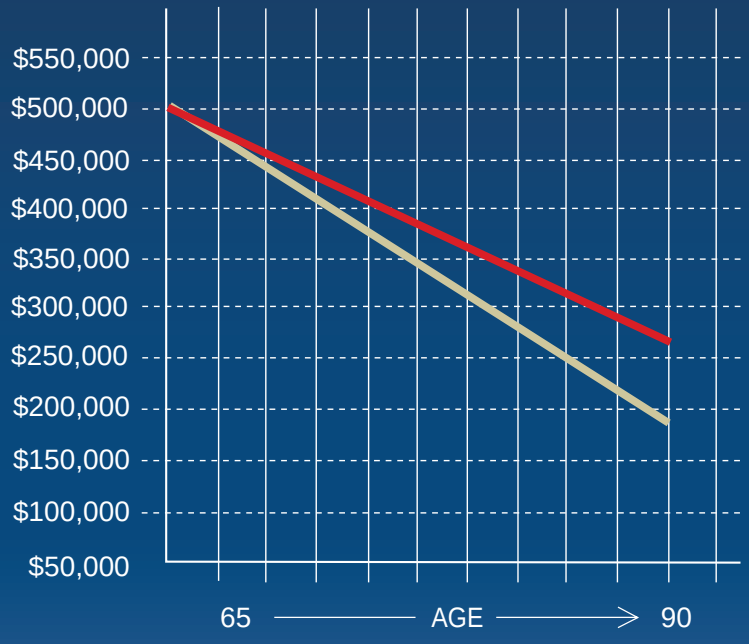

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100 YEARS OF ENGINEERING AND GEOSCIENCE IN BC

To help celebrate our 100th year, *Innovation* looks back at the history of our professions in BC.

A LOOK BACK IN PHOTOS

Our history is full of images that have helped document important moments. We take a photographic look back at 100 years of building, designing, exploring, creating, and protecting the public.

DIVERSITY: A STORY OF PROGRESS

Diverse professions perform better. But even as late as 1990, women comprised only a small fraction of registrants. The history of our professions is also a story of progress towards greater diversity.

THE FUTURE OF ENGINEERING AND GEOSCIENCE

As technology and society change and progress, what does the future hold for our professions?

THE DIGITAL EDITION OF *INNOVATION* INCLUDES VIDEO EXTRAS. TO ACCESS, SCAN THIS QR CODE FROM ANY MOBILE DEVICE, OR GO TO *EGBC.CA/INNOVATION*. IN THE DIGITAL EDITION, CLICK ON THE PLAY BUTTON TO VIEW CONTENT.

INNOVATION

THE CENTENNIAL COLLECTOR'S EDITION

January/February 2020 | VOLUME 24 NUMBER 1

NEWS / DEPARTMENTS

COMMENT

OTHER

100 YEARS

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

Lianna Mah,
P.Eng., FEC
President
president@egbc.ca

CELEBRATING 100 YEARS: HONOURING THE PAST AND LOOKING TO THE FUTURE

This year, Engineers and Geoscientists BC celebrates our centennial. As we commemorate our 100th anniversary, we can reflect on our rich history of safety and innovation. BC engineers and geoscientists have played an integral role in the province's growth and prosperity. We have designed infrastructure, aircraft, and submarines, created technologies, and discovered a wealth of resources. Our engineers and geoscientists have not only made an indelible impact at home, but also around the world, where our expertise is highly sought-after.

One hundred years ago, there were no women engineers in BC. Seventy years ago, two Chinese brothers who graduated from UBC with engineering degrees could not find employment in engineering because institutionalized discrimination meant no engineering company would hire them.

Today, it is my privilege to serve as president in our centennial year. I'm very thankful to Elsie MacGill, the first female engineering graduate in Canada, Bill and Jack Wong, the Chinese brothers who earned engineering degrees 70 years ago, and all the women and men who had the courage to pave the way forward for all of us. They established the foundation for our diverse and inclusive professions—professions that can be proud of how far we have progressed and what we have accomplished.

This year is also an opportunity to look forward to the future of engineering and geoscience. What can we do to shape a better world for all of us?

Consider our changing climate in everything you do. How will rising sea levels and increasing temperatures impact your project? How can you reduce greenhouse gas emissions? What can you do to improve the resilience of your projects?

Be a sponsor for equity, diversity, and inclusion. A diverse and inclusive workplace that includes people with a wide range of backgrounds, skills, and experience spurs creativity and results in better outcomes and stronger organizations.

Encourage the next generation of young women and men to consider careers in engineering and geoscience. Investing in our future is key to ensuring the sustainability of our professions.

Finally, our centennial year offers a fantastic opportunity to engage with the public and communicate how engineering and geoscience shape our province and communities. As this year progresses, keep connected to the events and initiatives Engineers and Geoscientists BC has planned at *egbc.ca/100*. Let's celebrate!

INNOVATION

January/February 2020 | VOLUME 24 NUMBER 1

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PROTECTING RESOURCES WITH INNOVATIVE DRAINAGE SOLUTIONS

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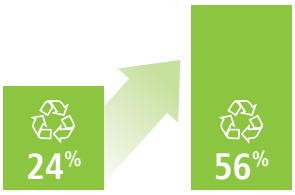

Increase in the percentage of
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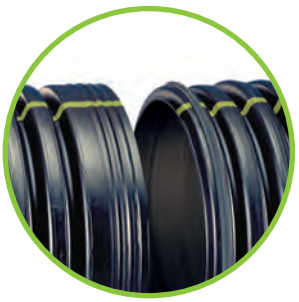
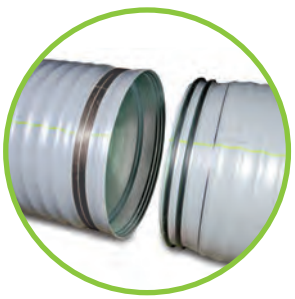

N-12® 100-1500 mm HDPE Pipe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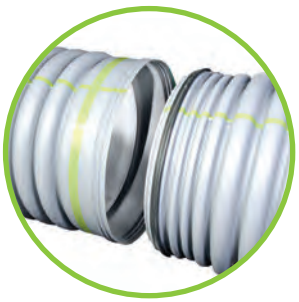
STORAGE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SERVICE ON COUNCIL A CHANCE TO GIVE BACK, DEVELOP SKILLS

Are you an experienced practitioner with a strong desire to protect the public and enhance public safety? If so, consider applying to serve on Engineers and Geoscientists BC's Council.

Engineers and Geoscientists BC Council governs the organization and the professions of engineering and geoscience in British Columbia. Council members act collectively to set the policy and strategic direction for Engineers and Geoscientists BC, and are accountable to the public through the Ministry of the Attorney General, under the Office of the Superintendent of Professional Governance.

Dr. John Clague, P.Geo., FGC, FEC (Hon.), both a former Councillor and president, was looking for a way to repay the profession that had benefitted him for many years. "I decided that I wanted to serve on Council because of a desire to "give back" to my profession and my geoscience colleagues. I have always held Engineers and Geoscientists BC in high regard, and felt that the best way to serve my profession on a volunteer basis was to serve on Council," he said.

Service as a Council member is an exceptional leadership opportunity. Engineers and Geoscientists BC is facing several significant changes in the upcoming year. Council will guide the organization forward under new legislation, and participate in the development of a transformative strategic plan that will shift Engineers and Geoscientists BC from the *Engineers and Geoscientists Act* to the *Professional Governance Act*. In addition, Council will continue to lead the organization forward on major initiatives, including the regulation of firms, mandatory continuing education, and diversity and inclusion.

For Caroline Andrewes, P.Eng., FEC, FGC (Hon.) also a former Councillor and president, it was challenges like these that pressed her skills into action on Council. "Governance, strategic planning, communications, risk management, and structured decision-making were all components of the skills I honed or gained through my service," she said. "I personally had the opportunity to participate in decisions impacting our professional practice, including our position on climate change, improved delineation of our designations, and taking steps on our reconciliation journey," she added.

Engineers and Geoscientists BC is committed to advancing diversity and inclusion in the governance of the professions, and is seeking a slate of candidates with diverse backgrounds, experience, and expertise.

The deadline to apply for this opportunity is 5:00 PM on March 9, 2020. If you are interested in being considered by the Nominating Committee, but are unable to submit your application before the deadline, please contact *nominations@egbc.ca*. The Nominating Committee reserves the right to extend the call for nominations.

For complete information on the application process, visit *egbc.ca/council-nominations*.

INNOVATION NOW ACCEPTING PROJECT HIGHLIGHTS SUMISSIONS

Each year, *Innovation* invites BC's professional engineers and geoscientists to submit photographs and project descriptions of recent work, for consideration for the magazine's popular Project Highlights Edition, planned for the May/June 2020 edition. To be eligible, projects must be currently underway, or have been completed on or after the end of June 2019.

Submissions are now being accepted. For more information, additional submission criteria, and the submission form, visit *egbc.ca/pictorial*.Submissions close March 3, 2020.

CELEBRATE OUTSTANDING ENGINEERING AND GEOSCIENCE TALENT

From designing seismic-resilient infrastructure, to understanding BC's unique geological profile, to creating innovative technology and teaching methods, professional engineers and geoscientists continuously work in the public interest.

Engineers and Geoscientists BC is asking registrants to help elevate and celebrate the work and contributions of your peers by submitting a nomination as part of the Engineers and Geoscientists BC awards program.

The President's Awards, BC's top awards for professional engineers and professional geoscientists, are presented in the following categories:

- R.A. McLachlan Memorial Award
- C.J. Westerman Memorial Award
- D.C. Lambert Professional Service Award
- Meritorious Achievement Award
- Community Service Award
- Teaching Award of Excellence
- Young Professional Award

Along with the President's Awards, the Mentor of the Year Award recognizes excellence among mentors in the engineering and geoscience community; the Sustainability and Environmental Awards recognize projects that highlight the important contribution the engineering and geoscience professions make to the well-being of human life and the ecosystems upon which we all depend.

The Forest Engineering Award of Excellence—sponsored jointly by Engineers and Geoscientists BC and the Association of BC Forest Professionals—recognizes excellence and promotes cooperation and leadership in forest engineering.

2020 AWARDS DEADLINES

President's Awards: Nominations accepted until Friday, April 3, 2020.

Sustainability and Environmental Awards: Nominations accepted until Friday, March 20, 2020.

Mentor of the Year Award: Nominations accepted until Friday, April 3, 2020.

Forest Engineering Award of Excellence: Nominations accepted February through October, 2020.

Nominations are now open, and the awards will be presented at our Annual Conference in October 2020. For detailed information about nomination procedures, award terms of reference, and eligibility, visit *egbc.ca/awards*. Questions about the association's awards program can be directed to Lizzie Matkovich, Communications Specialist, at *awards@egbc.ca* or 604.639.8178.

PHOTO: MIKE CRANE PHOTOGRAPHY

The 2019 President's Award Winners

Photo: © Lijuan Guo Photography / Fotolia

HAVE YOUR SAY ON OUR CLIMATE CHANGE ACTION PLAN

The Earth's climate is changing at an unprecedented rate, and this presents new and evolving opportunities and risks that will need to be considered by registrants in the fulfillment of their professional responsibilities.

Engineers and Geoscientists BC is developing a climate change action plan to ensure the association has an appropriate and methodological approach to addressing climate change issues related to the practice of professional engineering and geoscience.

This plan will provide a framework for how Engineers and Geoscientists BC can better support its registrants in their professional practice and allow the association to respond to climate change issues proactively rather than reactively.

For this action plan to be flexible, scalable, and responsive to the breadth of professional practice of registrants, Engineers and Geoscientists BC is planning an engagement process to gather feedback and input into the plan.

The engagement process will take place between February and June 2020. There will be several forums—such as written submissions, focus groups, and webinars—for registrants, industry professionals, and the wider BC community to participate.

Engineers and Geoscientists BC will be seeking feedback and input on the following four-pillar approach to addressing climate change:

- leadership;
- regulation;
- knowledge development; and
- knowledge application.

