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APPLYING ETHICS IN YOUR CIVIL ENGINEERING CAREER

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Abstract: This paper presents some of the examples where the authors have found themselves to be challenged regarding ethical issues and it provides suggestions they have found useful during their career to conduct their professional practice ethically while under these challenges. Examples discussed include, Duty to Report, Ethical Design, Prudency and Redundancy, "Low Bid" Procurement Environment, Conflict of Interest, and Cooperation with other Practitioners.

In addition, we present suggestions to encourage ethical practice and professionalism through, Cultivating a Culture of Ethics in a Company, and Promoting Professional Development.

1 INTRODUCTION

Engineers applying for professional status in this country are quickly introduced to the Engineer's Code of Ethics. This document is a guideline of how we must conduct ourselves as engineers in our professional life. Most engineers will not be able to recite the entire document but can usually recall the statement "that Engineers have a duty to the public as paramount".

To help solidify the concepts presented in the Code of Ethics we are mandated to read a book on Engineering Ethics and to write a three-hour exam on Professional Practice and Engineering Law. Upon successful completion of this process, a minimum of 4 years engineering type work, and recommendations from suitable professional engineers' references, we are granted our professional status and allowed to practice the profession of engineering. Although there are several examples in the text book of how an engineer may be conflicted on this issue of ethics during his professional career, the real challenge does not start until the engineer begins his professional work.

Whether the engineer fills a position with his employer of designer, manager, or executive, he will be charged to play a role in the company's mandate to be profitable, and so begins the difficult balancing act of trying to fulfill these two directives at the same time, a task which is often wrought with conflicts.

With the current trend in Canada's new infrastructure construction projects to utilize the project delivery methods of Design Build and P3, the engineer finds himself in an even greater challenge to juggle the quality and cost. Concepts of prudency and redundancy which were upheld as noble attributes in the past, are being replaced in today's market by a focus on cost cutting and low bid mentalities.

One definition for ethics is as follows: *moral principles that govern a person's behavior or the conducting of an activity. Also, Ethics and morals relate to "right" and "wrong" conduct. While they are sometimes used interchangeably, they are different: ethics refer to rules provided by an external source, e.g., codes of conduct in workplaces or principles in religions. Morals refer to an individual's own principles and conscience regarding right and wrong.*

Examples of their use to support the explanation above are, “the Engineers have their Code of Ethics”, or “he or she has a poor set of morals”.

The negative form of these words is unethical and immoral, which are probably more frequently used in our language. In our opinion essential to this is an understanding of right and wrong, which we all accept as fundamental. We will typically agree that stealing or lying is unethical but what about selling an inferior or unsafe product? Even this is a can be grey area. Many consumers appreciate the choice of buying inferior and cheaper product if the client is informed of the product’s limitations and risks. Is the same true of civil engineering structures?

The concept of right and wrong can be strongly influenced by culture. For instance, the practice of bribing a government official to win a contract is considered unethical in our society, not to mention highly illegal, but in other cultures is accepted as “a way of doing business”. To clarify for the readers, the authors are writing this paper based on their understanding of the Ethics of the business of civil engineering that currently exists in Canada.

Ethics that we have seen practiced in the work place include, do not price fix, do not collude and do not steal from your employer. These are not only ethical laws but also criminal laws. Although they are clearly tied to Ethics they are not to Engineering and so will not be discussed in this paper.

2 CODE OF ETHICS, PROFESSIONAL ENGINEERS OF ONTARIO

Inserted below is the Code of Ethics of the Professional Engineers of Ontario. We make numerous references to this document in this paper.

1. *It is the duty of a practitioner to the public, to the practitioner’s employer, to the practitioner’s clients, to other members of the practitioner’s profession, and to the practitioner to act at all times with,*
    i. *fairness and loyalty to the practitioner’s associates, employer, clients, subordinates and employees,*
    ii. *fidelity to public needs,*
    iii. *devotion to high ideals of personal honour and professional integrity,*
    iv. *knowledge of developments in the area of professional engineering relevant to any services that are undertaken, and*
    v. *competence in the performance of any professional engineering services that are undertaken.*
2. *A practitioner shall,*
    i. *regard the practitioner’s duty to public welfare as paramount,*
    ii. *endeavor at all times to enhance the public regard for the practitioner’s profession by extending the public knowledge thereof and discouraging untrue, unfair or exaggerated statements with respect to professional engineering,*
    iii. *not express publicly, or while the practitioner is serving as a witness before a court, commission or other tribunal, opinions on professional engineering matters that are not founded on adequate knowledge and honest conviction,*
    iv. *endeavour to keep the practitioner’s licence, temporary licence, provisional licence, limited licence or certificate of authorization, as the case may be, permanently displayed in the practitioner’s place of business.*
3. *A practitioner shall act in professional engineering matters for the practitioner’s employer as a faithful agent or trustee and shall regard as confidential information obtained by the practitioner as to the business affairs, technical methods or processes of an employer and avoid or disclose a conflict of interest that might influence the practitioner’s actions or judgment.*

