[VIEWPOINT]

SIGNIFICANT CHALLENGES TO THE ENGINEERING PROFESSION

By Peter DeVita, MBA, P.Eng., FEC

THE ACCELERATING PACE of technological change continues to push the engineering profession into major issues. These must be addressed to allow PEO to function effectively ("doing the right things") and be relevant to members, the provincial government and the people of Ontario.

Two large issues face PEO that, if ignored, will become more severe as time passes, even threatening PEO's existence. They are:

1. The need to increase the entrance qualifications to obtain a P.Eng.; and
2. The need to restructure our governance so it's able to embrace new areas of practice in response to the accelerating pace of growth in science and technology.

ENTRANCE QUALIFICATIONS

Engineering in Canada is the only remaining senior profession that can be entered directly from high school. All others require a bachelor's degree before the profession's specific training can be started. Former PEO president Walter Bilanski, P.Eng., FEC, convened a conference on this point in June 2007 with much controversial discussion.

The facts that we face now are summarized as follows:

(a) About 30 US states have already implemented a four-year degree for their technologist level. In short, this suggests that a US technologist is equivalent to a Canadian engineer. That is not a comparison we want made vis-à-vis Canadian engineers (Musselman 3, 4);

(b) At the National Council of Examiners for Engineering and Surveying (NCEES) annual general meeting in August 2014, NCEES stepped back from its year 2000 Model Law additions. These had proposed that starting in 2020, a master's degree would be required for the PE designation, or a bachelor's degree plus 30 continuing education units (Musselman 5). This would have meant that students of engineering beginning in 2015 would need to meet the new standards. NCEES recognized that since no states had followed its lead, it had created a confusing situation for new students of engineering. It has opted to remove clauses from its Model Law and is creating a position statement on what it believes should occur. The problem of under-qualification remains, but how US engineers will address it remains unclear. The implications for Canada are clear. US engineers are 15 years ahead of Canada in attempting to address the licensing qualification issue. Canadian engineers are still waking up to understanding what it's about; and

(c) Irrespective of the above external forces, growth in technology and social requirements find our new graduating engineers lacking. There is a desperate need for higher-level degrees to add both design abilities and soft skills (Musselman 5). University of Toronto professor Gordon Slemon, PhD, would often remind us that "design is the essence of engineering." Yet, our engineering schools are hard pressed to teach design. Our engineering programs at the bachelor's level are focused on the mathematics and science needed to give us solid analytical skills. Design increasingly requires specialization, synthesis and creativity in looking at the world. These can be enhanced via the proper academics at a master's and doctorate level. In addition, engineers must develop better communication skills (Musselman 5). A great idea will not succeed if no one can be convinced it's great. Several engineering schools have already picked up on these gaps by offering a dual degree program (engineering bachelor's and MBA), providing many of the enhanced skills.

We are falling behind in our engineering academic requirements. It will take a few years to mobilize Canada's engineering community into action on this point. The universities (and now the colleges offering engineering degrees) will need to be part of the discussions. University faculties could elect to offer pre-engineering schools whose graduates can continue on at the same faculty for their master's, or simply offer the master's programs. It should be noted that whereas in undergraduate work one professor may have 100 or more students in each class, a master's level supervisor will have perhaps 10 per cent of such numbers. In any event, PEO has the ultimate authority in law to demand what it believes is in the best public interest for the minimum qualification of a P.Eng. It will be up to the engineering faculties to determine the best routes to meet the standards.

Some believe that events are conspiring to push the Canadian engineering profession into adopting a master's degree (or its equivalent) as the minimum academic requirement for the P.Eng. Of course, a doctorate degree would put Canada at the forefront if we should be bold enough to make such a move.

NEW AREAS OF PRACTICE

Accelerating expansion of profession

Since 1922, the engineering profession has gone from five distinct disciplines to over 30. Originally, PEO council was set up to have all engineering disciplines represented on council. Three councillors (two elected and one appointed) represented each of the five disciplines of the day. There is merit in the concept that specific practice issues in a given area require members in that practice to voice them at PEO council so that the public interest can be better served.

Today's "engineering LGA" (lieutenant governor appointee) is a carryover from this concept. In the early 1990s, when the idea of appointing by engineering discipline was still

a tradition, the notion was to appoint one P.Eng. LGA of each recognized discipline. There are no longer enough seats on council to give every discipline one councillor, whether elected or appointed (DeVita, part 1, p. 97). (When I was appointed as an LGA in this period, for example, the registrar had pretty much given up on the idea of explaining to the attorney general the differences between types of engineers. It was good enough for a minister simply to find engineers to appoint, let alone specific types of engineers.)

The problem is compounded by the fact that new engineering disciplines (and specialties) are appearing more quickly as time goes by. This is related to the growth in new scientific knowledge leading eventually to new engineering practices, and there will be no slowing down in our lifetimes (DeVita, part 2, chapter 7). Only when humans learn all there is to know about the universe will the appearance of new engineering practices slow down. We do not foresee any such event! PEO must address this trend by ensuring engineering disciplines track the inevitable application of advances in science.

Natural science practices

The industrial exception (repealed but not fully promulgated) has given science school graduates the wrong impression. They have been led to believe that they can apply their work as they please because they are applying science. Clearly, under the *Professional Engineers Act*, this is not so even with the exception in the act. Applying science to work useful to humans is, by definition, engineering. Most engineering schools today award a bachelor of applied science degree as the main engineering degree in Ontario. When applying science to works that safeguard the public interest, the relevant practices *must* be done by licensed practitioners of engineering. At the moment, PEO is the only game in town to ensure this.

This same reasoning applies to graduates of engineering schools, working perhaps as employees, but doing engineering for their employer. When the public interest is at stake, the practitioner *must* be licensed, regardless of who is paying them.