The insights and information gathered throughout this engagement process will be used to inform the development of a preliminary draft of the action plan, which will be submitted to Engineers and Geoscientists BC Council in November 2020.

To learn more about the association's climate change initiatives and opportunities for engagement, visit *egbc.ca/climate-change*.

SEEKING PRESENTERS FOR 2020 ANNUAL CONFERENCE

Engineers and Geoscientists BC is seeking presenters for its professional development sessions, including technical, business, managerial, and personal development, for its 2020 annual conference and Annual General Meeting. This year, the annual conference and AGM are scheduled for October 15–17, 2020, at the Victoria Conference Centre, in Victoria, BC.

For annual conference presentations, Engineers and Geoscientists BC looks for innovative topics and current case studies on industry trends and best practices that will engage and inform delegates on issues impacting the professions. The deadline for proposals is Friday, March 13, 2020.

With presentations that reflect the challenges, successes, and innovations around the professions of engineering and geoscience, the conference will bring together engineers, geoscientists, technologists, faculty, government representatives, industry leaders, students, and other members of the community for two full days of professional development and networking. An anticipated 800 delegates will attend the 2020 conference.

Professional development at the 2019 annual conference included sessions on better business, career development for young professionals, energy efficiency and renewable energy, engineering and geoscience in the resource sector, environmental engineering and geoscience, management, municipal engineering, structural engineering, regulatory affairs, and geoscience.

Presentations are 1 hour and 15 minutes in length. All presentations must include time for questions and answers. Presentations for the purpose of promoting or selling specific products, services, or providers will not be considered. Presentations should be educational and tailored to registrants of the association.

Submit your proposal through our online form by Friday, March 13, 2020.

The form, and proposal requirements, are available on at *egbc.ca/call-for-presenters*.

For more information, email *conference@egbc.ca*.

UPCOMING SERIES TO DEVELOP WOMEN LEADERS

Engineers and Geoscientists BC is hosting a Women in Leadership professional development series—a webinar and two workshops designed to develop skills for women leaders. The *Women in Leadership* webinar, scheduled for February 6, will focus on fundamental leadership concepts, and message development and delivery skills. The two full-day workshops (*Taking the Stage*, scheduled for April 16, and *Succeeding on Stage*, scheduled for April 17) will focus on enabling women leaders to project a powerful leadership presence that commands recognition and respect.

Together, the series will focus on key communication fundamentals that will help women leaders adopt, develop, and project a leader's mindset. The dynamics of corporate life, and unspoken realities and situations that can shape one's career, will also be discussed. This series has been warmly received by attendees across the province, and has been praised for providing useful and practical real-life tools and techniques.

Members are asked to register for each event separately. All events provide Continuing Professional Development hours.

- The *Women in Leadership* webinar is scheduled for February 6, 2020.
- The *Taking the Stage* workshop is scheduled for April 16, 2020, in Vancouver.
- The *Succeeding on Stage* workshop is scheduled for April 17, 2020, in Vancouver.

For more information about any of these events, or to register, visit *egbc.ca/events*.

Engineers and Geoscientists BC offers a wide range of Continuing Professional Development opportunities—in-person workshops, online webinars, and online learning—all of which include both technical, and business and leadership training. Online learning helps members achieve professional development goals at a flexible pace and timing.

To learn more about upcoming webinars or in-person workshops, visit *egbc.ca/events*. To access online learning, visit the online store, at *egbc.ca/online-learning*. To suggest future topics or speakers, email *pdevents@egbc.ca*.

BC ENGINEER AND GEOSCIENTIST APPOINTED TO ORDER OF CANADA

Engineers and Geoscientists BC is proud to congratulate two members who were appointed to the Order of Canada in December 2019: Dr. John Clague, P.Geo., FGC, FEC (Hon.), and Dr. Don Mavinic, P.Eng., FEC.

Dr. Clague was awarded at the Officer level, for national service or achievement, in recognition of his contributions to environmental earth sciences, and for his impact on the study of natural hazards. Dr. Clague is an internationally-recognized expert in the field of Quaternary geology and has demonstrated exemplary public communication of natural hazards over the course of his career. A past-president of Engineers and Geoscientists BC, Dr. Clague previously received the Engineers and Geoscientists BC C. J. Westerman Memorial Award (1999), and was awarded the Geoscientists Canada Canadian Professional Geoscientist Award in 2019—the highest honour for a Canadian geoscientist.

Dr. Mavinic was awarded at the Member level, for outstanding contributions at the local or regional level or in a special field of activity, for his contributions to environmental engineering science and technology in Canada, notably in the areas of liquid wastewater and residuals management. Dr. Mavinic was instrumental in the development of the Pearl Nutrient Recovery Process, which recovers nutrients from wastewater for use in environmentally friendly fertilizer, transforming a costly problem into a valuable product. For his accomplishment in this area, Dr. Mavinic received Engineers and Geoscientists BC's Meritorious Achievement Award in 2011, as well as awards from the Manning Foundation and Natural Sciences and Engineering Research Council of Canada.

The Order of Canada was created in 1967, and is one of our country's highest honours. Presented by the governor general, the Order of Canada celebrates Canadians whose service shapes our society, whose innovations ignite our imaginations, and whose compassion unites our communities.

Dr. John Clague, P.Geo., FGC, FEC (Hon.)


Dr. Don Mavinic, P.Eng., FEC

NOVEMBER 22, 2019

Engineers and Geoscientists BC's Council of elected members and government representatives meets throughout the year to conduct the business of association governance. The following are the highlights of the November 22, 2019 meeting.

PROFESSIONAL PRACTICE GUIDELINES FOR THE DEVELOPMENT OF SAFETY CRITICAL SOFTWARE APPROVED

Council approved a guideline to provide clarity on the obligations required of professional engineers who work on software engineering services that result in safety-critical software. Safety-critical software includes software products that could reasonably cause harm, injury, illness, or death, or cause damage to the environment.

This is Engineers and Geoscientists BC's first guideline in the high-tech sector. It was developed by senior software engineers, and reviewed by industry and academic practitioners from British Columbia and other jurisdictions, as well as Engineers and Geoscientists BC's newly-formed Software Engineering Committee. The guideline will be published following legal and editorial review.

AGM MOTION TO CONSIDER ADVOCACY BODY DEFERRED

At the 2019 AGM, the assembly passed a motion asking Council to consider reviewing the pros and cons of establishing a sister organization to Engineers and Geoscientists BC that would focus on advocacy, so that Engineers and Geoscientists BC can focus on regulatory responsibilities.

The *Professional Governance Act* includes restrictions on advocacy activities, but the details of which activities would be considered advocacy are still unknown. Engineers and Geoscientists BC anticipates learning more from the Office of the Superintendent of Professional Governance on this early in 2020. Council therefore voted to defer consideration of this motion until the Office has provided clarity on the advocacy activities that Engineers and Geoscientists BC may undertake.

TRANSITION PLAN FOR COUNCIL COMPOSITION

The new *Professional Governance Act* requires that Engineers and Geoscientists BC Council comprise twelve members, including four public representatives, and increases term lengths to three years. The current composition of Council is seventeen members, including four public representatives, with term lengths of two years.

Maintaining continuity is a fundamental and critical governance principle for a complex organization such as Engineers and Geoscientists BC. To ensure continuity on Council is maintained during the transition from our current legislation to new requirements in the *Professional Governance Act*, Council has established a transition plan that accounts for a balance of new and returning councillors.

In addition, beginning in 2021, the method for selecting the Vice President will change; Council will appoint one of its elected members to serve as Vice President each year. This will enable Council to select a Vice President who can best meet the needs of the Council in any given year, and will be an important part of maintaining continuity during our transition to the *Professional Governance Act*. This approach is considered governance best practice, and is well-established in similar organizations, including the College of Physicians and Surgeons of BC, College of Dental Surgeons of BC, BC College of Nursing Professions, Architectural Institute of British Columbia, Chartered Professional Accountants of BC and the College of Veterinarians of BC.

NEW MODEL FOR CONTINUING PROFESSIONAL DEVELOPMENT REVIEWED

Council approved 18 recommendations from the Continuing Professional Development (CPD) Committee's report on updates to the current model for CPD, and asked the committee to further examine reporting requirements and the implementation timeline.

The model has been developed over the past two years through research and engagement with other jurisdictions, and consultation with members on how the current model could be adjusted to better enable members to maintain competency in their area of practice. The approved recommendations will update the model through changes to the number of hours required, new areas and avenues of learning, and increased flexibility through exemptions for members on parental or medical leave.

Staff will continue to engage with the Superintendent of Professional Governance on the proposed model and requirements for continuing education under the *Professional Governance Act* to ensure that Engineers and Geoscientists BC's model is aligned with legislative requirements. It is anticipated that the new model will be finalized in the Fall of 2020.

More information on the review process is available at *egbc.ca/cpd-program*.

THREE GUIDELINES ISSUED ON WATERSHED ASSESSMENTS, RETAINING WALLS, AND OHSR-RELATED EQUIPMENT CERTIFICATIONS AND INSPECTIONS

Engineers and Geoscientists British Columbia has recently issued three professional practice guidelines: one guideline on watershed assessment and management of hydrologic and geomorphic risk in the forest sector; one guideline on retaining wall design; and one guideline related to annual Occupational Health and Safety Regulation (OHSR) of BC equipment certifications and inspections.

GUIDELINES FOR RETAINING WALL DESIGN

Professional practice guidelines titled *Retaining Wall Design*, published in November 2019, will help engineering professionals design retaining walls in a consistent manner. The guidelines outline project roles and responsibilities, provide advice about how to incorporate best practices (such as providing complete documentation), and describe appropriate quality management procedures. The guidelines focus on the geotechnical aspects of retaining walls but also include some regulatory and structural issues. The guidelines include an assurance statement to assist engineering professionals consider and address relevant regulatory and technical issues.

GUIDELINES FOR WATERSHED ASSESSMENT AND MANAGEMENT OF HYDROLOGIC AND GEOMORPHIC RISK IN THE FOREST SECTOR

Professional practice guidelines titled *Watershed Assessment and Management of Hydrologic and Geomorphic Risk in the Forest Sector,* were developed jointly by Engineers and Geoscientists BC and the Association of BC Forest Professionals and were published in January 2020. The new guidelines are expected to help engineering, geoscience, and forest professionals, along with other specialists, understand their respective roles and obligations when assessing watersheds and managing their associated hydrologic and geomorphic risks. The guidelines provide a framework for risk assessment and management, along with examples that apply this framework. They describe the principles that shape the definition of a watershed assessment scope, along with the typical components of such assessments. These guidelines also provide assurance statements for professionals making submissions related to practice in this area.

GUIDELINES FOR CERTIFICATION OF ANNUAL EQUIPMENT INSPECTIONS IN BC

Engineers and Geoscientists BC has also issued *Certification of Annual Equipment Inspections in British Columbia* in conjunction with WorkSafeBC. The guidelines, published in January 2020, will help clarify the requirements of the inspection and certification of equipment listed in the OHSR of BC that requires annual certification by an engineering professional. The guidelines also cover other equipment for which inspection and certification has been requested.

The guidelines outline professional roles and responsibilities, provide advice about best practices for the equipment inspection and certification process, and highlight appropriate quality management procedures. The guidelines also provide sample documents and offer case studies to help professionals identify how to meet their obligations for a variety of inspection scenarios.

All three guidelines were written for Engineers and Geoscientists BC professionals, statutory decision-makers, regulators, the public, and other stakeholders who might be involved in, or have an interest in, the topics addressed in the guidelines. The guidelines provide a common level of expectation regarding effort, due diligence, and standards of practice.

These guidelines, and other professional practice guidelines and practice-related resources, are provided at *egbc.ca/Professional-Practice*.