4. *A practitioner must disclose immediately to the practitioner's client any interest, direct or indirect, that might be construed as prejudicial in any way to the professional judgment of the practitioner in rendering service to the client.*

5. *A practitioner who is an employee-engineer and is contracting in the practitioner's own name to perform professional engineering work for other than the practitioner's employer, must provide the practitioner's client with a written statement of the nature of the practitioner's status as an employee and the attendant limitations on the practitioner's services to the client, must satisfy the practitioner that the work will not conflict with the practitioner's duty to the practitioner's employer, and must inform the practitioner's employer of the work.*

6. *A practitioner must co-operate in working with other professionals engaged on a project.*

7. *A practitioner shall,*

    i. *act towards other practitioners with courtesy and good faith,*

    ii. *not accept an engagement to review the work of another practitioner for the same employer except with the knowledge of the other practitioner or except where the connection of the other practitioner with the work has been terminated,*

    iii. *not maliciously injure the reputation or business of another practitioner,*

    iv. *not attempt to gain an advantage over other practitioners by paying or accepting a commission in securing professional engineering work, and*

    v. *give proper credit for engineering work, uphold the principle of adequate compensation for engineering work, provide opportunity for professional development and advancement of the practitioner's associates and subordinates, and extend the effectiveness of the profession through the interchange of engineering information and experience.*

8. *A practitioner shall maintain the honour and integrity of the practitioner's profession and without fear or favour expose before the proper tribunals unprofessional, dishonest or unethical conduct by any other practitioner. R.R.O. 1990, Reg. 941, s. 77; O. Reg. 48/92, s. 1; O. Reg. 13/03, s. 21; O. Reg. 71/15, s. 24.*

The Code of Ethics contains the words: fairness, loyalty, fidelity, devotion, honour, professionalism, competence and conviction. These are strong words for which we all have a general idea of their meaning, but at the same time they are very abstract words. For this reason, Engineers-In-Training, (EITs) are given some practical examples in their Professional Engineering Practice books and exams to help them understand the concepts. We have followed a similar course in this paper and have used our own examples to illustrate how we have addresses ethics during our career as Civil Engineers.

3 AUTHORS' EXAMPLES

3.1 Duty to Report

The code of ethics states "a professional engineer shall regard the practitioner's duty to public as paramount". Following from this is an understanding that if there is a matter of public importance for an engineer, (practitioner) to speak up on an issue then he is compelled to do so and report on the issue whether it be safety or another issue of serious public concern. This does not mean that the engineer needs to go around and inspect everything he sees and report but rather to report on only those issues that come to their attention that fall under their judgment based on their professional training. With this understood, we list below a couple of examples the authors have found where this applied in their career.

While driving one day one of the authors noticed a retaining wall that had been severely undermined by the washing away of embedment soil at the base of the wall on a steep slope. Although the wall was not in jeopardy of immediate collapse it presented a situation that needed to be repaired, otherwise a more serious

situation could develop in the future. This author also knew that most people viewing the current situation would not understand this to the level they did, because of their intimate knowledge of retaining wall designs. If they did not report this situation, it was very likely that it would go unreported and could escalate to a dangerous situation. It was reported to an appropriate engineer they worked for the owner of the wall. That engineer under his “obligation to the public and his employer” ordered a repair which was carried out within a few weeks. This was an easy one. As an engineer acting completely outside of any contractual obligations the author fulfilled his “duty to report” and prevented a dangerous situation from arising. Not all situations are as simple.