Governance

In total, we now have some 50 disciplines (adding up all engineering and applied science disciplines) that PEO should/could be regulating. Unfortunately, we do not do a very good job at even the original five areas of practice. In short, how we govern now and into the future needs a radical overhaul. Here are some things to think about along these lines:

- A PEO council of over 50 members is impractical. Our current council, at 29, is already unwieldy to the point of being ineffectual. Hence, having every engineering discipline represented on council cannot be done. But, effective governance must have a way of responding to the street-level issues of the day in every discipline practised;
- The key in bridging this governance gap can be seen in the way PEO has evolved already. In the early days, council did admissions by discipline via the three councillors for that discipline (DeVita, part 1, chapter 6). In short, council did everything to effect licensure. Over time, the simple volume of applicants made this impractical for part-time volunteer councillors. So the Academic Requirements Committee (ARC) and the Experience Requirements Committee (ERC) and the other peer review committees formed, basically relieving council of administrative tasks. In terms of organizational culture, this has moved council from a hierarchical mode of thinking and acting to an egalitarian mode; and
- Critical issues to any new discipline are:
    - How new members are admitted (ARC/ERC/registration),
    - How current members are ejected (complaints and discipline),
    - How practices are protected so only licensed practitioners do them (enforcement), and
    - How current practitioners are helped with new guidelines and standards for each discipline (via PEO's Professional Standards Committee).

Using such peer review committees rather than council provides us the tools we need to effectively govern an ever-expanding profession.

Discipline specific

In all these cases, we now have committees for these tasks. We must become a proactively, *discipline-specific* organization to regulate effectively. Our regulatory committees have always operated like this out of necessity, in spite of council's insistence that the P.Eng. is a universal designation.

It is here at the regulatory committee level that new areas of practice can have explicit representation and recognition via a formal appointment process approved by council. Under this model, council's role moves to a pure policy body. Its role is to deliberate on new areas of emerging practice and how to integrate them for full proper licensure.

It is also council's role to ensure that all its regulatory committees are adequately funded and staffed, both volunteers and staff support. Key performance indices (KPIs) are a great way to keep tabs so council can look into areas that are having problems. Discipline-specific versions of two KPIs already in PEO's new strategic plan (www.peo.on.ca/index.php/ci_id/28289/la_id/1.htm) are particularly useful here–the uptake (or capture) rate and what I refer to as the "licence coverage rate."

Uptake (capture) rate measures the percentage of graduates who obtain their P.Eng. The licence coverage rate measures the percentage of members who have definable rights to practise in the engineering work they do (current Engineers Canada statistics tell us this amounts to fewer than 30 per cent of Canadian P.Engs).

The *Ontario Health Disciplines Act*, the College of Trades (2009) and the Quebec Office of the Professions are existing examples of overview boards governing a diversity of disci-

plines. PEO needs to examine these formally so it can develop its own plan on how to proceed.

Activity in new credentialing organizations

In the last decade, Ontario has been moving towards licensing or certifying pretty much all skilled occupations. The 2009 creation of the Ontario College of Trades is a watershed event, which is likely unknown to most PEO members.

It's clear there is significant activity in Ontario towards the credentialing of skilled occupations, whether licensed or certified. There are more acts in the works with lobby groups organized to push for official recognition.

There are also several science organizations, like the Association of the Chemical Profession of Ontario, that already certify members (Obal). They need only a major incident/example to show how the public interest is at stake in what they do (Thalidomide is one they could use already). Impact on the public interest is a necessary condition to justify licensure. These organizations could potentially be in conflict with PEO over jurisdictions and scopes of practice. The well-being of Ontario and Canada is served better in avoiding conflicts like those we have had in the past over software engineering and the Ontario geoscientists.

CONCLUSION

The basic point here is that Ontario society is moving on and PEO must adapt, preferably *lead*. If engineering does not keep up or help in leading the way, we will be bypassed. The issues raised are too big for impromptu answers, or to be ignored.

The Professional Organizations Committee (Spence, Swinton) and McRuer reports (McRuer) established the body of law behind Canada's self-regulation approach to licensing professional practice. They recommend commissions of public inquiry to examine new forms of licensure. This was done about 10 years ago to examine the trades. We, PEO (the members), missed it. Our inattention to Ontario legislative activity with respect to new licensing will be a big thorn in our side when we finally decide to do something. We must avoid being forced into late action again, as in the software engineering dispute. If we organize and project the obvious into the future, we can take action now to benefit all stakeholders.

Planned, co-operative and harmonious action now will help Ontario move into the future on the hoped-for positive economic wave. The alternative is continued internal dysfunction and self-destruction of the province.

It behooves us, at the very least, to set up a task force for each of the two major issues described herein. Council needs good field data to make considered decisions on how regulation and governance of the profession should proceed. Σ

THE NCEES MODEL LAW STRUCTURAL ENGINEER (MLSE)

The United States is taking steps to formally recognize specific disciplines (NCEES, Musselman 3). California did this in 1925 when it started off licensing civil engineers, not professional engineers like the rest of the US. The NCEES' new Model Law Structural Engineer (MLSE) standard applies for structural engineers, while others must meet the Model Law Engineer (MLE) standard. Like Canada, the US licensing boards were established about a century ago. At the time, civil engineering work was the focus of licensing attention. The state boards were set up with this in mind, accounting for the licensing of engineers, surveyors and architects by the same board in each state.

While the US has the hurdle of changing a state law to expand the scope of modern-day engineering practice, Canada does not. Canadians have recognized many new disciplines, but, unfortunately, similar to the US, have not been very good at establishing proper exclusive rights to practise for those new areas. Our forefathers in the early 1900s seemed to have grasped the concepts of licensure far better than we do today. We must do better for both the profession and the public interest.

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