TRAINING OPPORTUNITIES FOR PROFESSIONAL PRACTICE GUIDELINES

Engineers and Geoscientists BC is hosting two training opportunities on guidelines, and a professional practice webinar on changes to the BC Building Code. A seminar and webinar on the guideline titled *Legislated Flood Assessments in a Changing Climate in BC* (published in August 2018) will be held on February 20, 2020. And, a webinar on the *Retaining Wall Design* guideline will be held on March 13, 2020.

Engineers and Geoscientists BC will also host a webinar, titled *What's New? Changes to the BC Building Code 2018*, on March 2, 2020, hosted by Jun'ichi Jensen and Don Pedde of the Government of British Columbia's Building and Safety Standards Branch.

For more information or to register for any of these training opportunities, visit *egbc.ca/events*.

PARK INSURANCE

www.park.ca/egbc

CONGRATULATIONS

ENGINEERS AND GEOSCIENTISTS BC

ON YOUR

100TH

ANNIVERSARY!

Thank you for protecting our communities!

ONE HUNDRED YEARS OF ENGINEERING AND GEOSCIENCE IN BC

THE HISTORY OF ENGINEERING AND GEOSCIENCE IN BRITISH COLUMBIA, STRETCHING BACK MORE THAN 100 YEARS, HAS HELPED FORM THE FOUNDATION OF OUR PROVINCE.

ROBIN J. MILLER

An aerial view of the under-construction Granville Street Bridge, circa 1953. Vancouver Public Library Special Collections, 67864. Photo: Province Newspaper, William Cunningham.

1885

CANADIAN PACIFIC RAILWAY LINKS EAST AND WEST

In 1871, the Government of Canada promised the Government of British Columbia that it would build a transcontinental railway connecting BC to the system already linking Ontario, Québec, New Brunswick, and Nova Scotia within 10 years. That commitment was not quite met—the railway took 14 years from BC's joining federation to complete—but it was enough to make us Canadian. It was also enough to push early engineers to new heights.

Working in difficult and dangerous conditions, they toiled alongside thousands of labourers, including as many as 17,000 Chinese workers (paid $1.00 a day), to build a transportation link that proved vital to the success of our young, far-flung country. By establishing its western headquarters in Vancouver, the Canadian Pacific Railway also ensured a new and steady market for resident civil and mechanical engineers.

One of the many great engineering feats of the Canadian Pacific Railway: the Scow Wash Bridge, 1885. City of Vancouver Archives, CAN N131

Civil engineering students take part in the Great Trek of 1922—a protest provoked by overcrowded and inadequate facilities that helped push forward the creation of UBC's Point Grey campus. University of British Columbia Archives [UBC 88.1/4-2]

1916

UBC'S FACULTY OF APPLIED SCIENCE BEGINS ITS 56-YEAR REIGN AS BC'S ONLY ENGINEERING SCHOOL

In 1906, McGill University College of British Columbia began offering first- and second-year university courses in two faculties: arts and applied science. The Faculty of Applied Science included BC's first courses in civil and mechanical engineering, surveying, and mining. However, aspiring engineers were required to travel to McGill's home campus in Montréal to complete their studies, and received a McGill degree. On September 30, 1915, a new independent university—the University of British Columbia—absorbed McGill University College, and opened with 379 students and 34 full- and part-time faculty members. Adding agriculture to arts and applied science, UBC began awarding its own degrees in 1916. At that time, engineering programs included chemical, civil, mechanical, and mining and metallurgy engineering. Students were expected to complete mandatory military training until the First World War ended in 1918. Nearly 700 UBC students would see active military service; 78 would be killed in action.

Charles Alfred Holstead "Chas" Wright (Chemical Engineering) was UBC's first graduate of applied science in 1916. The Faculty of Applied Science remained British Columbia's only engineering school until 1971.

1920

BC PASSES THE FIRST *ENGINEERING PROFESSION ACT*

Engineers gather in Montréal in 1919 to formulate a model bill that would form the basis for provincial legislation across the country.

In 1907, after four years of construction, the south arm and part of the central section of the first Québec Bridge collapsed into the St. Lawrence River, killing 75 workers and triggering a royal commission.

The second Québec Bridge, also designed as a single long cantilever span to run between Québec City and Lévis, Québec, collapsed in 1916, killing 13 more. This time, the collapse sparked a cross-Canada movement to regulate the engineering profession that resulted, on April 5, 1919, in a group of engineers gathering in Montréal to draw up a model bill. This bill became the basis for all provincial acts, including BC's *Engineering Profession Act* of 1920.

The new act both required BC employers to hire only registered professional engineers to oversee complex engineering projects and created the Association of Professional Engineers of the Province of British Columbia, responsible for regulating and licensing engineers in BC. Seventy years later, the association expanded to include geoscience and was later renamed the Association of Professional Engineers and Geoscientists of the Province of British Columbia.

1946

MAGNITUDE 7.3 EARTHQUAKE STRIKES VANCOUVER ISLAND

Damage at Courtenay Elementary after an earthquake in 1946. The hole in the roof in the photo on the left was caused by a chimney collapsing. Geological Survey of Canada, Natural Resources Canada (www.earthquakescanada.nrcan.gc.ca/historic-historique/events/19460623-photo-en.php)

On the morning of June 23, 1946, a magnitude 7.3 earthquake struck Vancouver Island with such force that, within seconds, it broke a seismograph in Victoria, located at what was then the only earthquake monitoring station in British Columbia. It also caused one death and considerable damage to buildings, including an elementary school in Courtenay. Luckily, it hit on a Sunday and no children were inside.

After an even more significant earthquake hit along the Queen Charlotte Islands (now Haida Gwaii) in 1949, the Canadian government began to pump significant funds into geoscientific research on the West Coast and, in 1951, transferred eminent seismologist W.G. Milne from Ottawa to Victoria's Dominion Astrophysical Observatory. Milne set up state-of-the-art seismographs in Alberni and Horseshoe Bay to form a triangle with the (now replaced) seismograph at the observatory and monitor local earthquake activity.

Milne's research over the next 10 years led to the development of the country's first modern seismic zoning map, and to the inclusion of seismic requirements in the National Building Code of Canada.

1940s TO 1970s

MAJOR CIVIL ENGINEERING PROJECTS TAKE OFF, WITH HELP FROM BC'S FIRST ENGINEERING GEOLOGIST

Victor Dolmage became the first engineering geologist in British Columbia when he was sent west to head the BC Division of the Geological Survey of Canada in 1922, responsible for mapping the geology of vast stretches of this province.

In 1929, Dolmage opened his own consulting geologist practice in Vancouver. It was the beginning of the depression, however, and work was scarce: he earned only $35 in fees that first year. For the next 10 years, Dolmage taught structural geology and economic geology part-time at UBC until finally, in the 1940s, the market for his particular skills opened up dramatically.

Over the next 30 years, Dolmage's broad knowledge of the soils and rock formations of British Columbia contributed to the success of countless major civil engineering projects, including:

- the power tunnel and underground powerhouse of the Kemano generating station, completed in 1954 to provide hydroelectricity for Alcan's Kitimat aluminum smelter. The project not only required the construction of the largest rockfill dam in the world at the time, it also needed a 16-kilometre-long water intake tunnel running right through the Coast Mountain range;
- one of the world's largest non-nuclear explosions on April 5, 1958, demolishing the underwater mountain known as Ripple Rock, which once sat just 2.7 metres below the surface in Seymour Narrows, the critical navigation channel between the mainland and Vancouver Island. Ripple Rock claimed at least a hundred vessels and 110 lives. The explosion is a designated Event of National Historic Significance in Canada, and was broadcast live on CBC Television;
- BC Hydro's W.A.C. Bennett Dam, completed in 1968 at a cost of $750 million. Topping out at 183 metres high, the Bennett is the largest dam in British Columbia, and one of highest earth-filled dams anywhere in the world. Dolmage also consulted on damsites for BC Hydro's Wahleach, Daisy Lake, Terzaghi, Mica Creek, and Revelstoke power projects.

The Grand Forks Sun and Kettle Valley Orchardist

GRAND FORKS, B. C., FRIDAY, JUNE 22, 1923

PREMIER OLIVER MAKES PLEA FOR EQUAL RATES

SURVEY OF COPPER MOUNTAIN

Dr. Dolmage and Assistants Will Make a Geological Survey of the Granby's New Property

With the purpose of spending a season at Copper mountain, near Princeton, Dr. Victor Dolmage, head of the British Columbia office of the geological survey of Canada, has arrived at that place He will make a complete examination and report on the geology of the large body of ore which is to be worked by the Granby Consolidated Mining, Smelting & Power company.

Dr. Charles Camsell, now deputy minister of mines for Canada, made a brief preliminary report on the geology of Copper mountain some years ago and Dr. Cairnes, of the survey, did some reconnaisance work there last year, but as yet the department of mines has no exact information on the country in which the Copper mountain ore lies It is to supply this want that Dr. Dolmage will devote his efforts this summer.

He will work within an area of 25 square miles. Expensive development work carried on at Copper mountain by the Canada Copper corporation, which proved up a large body of copper ore, will make the geologist's investigations considerably easier. His will be the only detailed examination made by any member of the survey in British Columbia this year.

With him will be George F. Barnwell, a graduate of the University of British Columbia and now professor of mineralogy in the Missouri School of Mines; William Smithingale, a third year student of the U.B.C., and J. Buckle, of Saanichtown, V. I., formerly a student at the university in Vancouver, who has been attending McGill university.

The front page of the June 22, 1923, edition of the Grand Forks Sun and Kettle Valley Orchardist announces that Victor Dolmage will spend "a season" surveying Copper Mountain, near Princeton. UBC Archives

1961

THE 4,000TH BC PROFESSIONAL ENGINEER REGISTERS WITH THE ASSOCIATION

When the Association of Professional Engineers of the Province of British Columbia was created in 1920, between 500 and 600 members—all men and mostly civil engineers—signed up. It grew quickly over the next decade, reaching nearly 850 members by 1930. But growth slowed abruptly with the Great Depression. Engineers struggled for work, and the association started a Christmas fund to provide loans to members in financial distress.

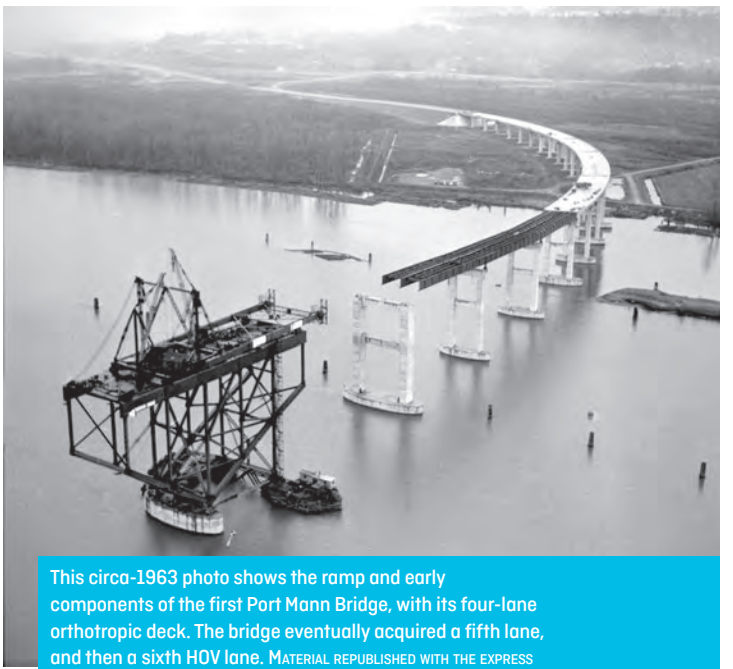
By 1945, however, with both the Depression and World War II over, things began to look up: post-war prosperity led to new bridges, roads, dams, pipelines, ferries, and more across the province, and good, steady work for professional engineers throughout BC. In 1961, the 4,000th professional engineer registered with the association.