A far more complicated scenario is when a competitor presents a design or product detail which you feel is not consistent with the engineer’s obligation to the public as paramount. In this case an engineer is torn between his “duty to report”, and 6 iii) of the Code, “not maliciously injure the reputation or business of another practitioner”. In addition to the ethical challenge the situation also brings up a legal challenge. Many years ago, a company with which we are familiar endeavored to raise attention to what they believed to be an unsafe design by their competitor. They were delivered with a court injunction which required them to cease and desist any further statements on the issue. The first company complied with the injunction and the questionable practice by the competitor continued. Often the practice of an engineer can be influenced by more than the code of ethics and is sometimes strongly influenced by legal or commercial powers.

3.2 Ethical Design, Prudency and Redundancy

Section 1 v) of the Code of Ethics reads that “the practitioner is to act at all times with competence in the performance of any professional engineering services that are undertaken.” When the engineering service is design, there is often much guidance to the designer in the form of codes and manuals. In some cases, such as during the first decades that MSE design was introduced in Canada there was no detailed coverage in the codes and the design engineer had a very broad range of flexibility from which to operate. Without detailed coverage in the codes the design engineer must rely more on their judgement, ethical decisions and concepts such as prudency and redundancy. We relied on the performance record of previous designs and tried and tested factors of safety and avoided probabilistic design methods.

Some of the design principles that we have used include:

Design for Serviceability Limit States in addition to Ultimate Limit States with respect to settlement tolerance and connection design to address deformations and not just tensile requirements

Design for end of life so that all factors of safety are still in place at the end of the design life and after all time dependent changes accounted for such as corrosion of steel or creep of plastic

For permanent structures, utilize only material that has been extracted and tested from installations in service for more than 10 years to reduce extrapolation risk

Recognize structures of high security such as true bridge abutments and rail loading

Recognize security levels concerning the land use immediately above and below retaining structure and impact and damage of a failure

3.3 “Low Bid” Procurement Environment

Our experience with private owners is that they are very willing to look at the best value and not just the lowest price. If a product has better quality, supported by better service, and is marginally higher in price, the owners of private companies are pleased to select the higher priced product, particularly when the more expensive product has a greater reliability and requires less maintenance. This is particularly true of mining companies where repairs result in the shutdown of operations resulting in the loss of millions of dollars per day.

The same is not true in the “low bid” procurement environment currently used by our governments and their contracting industry in Canada. Under this practice the builders will provide the owner with the product or construction which is of the very lowest quality and price that still meets the owner’s specifications, sometimes very marginally and sometimes not at all. At times the low bid environment seems completely in conflict with the engineer’s duty to the public welfare. It is a challenge indeed for owners to minimize the spending of tax payer’s dollars while at the same time ensuring a safe and reliable design. The way in which our governments endeavor to achieve this is through use, and enforcement, of a strong specification which sets a minimum standard of quality that must be achieved.

This raises a question that is covered in the book, Professional Engineering Practice, Ethical Aspects, by C. Morrison and P. Hughes, 1982. Question number five in this book reads as follows:

For many years the XL Company has manufactured a product that has enjoyed a high rating with the industry and the public. Competing manufactures have now introduced a similar product of lower quality at a lower cost. To meet this competition XL Company instructs its engineers to redesign its product so it may be made available to the market at a lower price. Some of the engineer’s question whether this action would be consistent with the Code of Ethics because a lower quality product under the same brand name would mislead the public into accepting a product of lesser quality in the mistaken belief that it meets the higher quality standards with which the product has been associated in the public mind for many years.

Having found ourselves in a similar situation we offer our perspective.

Prior to resigning ourselves to the fact that we must redesign our product to a lower quality and cost we believe that any company found in this situation should first explore, the alternative of educating their clients to appreciate and clearly specify the higher quality standard. However, if the clients are fully knowledgeable on the safety and durability risks of the lower quality product, but still prefer it, there can be an opportunity to introduce a lower quality product. In fairness to their client we believe it should be branded under a different product name and the differences and shortcomings of the lower quality product should be clearly explained in detail to the client.

3.4 Conflict of Interest

There are many opportunities for a conflict of interest to arise during the business activity of a civil engineer. One that we have found often surfaces is on projects where the owner requires the MSE wall design/supply engineer, the business of the authors, to sign a Certificate of Conformance that the wall was constructed in accordance with the drawings and specifications of the project. Since the supplier is directly retained by the contractor he is in a position of a conflict to either supervise the contractors work, or report on his work objectively in the form of a Certificate. A similar conflict was recently identified by the Auditor General Report for the Ministry of Transportation of Ontario for when the contractor had hired a Quality Verification Engineer to review the contractor’s quality. The concern was that the Verification Engineer could not objectively evaluate the contractor since he was working directly for him and being paid directly by him, resulting in a conflict of interest.