General construction of the Granville Street Bridge in 1953, which would open the following year. This photo was taken from the now-demolished Continental Hotel. City of Vancouver Archives, CVA 800-0660. Photo: Alan J. Ingram

1960s

MORE DRIVERS, MORE DEMAND FOR NEW ROADS AND BRIDGES THROUGHOUT THE LOWER MAINLAND

Vancouver grew quickly after the Second World War. By the mid-1960s, its population approached one million and the downtown core began to bulge at the seams. With increasing car ownership, people and businesses started to look for new spaces to live and work, and



This circa-1963 photo shows the ramp and early components of the first Port Mann Bridge, with its four-lane orthotropic deck. The bridge eventually acquired a fifth lane, and then a sixth HOV lane. Material republished with the express permission of: Vancouver Province, a division of Postmedia Network Inc.

drivers soon began to demand fast, direct roads and bridges that would link both to the up-and-coming suburbs, and to the newly constructed Trans-Canada Highway.

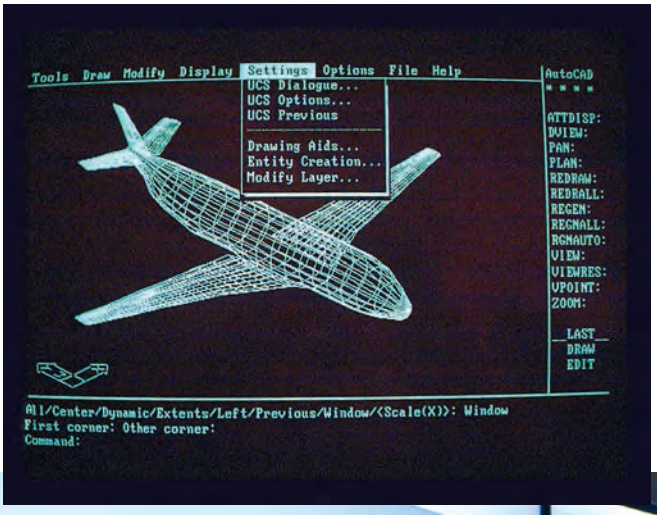
BC engineers were instrumental in opening out the Lower Mainland's two-lane urban road system, built in the 1940s and 1950s, to four and six lanes, and in designing and building brand-new routes throughout the 1960s.

Many of these new routes also required new bridges, such as the original Port Mann Bridge, which was the longest arch bridge in Canada and the third-largest in the world when it was completed in 1964. It was replaced by a new, 10-lane version in 2012.

1980s

NEW ENGINEERING DISCIPLINES CAUSE AN EXPLOSION OF SCIENTIFIC AND TECHNOLOGICAL ADVANCES

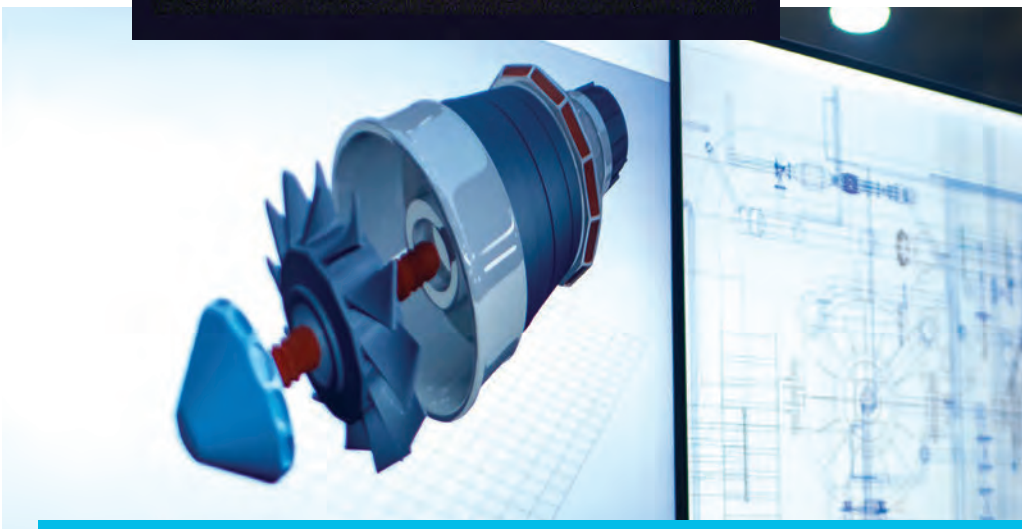
From the late 1960s through the 1970s, traditional ideas about what engineering is or should be began to expand and new engineering disciplines—like aerospace, computing, software, and biomedical engineering—began to arrive on campuses around the world, resulting in an explosion of advances in science and technology in the 1980s.



These advances included the IBM personal computer in 1981, followed in 1982 by Autodesk's AutoCAD software, the first computer-aided design software intended for personal computers instead of mainframes. CAD had been used in auto and aerospace manufacturing since the late '60s, but the advent of fast processors now made CAD more accessible and affordable to many other industries.

The '80s also saw the advent of the Apple Macintosh and additive manufacturing (yes, 3-D printing dates from the 1980s!), as well as video game design and cable TV.

Biomedical engineering, too, was on a roll: 1980s inventions included magnetic resonance imaging (MRI), laser surgery, the pulse oximeter, vascular stents, and the digital hearing aid. Here in BC, Dr. Carolyn Small was the first person to register with the association as a biomedical engineer in 1980. She worked at Vancouver General Hospital in medical technology management before returning to Ontario in 1987, where she was the first female engineering graduate to be appointed to the faculty at Queen's University. Under her leadership, Queen's Human Mobility Research Centre became renowned for its interdisciplinary research into innovative treatment strategies for bone and joint disorders.



The personal computer, first made available by IBM in 1981, brought significant computer processing power to the desktop. It also made CAD affordable and available to a substantial number of engineers and their firms. AutoCAD screenshot circa 1982/1983: Autodesk. Photo: Gorodenkoff/Shutterstock.com

The Phoenix Mine comprised an open pit (shown here in 1967) and underground workings, located in the now-defunct town of Phoenix. Photo: Greenwood Museum, Greenwood, BC

1990

GEOSCIENCE BECOMES A REGULATED PROFESSION

Sir James Hector, a Scottish geologist, naturalist, and surgeon, became the first to observe and map British Columbia's geological features when he participated in the Palliser Expedition of 1857 to 1860. He was also the one responsible for a name that has puzzled many travelling through the Canadian Rockies. The expedition was traversing a high mountain pass in 1858 when Hector was kicked in the chest and knocked unconscious by one of his own packhorses. Thinking him dead, his companions dug a grave and were preparing to put him in when he, fortunately, woke up. And Kicking Horse Pass got its name.

Many other trail-blazing geoscientists followed over the next hundred years to explore and record our landscapes, evaluate and develop our natural resources, collect geophysical data, and analyze seismic activity. Eventually, however, people both within and outside the profession became concerned about overlapping engineering/geoscience practises and the absence of oversight for mining resource evaluations.

In 1990, after 10 years of working with government to develop new legislation, as well as internally to create new credential examination and registration procedures, geoscience became a regulated profession in BC—and the association expanded to become The Association of Professional Engineers and Geoscientists of the Province of British Columbia.

2015 AND BEYOND

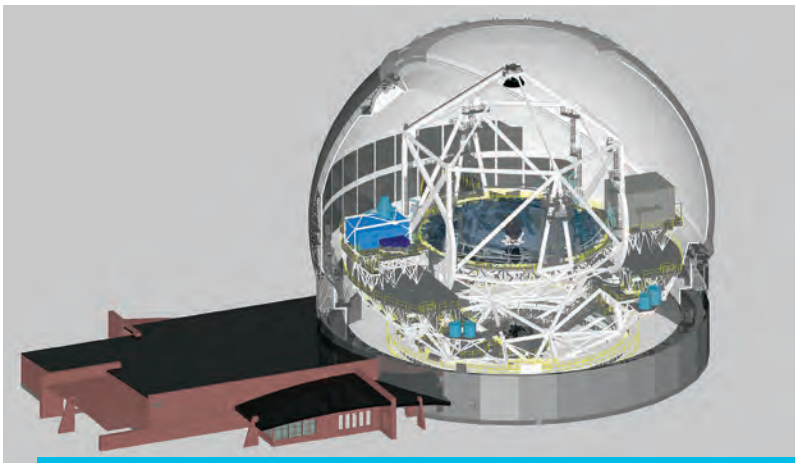
BC ENGINEERS TAKE THE LEAD IN TELESCOPE TECHNOLOGY

Over the past three decades, engineers and geoscientists have played a central role in major projects across the province, including (to name just a few) massive seismic retrofits, economically significant mineral exploration developments, and Vancouver's Expo 86, attended by over 22 million people from around the

world, which also spurred construction of the city's SkyTrain rapid transit system and BC Place Stadium.

Over the same period, BC engineers from many disciplines and fields—optical, structural, and mechanical, electrical, software—have also been working to keep Canada at the forefront of large telescope design and development.

Most recently, a small contingent of BC engineers has been working on designing the enclosure for the Thirty Meter Telescope (TMT), a five-country project that will allow astronomers and astrophysicists to see deeper into space and observe cosmic objects, like pulsars and back holes, with extraordinary sensitivity. Another group is developing an adaptive optics system that will eliminate the blurriness that occurs when starlight hits a telescope's mirror, allowing the TMT to create images of the cosmos that are 10 times clearer than those created by previous devices, including the Hubble Space Telescope.



The planned Thirty Meter Telescope will be one of the largest telescopes in history, with a resolution 12 times that of Hubble. BC engineers are developing the telescope's enclosure, and the adaptive optics system that will compensate for atmospheric turbulence. PHOTO: TMT INTERNATIONAL OBSERVATORY

Still more engineers are exploring in a whole other direction, developing new technologies for radio telescopes—such as the one at the National Research Council's Dominion Radio Astrophysical Observatory near Penticton—that will detect radio waves from hydrogen clouds billions of light-years away. With that information, scientists will come ever closer to understanding the history of the universe. ♦

A LOOK BACK IN PHOTOS

1924 CITY OF VANCOUVER ENGINEERING STAFF

Engineering staff (surveyors, drafters, and sewer systems engineers) in the south wing of the City of Vancouver's Main Street office. City staff would move to an East Hastings building five years later, and then to its current location on 12th Avenue in 1936. City of Vancouver Archives, CVA 216-6

1928 BRITANNIA MINE AND TOWNSITE

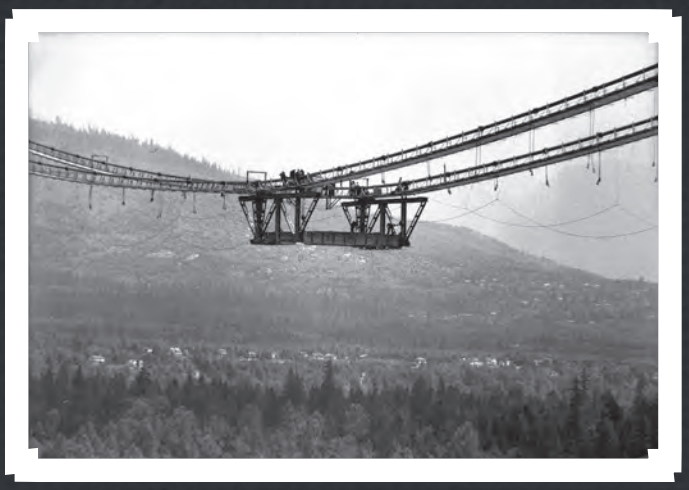
The Britannia deposit was discovered in 1888, leading to a 70-year-long mining operation involving 60,000 workers, 9 mining camps, and 50 million tons of copper, zinc, lead, cadmium, silver, and gold. Vancouver Public Library Special Collections, 10108B. Photo: Frank Leonard

1931 CANADIAN PACIFIC RAILWAY UNDER CONSTRUCTION

The Canadian Pacific Railway provided a physical link across Canada, and played a played a major role in BC's economic development, migration, immigration, and tourism. Its design and construction is believed to be one of Canada's greatest engineering accomplishments. This photo, taken in 1931, shows the construction of a tunnel as part of the railway's ongoing development. Vancouver Public Library Special Collections, 12416. Photo: Frank Leonard

CIRCA 1938 FIRST NARROWS BRIDGE CONSTRUCTION

Officially known as the First Narrows Bridge, the Lions Gate Bridge was first approved for construction in 1933, and opened in 1938. At the time, it was hoped that bridge construction would help alleviate the effects of the Great Depression by providing work to thousands of labourers. Vancouver Public Library Special Collections, 39753. Photo: Province Newspaper



1951 PRINCESS ELIZABETH AND PRINCE PHILIP GREET A BC ENGINEER

With the King of England's health declining, then-Princess Elizabeth, the King's daughter and heir to the throne, and her husband, stood in for the King on a 1951 tour of Canada. Here, she greets engineer John Oliver, P.Eng., in council chambers of the City of Vancouver. Elizabeth would become Queen about four months later. Vancouver Public Library Special Collections, 69729B. Photo: Chuck Jones, Province Newspaper

100 YEARS OF GROWTH

From 500 engineers to 37,000 engineers and geoscientists, our 100-year history is punctuated with growth and change—but always rooted in supporting the professions and serving the public.

1919

Two collapses of the Quebec Bridge—one in 1907 and another in 1916—triggered engineers from across Canada to begin a movement to regulate the engineering profession. In 1919, a group of engineers gathered in Montreal to draw up the first "model registration bill"—upon which all provincial acts were later based.

1920

The first *Engineering Profession Act* was brought into law in BC, leading to the formation of the Association of Professional Engineers of the Province of British Columbia (APEBC). Initial membership was between 500 and 600 men. Horace L. Robertson (certificate shown) was the third member and the Secretary-Treasurer.

1930

Association membership rises to about 850.

1933

The association creates a Christmas Fund (now known as The Benevolent Fund), that provides loans to members in financial distress, to offset the effects of the Great Depression.

1942–1945

The association lends its assistance to the war effort through the Wartime Bureau of Technical Personnel, to help address the critical shortage of engineering expertise. Many engineers are conscripted to serve in the war.

1950

Membership in the association reaches 3,000.

1951

The association journal, *BC Professional Engineer*, as it was in May 1951.

1955

After multiple minor amendments throughout the 1920s (primarily to strengthen *Act* enforcement and ensure uniform qualifications), 1940s, and 1950s, an entirely new *Engineering Profession Act* is introduced and passed as legislation.

1959

Marianne Ingeborg Claus becomes the first woman to be registered as a professional engineer. (She enrolled with the association as an EIT in 1954.)

1961

The 4000th BC professional engineer is registered to the association.

1975

Membership in the association reaches 12,230.

1980s

New engineering disciplines, such as aerospace engineering, software engineering, and biomedical engineering begin to take hold. The association begins pursuing professional licensure for geoscientists amid concerns about practice overlap and resource evaluations.

1990

The Division for the Advancement of Women in Engineering and Geoscience is created.

Geoscience officially becomes a regulated profession, and the association is renamed the Association of Professional Engineers and Geoscientists of BC. The name of the *Act* would be updated in 1996 to reflect this change.

1992

Kathleen Gissing becomes the first woman to serve as president. At the time, only 2.2 percent of members were women.

1997

The association journal, *BC Professional Engineer*, changes its name to *Innovation*.

2002

Membership in the association rises to 21,756.

2004

Engineers and Geoscientists BC, UBC, and government partner to implement Seismic Retrofit Guidelines for BC schools, leading to the upgrade of 168 schools in active seismic zones across the province. The guidelines have been expanded to other critical infrastructure across the province and internationally.

2013

The 30 by 30 initiative—a goal to raise the percentage of newly licensed female engineers to 30 percent by the year 2030—is developed by Engineers Canada and endorsed by Engineers and Geoscientists BC.

2015

Membership in the association reaches 29,839.

TODAY

Engineers and Geoscientists BC has more than 37,000 engineering and geoscience members (15 percent of which are women), working in over 40 disciplines. We are a modern and progressive regulator focused on ethics, excellence, and progress. But no matter how much our world has changed, our primary purpose remains the same: to protect the public.

1953 GRANVILLE STREET BRIDGE UNDER CONSTRUCTION

The 1953 version of the Granville Street Bridge (an eight-lane structure) was actually the third Granville Street Bridge. The first (a trestle design) was built in 1889, and the second in 1909. City of Vancouver Archives, CVA 228-332. Photo: Lew Parry Film Productions.

CIRCA 1957 KELOWNA FLOATING BRIDGE UNDER CONSTRUCTION

The Kelowna Floating Bridge (formally known as the Okanagan Lake Bridge) was a three-lane, 650-metre pontoon bridge with a vertical lift, that crossed Okanagan Lake. Operational in 1958, the bridge was the first of its kind in Canada. It was replaced by William R. Bennett Bridge—also a pontoon bridge—in 2008, and then dismantled. Vancouver Public Library Special Collections, 41380. Photo: William Cunningham, Province Newspaper

APRIL 5, 1958 RIPPLE ROCK MEETS ITS DEMISE

After it has claimed more than 20 large vessels, about 100 smaller vessels, and at least 114 lives, officials decided that Ripple Rock—an underwater, two-peak mountain in Seymour Narrows near Campbell River, BC—had to go. Two plans (one in 1943 and another in 1945) involving an on-surface barge and drillholes into the top of the rock both failed, due to excessive water turbulence. A third plan involved drilling from a nearby island, under the narrows, and up into the rock. A total of 1,270 tonnes of explosives were used. The blast was broadcast on live television. Images 20463-5 and 19984-3 courtesy of the Museum at Campbell River

1982 SKYTRAIN CONSTRUCTION

A rapid transit system in Vancouver was first considered as early as the 1950s. Skytrain—initially comprising one line with 16 stations—was finally built and placed into service in December 1985. The system would later grow to 53 stations over 3 lines. The system is commanded using vehicle-controlled computers communicating to computers on each train, through leaky coax cable laid along the tracks. City of Vancouver Archives, CVA 800-3052. Photo: Alan J. Ingram

Continues on page 49...


Manulife would like to *congratulate* Engineers and Geoscientists BC on their 100th anniversary!

Just the *facts*

about Engineers Canada-sponsored insurance plans

Manulife has been proud to provide Engineers and Geoscientists BC members with innovative insurance solutions for more than 70 of your 100 years.

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- Disability Income
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ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

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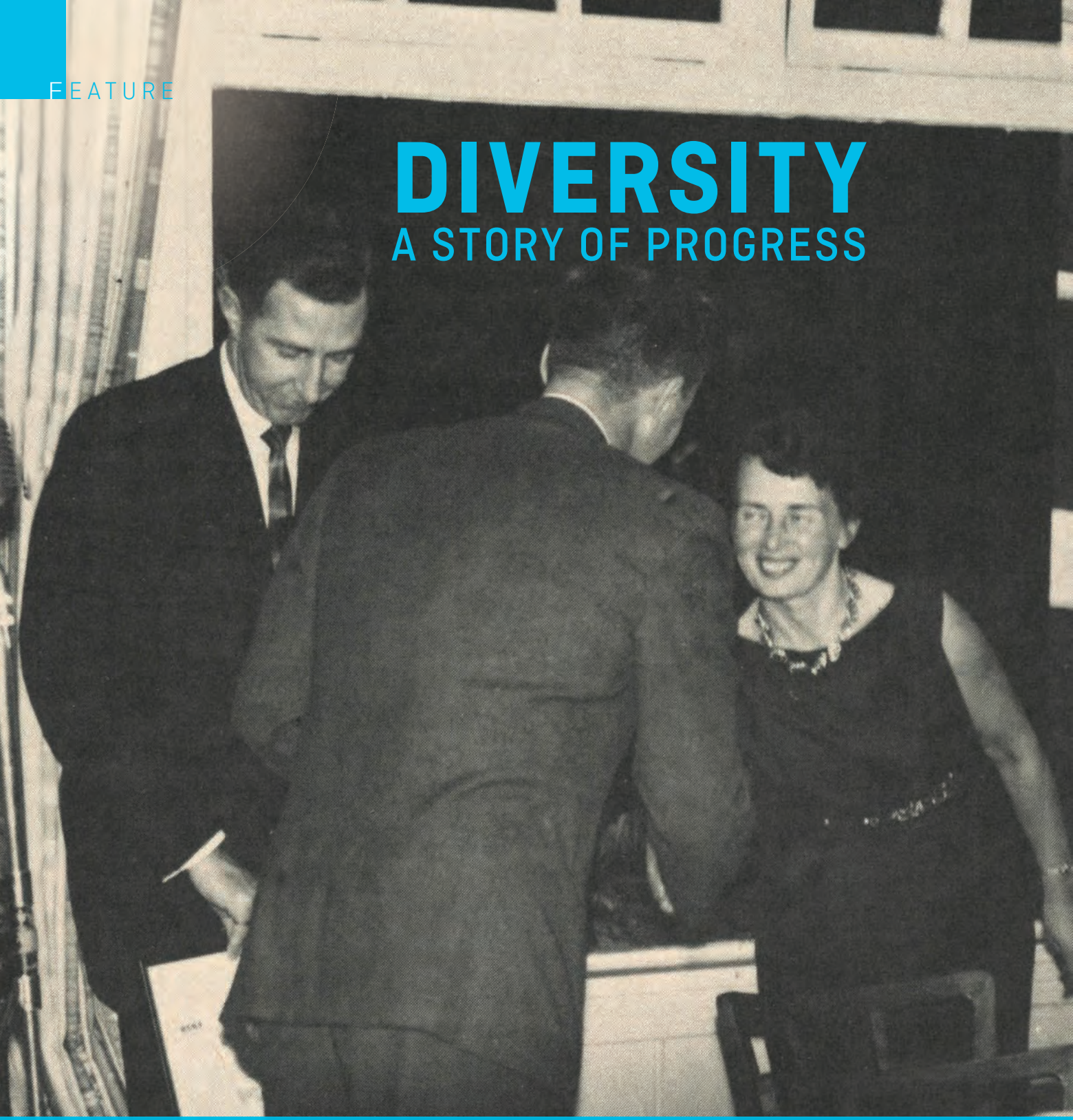
DIVERSITY
A STORY OF PROGRESS



The engineering profession in BC comprised only men—until 1959, when Marianne Ingeborg Claus, P.Eng., became the first woman professional engineer. (She enrolled with the association as an EIT in 1954.) Here, she receives her association registration at a branch event in Vancouver on September 8, 1959. The milestone moment was announced in the September edition of the association's journal, *The BC Professional Engineer*.

Over the last 10 years, the advantages of diversity in applied science professions and workplaces have become increasingly obvious. Multiple studies have confirmed that diverse workplaces almost always outperform their competitors; one 2012 study even concluded that, for companies whose senior leadership comprised diverse genders and national origins, return on equity averaged 53 percent higher than less-diverse leadership compositions.

But in the early days of engineering regulation, the profession was notably non-diverse. In BC, women first began entering undergraduate engineering programs in the late 1940s, but they were often met with discrimination and told that course work would be too challenging, or that industry was not ready to hire women in engineering roles.

It wasn't until 1959 that the first woman would be registered as a professional engineer in BC. By the 1970s, women comprised half of UBC undergraduate students, but only 5 percent of applied science undergraduate students. Women in engineering would remain a rarity for many years. Progress would remain slow within an undergraduate culture often mired in controversy for its sexist practices, including an annual re-enactment of the historical ride of Lady Godiva that drew vocal and diverse protests from students, the UBC Senate, and the public.

Events like this served as a microcosm of the attitudes towards women in engineering and women's rights more generally, but the tide began to shift in the late 1970s, and principles of diversity began to surface. Expansive human rights legislation—which, among other things, prohibited workplace discrimination—was passed in 1979. The refreshed laws, and broadening cultural environment, opened up engineering careers to those that had previously been excluded.