Although we feel this conflict with respect to our work should be avoided by the owners revising the contractual arrangement of the parties, and are involved in an ongoing lobby to achieve this, it currently does exist on some projects and we must find a way to ethically deal with it. The challenge arises when the contractor does not adhere to the specifications and presents us with the Certificate of Conformance and tells us we must sign it or we will not be paid. Yes, this has happened more than once. How do we deal with this?

One theoretically possible option, which is clearly not acceptable, is for us is to falsely report on the Certificate that all construction was in accordance with the specifications. We would never do this for many reasons, one of which includes the ethical behavior as an engineer whose Code of Ethics in 1 iii) state “the practitioner to act at all times with devotion to high ideals of personal honour and professional integrity.” Falsely reporting would clearly not align with this requirement.

The option which we have elected to follow, and maintain our ethical practice, is to complete the Certificate of Conformance with any exceptions clearly identified so the owner can see exactly what was outside of the specifications. We also make ourselves available to the owner through the contractor, our client, to give our personal professional opinion on the consequences that the deviation from the specification will have on the structural integrity and durability of the finished structure.

3.5 Cooperation with other Practitioners

Section 6 of the Code of Ethics reads that "a practitioner must cooperate with other professionals engaged on a project". This is an area we have found very fulfilling during our professional career. Our involvement in projects with other engineers, in particular during the design stage, involves an understanding and knowledge of not only our area of expertise concerning retaining walls, but also the area of expertise of the other professionals, typically Geotechnical and Structural Engineers. In our effort to cooperate with these engineers we have found one of the most useful techniques is to have a basic level of knowledge of their aspect of work. In the field of MSE design the scope of responsibilities are pretty clearly defined between the Structural, Geotechnical and MSE designer so one may conclude at first glance, that it is not necessary to have any knowledge in an area for which one is not responsible.

Some of the specific tasks which we routinely carry out are to read the Geotechnical Report and also review the detail bridge design for abutment walls. Although we are not responsible for either, we have found it very beneficial and have often uncovered some inconsistencies about assumptions for which we raise the issue to the design team.

3.6 Cultivating a Culture of Ethics in a Company

To a very large degree ethics is a cultural concept consisting of a set of beliefs shared by a group. In our case the group can actually be a number of groups, including our region of the world, our country, our profession and, last but not least, the company for which we work. In corporations the culture often comes from the head of the organization. When first hired by a new company an individual can quickly see the value system held by the senior management; is it sales, profit, safety, engineering principals, quality, or customer service? It can be any of the above and is often a combination of several of these. One of phrases which has been repeated numerous times by a member of our executive is, "Gentlemen, (and ladies) we are engineers first." This is followed by a gesture pointing to the iron ring worn on the small finger. This is usually at a time in the conversation where the discussion is focused on the balance between cost and quality or safety. Our staff knows what is meant by this phrase. We all appreciate the support by top management given to ethical conduct and to not cut corners on design or quality or safety, simply due to financial pressure.

One of the areas where our company's ethical mandate is most obvious is with respect to our safety culture. Through a large effort by our management the safety culture in our company has evolved from something that we first only "talked about" to "the way that we do business around here." This safety culture has spilled into our private lives.

3.7 Promoting Professional Development

Under section 6 v) of the Code of Ethics it reads, "a practitioner shall provide opportunity for professional development and advancement of the practitioner's associates and subordinates and extend the effectiveness of the profession through the interchange of engineering information and experience."

Some of the ways in which we have accomplished this in our company include promoting involvement in learned societies, both by attending the meetings and conferences and also by volunteering to sit on the committees. In some cases, our involvement with the learned societies is extended to corporate sponsorship of the annual conferences. In addition to this, we promote the exchange of information by authoring of papers for such conferences. More recently we have been granted the opportunity to be involved in the writing and editing of a portion the Canadian Highway Bridge Design Code.

4 CONCLUSIONS

As professional civil engineers in Canada, we have many occasions during our career to adhere to our Ethics while making decisions, the challenge of which reaches far beyond the calculations involved in an adequate design. We feel that the best way to maintain ethics in your career is by applying them to every aspect in your daily work. In addition, it is important to develop at a corporate level a culture of ethics in a company, and by promoting professional development.

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