In 1990, just 2.2 percent of the association's members were women. The association committed to helping more women pursue careers as professional engineers. It created a committee to gather information on the issues facing women in engineering, which resulted in the Division for the Advancement of Women in Engineering and Geoscience. In 1992, Kathleen Kompauer. P.Eng., (nee Gissing) became the first woman to serve as president of the association.

The percentage of women registered with the association continued to rise, and had reached 11 percent by 2013.

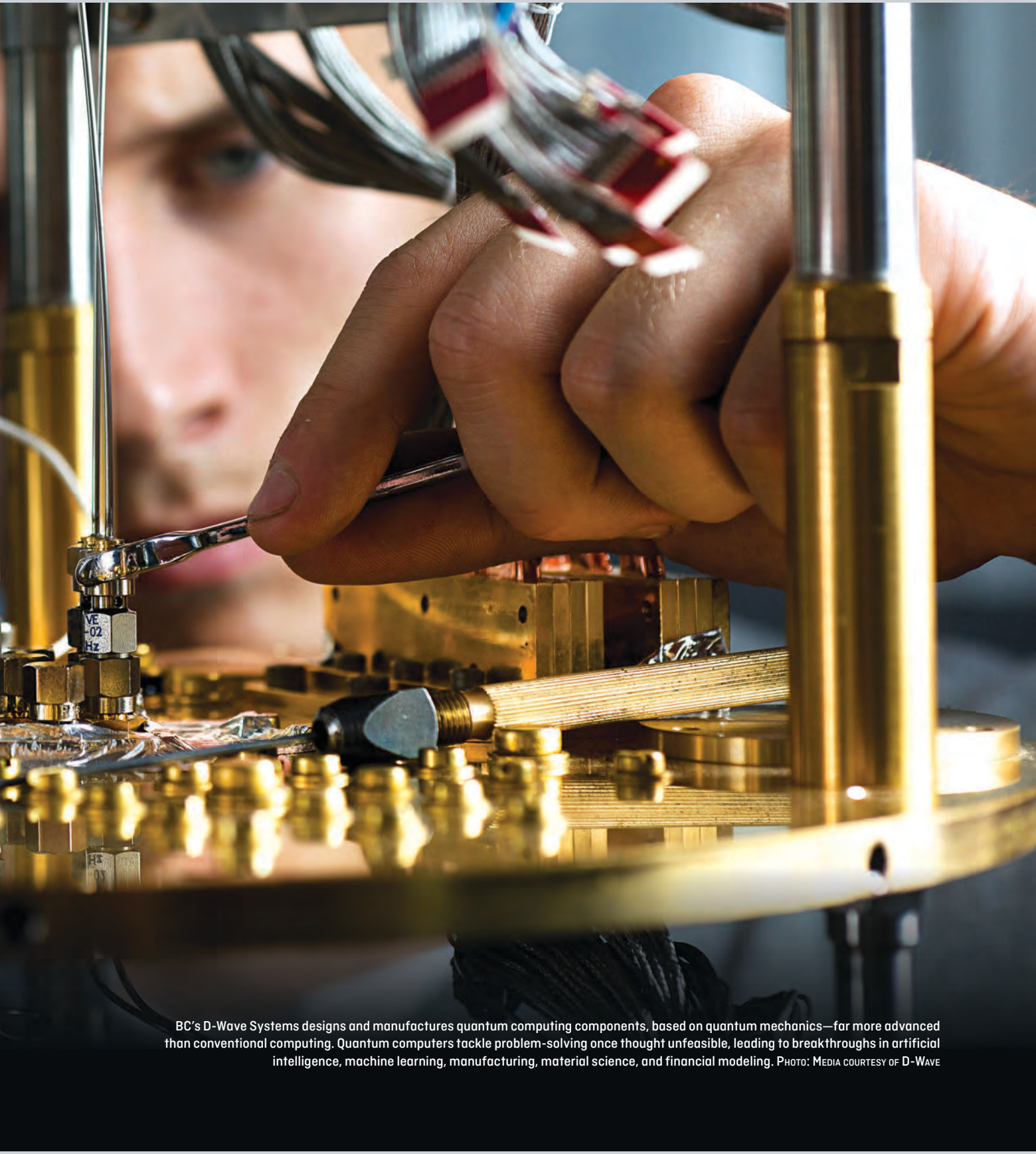
CONTINUES ON PAGE 46...

BUILDING FOR TOMORROW

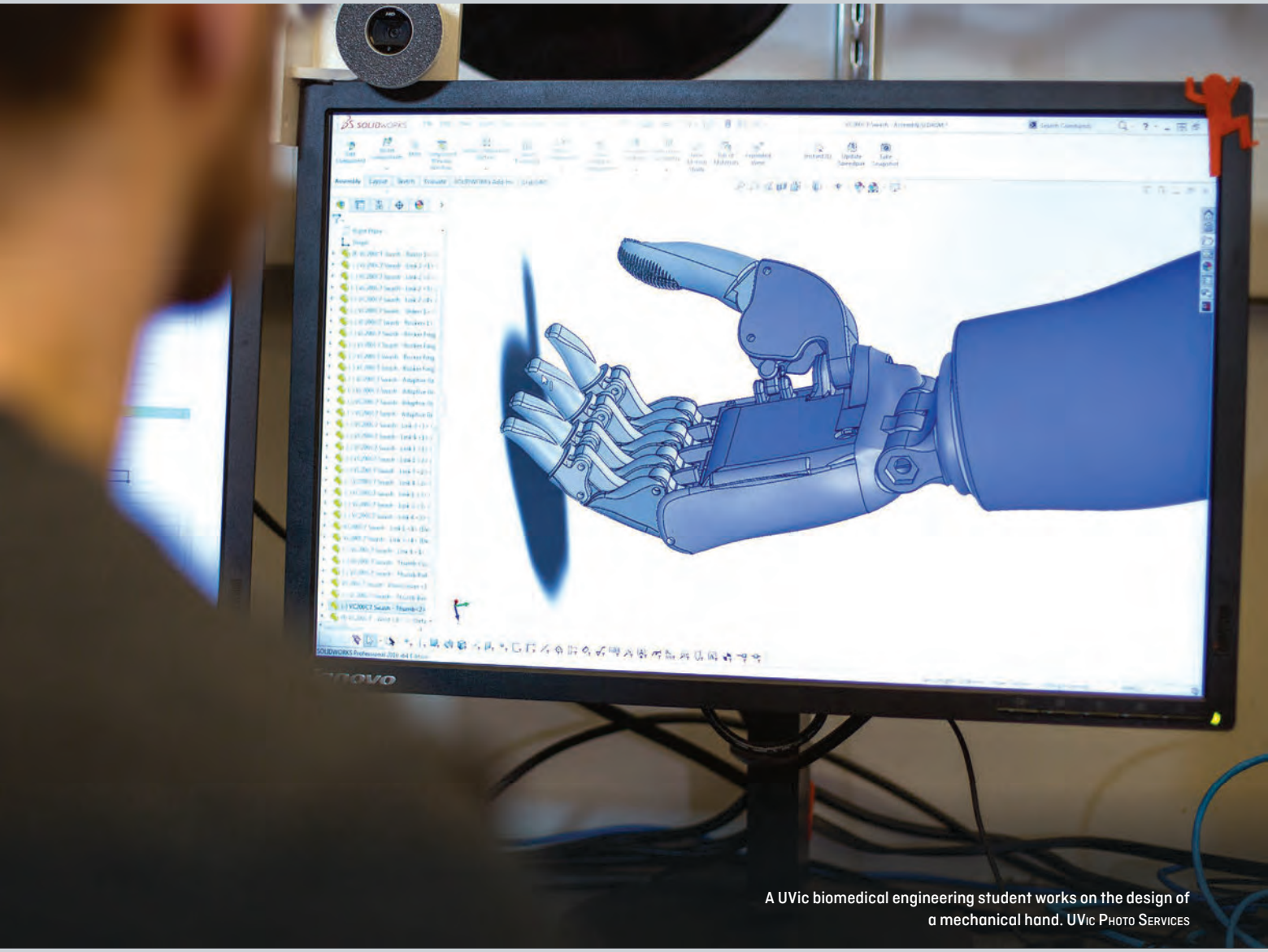
THE FUTURE OF ENGINEERING AND GEOSCIENCE IN BC

MONIQUE KEIRAN
AND STAFF

The work of engineers and geoscientists in BC is impacted by changes in tools and technology. How is the landscape of our work changing, and what disciplines are emerging? In this Centennial Collector's Edition, *Innovation* looks at biomedical technology, nanotechnology, seismology, climate change, artificial intelligence, and big data.



BC's D-Wave Systems designs and manufactures quantum computing components, based on quantum mechanics—far more advanced than conventional computing. Quantum computers tackle problem-solving once thought unfeasible, leading to breakthroughs in artificial intelligence, machine learning, manufacturing, material science, and financial modeling. Photo: Media courtesy of D-Wave



A UVic biomedical engineering student works on the design of a mechanical hand. UVic Photo Services

BIOMEDICAL AND NANOTECHNOLOGY

A vibrant, active, fertile ecosystem for biomedical and nanotechnology engineering is emerging in British Columbia, building the province's reputation as a burgeoning, world-class biotechnology hub.

"It's a really exciting time to be working in this field in BC," says Dr. Stephanie Willerth, P.Eng., engineering professor and Acting Director of the Biomedical Engineering school at the University of Victoria. "The way healthcare is going, we're going to need better solutions to bring down the cost of healthcare as people live longer. From my experience in stem cell research and working with diseases like Alzheimer's and Parkinson's, I think we're going to find that a lot of these diseases have a bunch of different causes and it's going to take some personalized-medicine approaches to treat them."

And, she says, biomedical engineering and nanotech will help get us there.

The industry's growth involves a feedback loop between the province's universities and private enterprise. Research from the province's two biomedical engineering schools, located at UVic and UBC, is leading to new patent applications, new business startups, and

clinical trials to test new, locally developed therapies and devices. For example, STEMCELL Technologies Inc. and StarFish Medical—two Canadian biotech leaders—emerged from the universities' research labs, as did nanotechnology firms Precision Nanosystems, Aspect Biosystems, Accelera Canada, and others.

That, in turn, is attracting investors and support, prompting established companies to set up offices in BC, and drawing talent to the region. And that feeds back again into the universities, leading to new funding, new opportunities, and expanded programs.

"A really large cohort of new biotech companies has spun out of the university engineering departments," Willerth says. "And they're hiring many of our grads—which just shows that this is a growing industry here in BC. I think we're going to start seeing really big transformations across the region in the coming decades as these technologies start to contribute to the economy."

SEISMOLOGY

"Science and technology are driving seismology and earthquake engineering forward very quickly," says Dr. John Clague, P.Geo. "We can do things now that we were unable to do even 10 years ago."

Those advances, Clague says, are reshaping BC geologists' and engineers' work in seismic-related fields.

For example, growing networks of new, smaller, less expensive seismometers in the province's coastal urban areas will collect better data, at highly local scales, about seismic ground motions—velocities, accelerations, intensities, and directions of ground-shaking, and about how the networked buildings respond to the motions.

"In the past," Clague says, "the general tendency has been, 'The ground shakes: it shakes the same everywhere.' But empirical evidence shows the strength of shaking can differ by up to a factor of five, depending on topography and earth materials below the surface."

The seismometer networks will allow the province and municipalities to tailor earthquake design to the seismic requirements of specific locations, instead of applying a one-size-fits-all approach across the region. Coupled with seismic inventories of the region's existing infrastructure, the data will help local and provincial governments and authorities identify which infrastructure needs what kind of seismic upgrades most urgently and prioritize funding accordingly.

It will also pinpoint where water mains, fuel lines, sewer networks and other underground infrastructure are at particular risk from ground shaking and liquefaction, which occurs when solid, wet soils suddenly behave like liquids.

The province's network of automated earthquake early warning systems is also expanding. Depending on how far away an earthquake's epicentre is, automated systems connected to the early warning networks may have anywhere from a few seconds to a minute to sound alarms, shut down fuel lines, power sources and water mains, close bridges and tunnels, and start up emergency backup systems before shaking begins. That may be just enough to limit damage, prevent fires and flooding, and save lives. (*To learn more about how*

LEGISLATIVE ASSEMBLY OF BC CONTRACT: SEISMIC UPGRADE ADVISORY SERVICES

Engineers and Geoscientists BC has a long history of leadership in seismic technical excellence to enhance public safety. Since 2004, we have worked with the BC Ministry of Education, with support from the University of British Columbia Civil Engineering Department, to assist with the implementation of a seismic upgrade program for schools in the province.

This included the development of seismic assessment tools and guidelines for the performance-based seismic retrofit of BC school buildings. The most recent, are the Seismic Retrofit Guidelines, 3rd Edition (SRG). The award-winning guidelines utilize a performance-based methodology for the seismic assessment and retrofit of school buildings and have been recognized internationally for their innovation, technical expertise, and contributions to public safety.

The success of the guidelines has led to new applications that continue to enhance BC's seismic preparedness. The Legislative Assembly of BC has engaged the association to apply and adapt the SRG to the unique building types located on the grounds of the BC Legislature. The Building and Safety Standards Branch is also working with the association to evaluate how the SRG could be applied in developing a standardized engineering approach for the seismic assessment and retrofit of existing building stock in BC (eight storeys or less).

To learn more about our involvement in this area, visit: *egbc.ca/seismic-initiatives.*

earthquake early warning systems work, see the March/April 2016 edition of Innovation*, at* egbc.ca/innovation.)

Clague also predicts emphasis in seismic engineering will shift in the coming decades. Today, buildings are designed primarily to prevent injury and loss of life during an earthquake. In the coming decades, they'll also be designed to remain functional.

"In the [February 22, 2011] Christchurch earthquake, only two buildings collapsed, but many others had to be torn down—they were uninhabitable. Christchurch's urban core has essentially been gutted."

To limit social and economic disruption after an earthquake or other disaster, the region will need to continue functioning. To do that, it needs usable buildings—and functioning water and sewer systems, roads, bridges, airports and marine ports.

As seismic data becomes increasingly detailed and region-specific, seismic engineering—including designing buildings to ensure they remain functional—is expected to become increasingly important in the coming decades. PHOTO: ROMAKOMA/SHUTTERSTOCK.COM

CLIMATE CHANGE

Over the past few years, Conor Reynolds, P.Eng., Division Manager with Metro Vancouver's Air Quality and Climate Change Policy group, and Mark Porter, P.Eng., Struct.Eng., Associated Engineering Ltd.'s National Practice Lead for Building Services, have seen the conversation around climate change among their peers shift to emphasize both climate change adaptation and mitigation.

"There's much more recognition that the two are co-joined—that we need to have both in order to have better solutions," Porter says.

Reynolds says consensus is emerging in BC's engineering and geoscience community that society needs to be carbon neutral by 2050 if we're going to avoid the worst and most disruptive effects of climate change. "That means when we design infrastructure that's going to last for 20 to 30 years, maybe 50 to 100 years, we've got to think about, (a) in 2050, will it be a net-zero emissions producer? And (b) in 2050 and beyond, will it be resilient to the increasing climate-related impacts?"

The two engineers, chair and vice chair, respectively, of the Engineers and Geoscientists BC's Climate Change Advisory Group, say combining climate change adaptation and mitigation goals deepens the complexity and challenge for BC engineers and geoscientists, and will require changes in how they do their work, how they approach doing their work, and the range of other experts they work with.

"We'll need to think about climate impacts beyond exactly what we're looking at in front of us at the table," Porter says. "We'll need to consider the broader impacts the project is going to have, what cascading impacts it will have on the wider, bigger picture, and who we need to bring into the conversation to help us understand those things."

Systems-wide, contextual, risk-based approaches to projects will be essential.

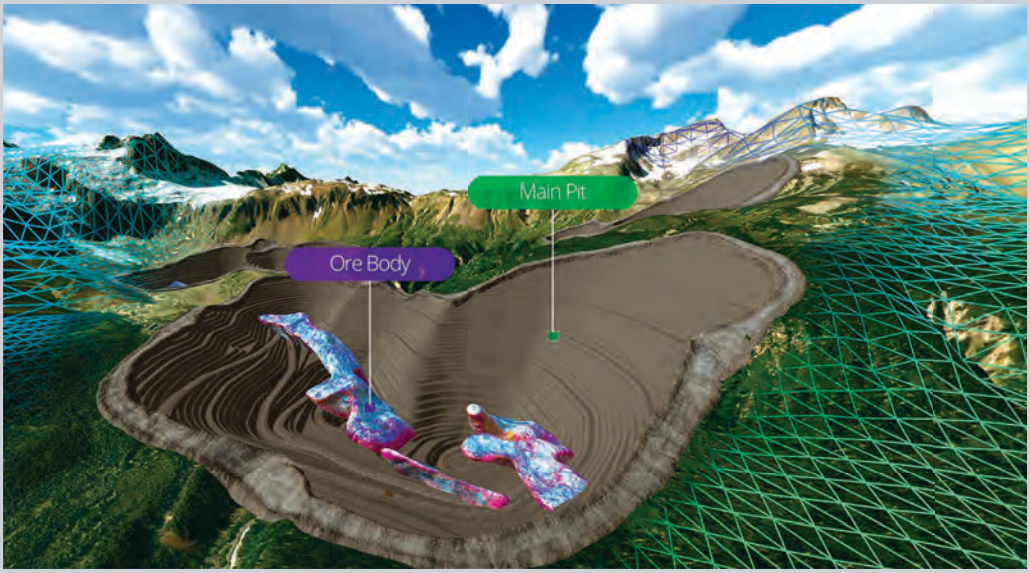
For example, when engineers design a piece of infrastructure in a particular location, climate science indicates the range in which temperature and precipitation will likely increase in that region. With that information, Porter says, "We can start asking, 'How vulnerable will this infrastructure be if the environment changes? If wildfire risk increases, how does that affect our design? If precipitation increases, do we need to consider what we're doing to manage flash flooding?' We don't know exactly what number to use to assess risk, but we'll know enough to ask how it will affect our design."

This, he says, will be "a real change in professional practice—it won't be a blanket, prescriptive method."

He notes that engineers and geoscientists will need to consider cumulative impacts of multiple climate-induced risks—wildfire, flood, sea level rise, and so on—on projects. Potential failure will be another important consideration—how, for example, a power outage caused by a windstorm might affect broader community safety, resilience and functioning, and how project design might lessen those cascading effects.

Choice of energy source will become as important as a project's energy efficiency—with preference given to carbon-neutral sources. Choice of materials used—and

Innovation has covered many different forms of alternative energy, such as solar (November/December 2018), tidal/wave (May/June 2018), biomass (November/December 2018), and geothermal (March/April 2019). Alternative energy sources, like this SunMine solar project in Kimberly, BC, will increasingly govern design decisions in the coming years. Photo: City of Kimberley.



where they come from, how long they last, and what happens to them at the end of their lives—will also figure prominently. Engineers will need to design things to be long lasting and adaptable, not disposable.

In the coming decades, tools such as Engineers and Geoscientists BC's Climate Change Information Portal—the association's centralized source of climate-related information (*egbc.ca/Practice-Resources/Climate/Climate-Change-Information-Portal*)—and new professional practice guidelines will help members stay informed about the latest climate science affecting their professional practice.

Despite the unfolding challenges presented by climate change, Engineers and Geoscientists BC members should expect many new opportunities to emerge in the coming decades.

"We're the go-to people when clients and the public ask, 'We have to get to this seemingly transformed place—how do we do that?'" Reynolds says. "In the past, innovative engineers and geoscientists might have had ideas, but there was less receptivity to those ideas. That's changing. Opportunities are opening up for engineers and geoscientists to use their really innovative skills to help society change the way we do things and make this a better, more resilient place to live and work and play."

ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, AND BIG DATA

Technology has always shaped how engineering and geoscience work is conducted. The introduction of handheld scientific calculators, for instance, made manual calculations using a slide rule obsolete. Lasers in the 1960s led to LiDAR, followed by the broader availability of GPS and inertial measurement units in the late 1980s. Improvements to computer processors made CAD broadly (and affordably) available for design work across a range of disciplines.

Today, technology is advancing most rapidly in the areas of artificial intelligence (AI), machine learning, and big data—areas that are certain to transform the future

Left previous and current page: Resource companies must face a range of risks, but they're gathering more data than ever to help manage them. LlamaZOO Interactive helps them tackle complex planning, approval, and operational processes through a number of digital products that makes the most of big data. MineLife can integrate and visualize almost any kind of data, and OCC 3D provides a real-time monitoring through a "digital twin" visualization. Photo: LlamaZOO Interactive

work of engineers and geoscientists. The advent these technologies could bring about bigger changes than any other technological development in history. (*To learn more about the impact of big data on the mining industry, see the January/February 2019 edition of* Innovation*, at* egbc.ca/innovation.)

To Robin Fell, Senior Director, Strategic Technology Solutions at Newmont (formerly Newmont Goldcorp), these three areas are changing both the "how" and the "what" of the work of engineers and geoscientists.

"A lot of the [exploration] techniques weren't even feasible five years ago," said Fell. "Technologies like machine vision, predictive algorithms, querying in 3-D [means that we can] take drilling data, look at assay results, and then work backwards to predict what the future results will be with different inputs. There is no reason why datasets in the exploration world can't be combined using previous data, LiDAR, geophysics, reports and other unstructured documents," he said.

Fell says that a computer can be assigned to quickly scan and link all these datasets—"massive datasets…petabytes of data"—and artificial intelligence and machine learning can "reveal something that [humans] haven't seen." Data, he says, is becoming an asset.

Fell thinks that technology is also changing engineering design. "In the golf industry, Callaway used AI to simulate all kinds of different driver heads, and last year they released a driver that was designed by AI," he said. "This means that a computer can do all that work—tens of thousands of simulations with various inputs to arrive at a particular result."

But while Fell believes that the work of engineers and geoscientists is moving away from what he calls "human experience and tribal knowledge," "janitorial data manipulation," and a "purgatory of data grinding"—he also believes this type of work is shifting towards interpretation, modelling strategies, and knowledge guidance. To Fell, engineering and geoscience work will involve less manual manipulation of datasets, and more guidance about how to strategically approach the work.

DISCIPLINARY NOTICE: VIVIAN PARK, P.GEO., KAMLOOPS, BC

Engineers and Geoscientists BC issued a Notice of Inquiry to Vivian Park, P.Geo., in August 2019, regarding her conduct related to geoscientific services she provided by preparing two technical reports—one for a mineral property in Nelson, BC (the BC Report) and the other for a mineral property in Albania (the Albania Report). Instead of proceeding to a disciplinary inquiry, Ms. Park agreed to a Consent Order, dated October 16, 2019.

In the Consent Order, Ms. Park admitted that she demonstrated unprofessional conduct, incompetence, or negligence, and that her conduct was contrary to Principles 1, 2, 3 and 6 of the association's Code of Ethics.

Ms. Park agreed that she demonstrated unprofessional conduct, incompetence, or negligence in her preparation and authorship of the BC Report, by:

- taking responsibility for resource estimation work when she did not have the requisite experience to take responsibility for that work as a Qualified Person as defined in National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101);
- misrepresenting the resource estimation work as current when it was in fact taken from an earlier technical report for the property, contrary to NI 43-101 and Form 34-101F1 Technical Report (the Form);
- misrepresenting the BC Report as compliant with 2014 Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards, with the result that the BC Report overestimated the confidence in and magnitude of the mineral resource, which was misleading to the public; and
- relying on expert reports referenced in the BC Report when she had not read those expert reports or verified the experts' qualifications.

Ms. Park also agreed that she demonstrated unprofessional conduct, incompetence, or negligence in her preparation and authorship of the Albania Report, by:

- failing to adequately describe drilling, including an adequate summary and interpretation of all relevant drilling results and the relationship between the sample length and the true thickness of the mineralization, and the results of any significantly higher-grade intervals within a lower-grade intersection, as required by the Form;
- failing to adequately discuss sample preparation, analyses, and security as required by the Form;
- failing to follow the CIM Guidelines in relation to data verification, and failing to disclose adequate data verification, as required by the Form, to support the mineral resources disclosed in the Albania Report; and
- preparing an amended version of the Albania Report, which failed to adequately describe the quality control and quality assurance procedures with respect to data relied on in the Amended Report, and improperly relied on data that was not reliable and was not justified as supporting the disclosure of a mineral resource estimate under NI 43-101.

As part of the Consent Order, Ms. Park agreed to the following provisions. Her membership in Engineers and Geoscientists BC is suspended for a period of three months, effective October 16, 2019.

- She will not act as a Qualified Person as defined in NI 43-101 for at least one year from the end of her suspension, but may partner with another Qualified Person, approved by the association, to supervise her work and act as Qualified Person for the purposes of NI 43-101 reports.
- She will complete the course "Mineral Project Reporting under NI 43-101", and successfully complete its examination.
- She will pay $7,500 toward the association's legal costs.

The full text of the Consent Order can be found in the Disciplinary Notices section of our website, at *egbc.ca/Complaints-Discipline/Discipline-Notices.*

Engineers and Geoscientists BC's website contains information on the complaint, investigation, and discipline processes. You can contact us at 604.558.6647 or toll-free at 1.888.430.8035 ext. 6647, or by email at complaints@egbc.ca.

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The association signed on to Engineers Canada's 30 by 30 initiative: a goal to raise the percentage of newly-licensed engineers who are female to 30 percent by 2030. New initiatives followed: work to identify causes of gender imbalance in the professions, support for STEM education, and partnerships with organizations that actively recruit and retain women in the engineering and technology professions.

Today, we're seeing progress. About 15 percent of Engineers and Geoscientists BC members, and 21 percent of newly-licensed members, are women. And there are more opportunities for young women to explore careers in STEM than ever before.

Our focus on diversity continues, and intensifies; many organizations are adopting policies that encourage and

support women to have full career paths in the industry, and attitudes are changing towards having a diverse workplace culture. However, we need to continue to push. Members can help in many different ways, like becoming a member of the association's Women In Engineering And Geoscience Division, mentoring women professionals through the association's mentoring program, or participating in events through the *womenintech.ca* joint initiative. For the communities and economies of tomorrow to thrive, we need to cultivate a deep, diverse, and innovative talent pool today, and raise the bar for inclusion for people at all points of their career.

To learn more about our commitment to diversity, visit *egbc.ca/Diversity-and-Inclusion.*

ORGANIZATIONAL QUALITY MANAGEMENT PROGRAM

The following organizations have recently received OQM certification.

To find out more, visit *egbc.ca/oqm.*

Beta-Tech Inc.

Chartwell Consultants Ltd.

Elemental Structural Engineers Ltd.

Protech Consulting 2012

Reliance Engineering Inc.

SB Engineering

SY TEH Engineering Ltd.

Technology Brewing Corp.

Tochal Consulting Ltd.

Tryon Engineering Inc.

Web Engineering Ltd.

West Power Energy

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IN MEMORIAM

The association announces with regret the passing of the following members:

W.P. Alsip, P.Eng. (Non-Practising)

W.L. Anderson, P.Eng. (Non-Practising)

D.C. Austin, P.Eng.

C.F. Carter, P.Eng.

I.D. Chrapko, P.Eng.

R.M. Cretain, P.Eng.

B.N. Crocker, P.Eng. (Non-Practising)

J.B. Henderson, P.Eng. (Non-Practising)

G.A. Hermosura, P.Eng.

R.A. Jemson, P.Eng.

R.L. Nassim, P.Eng.

R.W. Neuman, P.Eng.

D.E. Oldknow, P.Eng. (Non-Practising)

B.A. Quinlan, P.Eng.

R.G. Ryan, P.Eng. (Non-Practising)

R.S. Shuff, P.Eng. (Non-Practising)

I.G. Slater, P.Eng. (Non-Practising)

H.G. Stephenson, P.Eng. (Non-Practising)

F.J. Sveinson, P.Eng.

A.E. Thomson, P.Eng. (Non-Practising)

A.R. Underhill, P.Eng.

A.E. Von Maydell, P.Eng.

J.M. Wallace, P.Eng.

Engineers and Geoscientists BC was saddened to learn of the passing of member Ardalan Ebnoddin-Hamidi, P.Eng., and applicant Mohammadhossein (Daniel) Saket in the Ukrainian International Airlines plane crash.

We offer our deepest condolences to their families, colleagues, and friends, and to the Iranian community in BC, in the wake of this tragedy.

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2009 WILLIAM R. BENNETT BRIDGE

Kelowna's Okanagan Lake Bridge was the only pontoon bridge in Canada and one of only a handful of that type in the world. In 2009, it was replaced by another pontoon bridge: the William R. Bennett Bridge, a five-lane bridge spanning over 1,000 metres, with a capacity of about 80,000 vehicles each day. In the foreground of this photo, portions of the previous Okanagan Lake Bridge are tugged away. Photo: Darren Kirby under Creative Commons Attribution-Share Alike 2.0 Generic.

2011 BC PLACE STADIUM REFURBISHMENT

BC Place Stadium first opened its doors in 1983. In an extensive revitalization in 2011, the air-inflated domed roof was replaced with the largest cable-supported fabric roof of its kind in the world. The 18-month-long renovation project also featured a new scoreboard, new seats, and a new playing-surface turf. Photo: BC Place

CONTINUING PROFESSIONAL DEVELOPMENT

PERSONAL INVESTMENT. PROFESSIONAL COMMITMENT.

FUNDAMENTALS OF DESIGN OF PRE-STRESSED CONCRETE MEMBERS

February 13 & 14, 2020 – Vancouver, BC

This course provides the essential basics to design pre-stressed and post-tensioned concrete structures. After this seminar, the attendee will understand the advantages of using pre-stressed and post-tensioned concrete structures to reduce construction time and provide quality-assured members.

LEARNING TO LEAD: THE ESSENTIALS

February 19, 2020 – Vancouver, BC

This session will provide a good foundation of knowledge, skill, and will for those with leadership aspirations, or who have recently commenced a leadership role in their organization. The course will provide 'the essentials' needed to be successful in your first leadership role.

PROFESSIONAL PRACTICE GUIDELINES: LEGISLATED FLOOD ASSESSMENTS IN A CHANGING CLIMATE IN BC

February 20, 2020 – Vancouver, BC and Webinar

This seminar will review and discuss the Engineers and Geoscientists BC Professional Practice Guidelines on Legislated Flood Assessments in a Changing Climate in BC.

VALUE BY DESIGN: INTEGRATING VALUE ENGINEERING AND SUSTAINABILITY

February 20, 2020 – Vancouver, BC

Value by Design is a collaborative and systematic approach to a project or product design that draws out creativity and innovation of the people integrating their ideas to develop the most efficient and value enhanced solutions.

ASPHALT PRODUCTION AND PLACEMENT

February 24, 2020 – Vancouver, BC

This course examines the basic design principles of flexible, asphalt-surfaced pavements to give participants a good understanding of what matters to ensure the maximum pavement life possible.

EVALUATION AND REHABILITATION OF PAVEMENTS

February 25 & 26, 2020 – Vancouver, BC

This course discusses pavement design, specification, subgrade preparation, base/subbase, and surface types and function, construction details, and long-term functional and structural performance considerations to ensure a long-life and effective product. It provides details on maintenance and rehabilitation procedures, how to evaluate both old and new, and innovative pavement treatments using life-cycle cost analysis.

CONTRACT ADMINISTRATION AND CONTRACTUAL ISSUES FOR ENGINEERING AND CONSTRUCTION PROJECTS

February 26 & 27, 2020 – Vancouver, BC

This module will cover legal and contractual issues related to the effective management and administration of construction projects. It focuses on the roles and responsibilities of the project managers to contractors and suppliers. It provides project managers with a good understanding and the practical implications of the legal precedents and improves the ability to make better decisions. Legal cases and disputes situations will be reviewed and discussed with participants.

LEADING MAJOR CAPITAL PROJECTS

February 28, 2020 – Vancouver, BC

This session provides an opportunity to discuss the relationship between the business and project sides of the organization.

HYDRAULIC MODELLING OF WATER DISTRIBUTION SYSTEMS

March 3, 2020 – Vancouver, BC

The water distribution modelling training begins with the basics of hydraulic theory as it applies to water distribution modelling, then takes participants through more advanced topics such as working with multiple scenarios, model calibration, pump selection, energy cost studies, extended period simulation, fire flow analysis, and water quality. Participants will become familiar with EPANET and use the software to reinforce concepts with the workshop problems.

MICROSOFT EXCEL EXPERT TRAINING FOR PROFESSIONALS

March 4, 2020 – Vancouver, BC

Learn to manage data through databases and pivot tables which will simplify complex reporting and tracking requirements for projects. Also learn advanced functions and tools like Goal Seek and creating scenarios useful for providing variations on quotes.

LEADING AND MANAGING ORGANIZATIONAL CHANGE

March 5, 2020 – Vancouver, BC

This session is designed for professionals who want to better understand how to adapt to changes and how to lead others more effectively. You'll understand the impacts change has on employees, and how you can increase your organization's readiness levels.

RELIABILITY ENGINEERING, MAINTENANCE OPTIMIZATION, AND ASSET MANAGEMENT

March 5 & 6, 2020 – Vancouver, BC

Participants will gain a comprehensive understanding of basic concepts, methods, and tools in the area of reliability engineering, maintenance optimization, and engineering asset management. They will learn the topics of reliability and maintenance concepts, component and system reliability analysis, preventive maintenance, condition-based maintenance, asset management programs, and various techniques and tools.

GEOTECHNICAL EARTHQUAKE ENGINEERING

March 9-11, 2020 – Vancouver, BC

This short course should be of interest to geotechnical, structural, geological, and mining engineers and consultants who wish to have a better understanding of the issues in the field of geotechnical earthquake engineering, as well as current state-of-the-art seismic analysis and design of geo-structures.

ADVANCED PROJECT MANAGEMENT

April 1 & 2, 2020 – Vancouver, BC

This project management course is designed for project executives, directors, managers, and project managers who are involved directly or indirectly in managing projects. The purpose of this course is to build on the Fundamentals of Project Management background by analyzing current industry practices and introducing some value-improving practices to enhance the delivery of complex construction projects.

WRITING EFFECTIVE PROPOSALS AND REPORTS

April 7, 2020 – Vancouver, BC

This seminar is for engineers and geoscientists who wish to develop the confidence and writing skills necessary to write effective proposals and reports. Through a series of hands-on workshops, you will learn the key elements of writing and submitting winning proposals and reports, and how to tailor your content for both technical and non-technical audiences.

For a complete listing of events or for more information, visit *egbc.ca/Events/Seminars* or contact us at 604.430.8035 or 1.888.430.8035.

CALL FOR PRESENTERS

Are you an expert in your field who would like to contribute to engineering and geoscience practice? Engineers and Geoscientists BC is actively seeking members to present on a variety of topics. For more information, please visit *egbc.ca/Events/Seminar*.

100 YEARS

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

PHOTO: ARIENA/SHUTTERSTOCK.COM

100 YEARS

ENGINEERS & GEOSCIENTISTS
BRITISH COLUMBIA

SAVE THE DATE

2020 ANNUAL CONFERENCE AND AGM

Engineers and Geoscientists BC's 2020 Annual Conference and AGM is October 15 – 17, 2020, in Victoria, BC. We look forward to welcoming professionals and industry leaders for two full days of professional development on industry trends, innovative case studies, best practices, and emerging issues.

Are you a senior practitioner with unique experience or expertise to share? We're seeking proposals! Submit your idea by **March 13, 2020** at egbc.ca/call-for-presenters.

Should you have any questions, please contact conference@egbc.ca.

100 YEARS

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