Geotechnical Risks, Liabilities and Mitigative Measures An Engineer's Perspective

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ABSTRACT
Risk and liability in geotechnical engineering has changed and increased significantly since this topic was addressed during the 1988 VGS Symposium. Further changes, some positive but many negative, have already occurred or are likely to develop in the future. This paper presents an overview of some of the significant changes over the last 20 years which have or could have significant impact on the risks and liability of geotechnical professionals. Some of the changes considered particularly important with respect to risk and liability include: the Station Square (Save-On) collapse and resulting Closkey Commission report, the introduction and implications of the BC Building Code Letters of Assurance, the Association of Professional Engineers and Geoscientists of BC (APEGBC) March 1998 Guidelines for Geotechnical Engineering Services for Building Projects and the associated Guidelines for other engineering professionals, the March 2006 APEGBC Guidelines for Legislated Landslide Assessments for Proposed Residential Development, and a recent BC Court of Appeal judgment on the limitation of liability of municipalities.

1 GEOTECHNICAL PRACTICE AND LIABILITY RISK - UP TO 1988

At the time of the May 1988 VGS Symposium, the 1985 BC Building Code established the requirements for engineering services related to building projects. Those aspects of the Code applicable to geotechnical engineers were generally limited to Section 4.2, titled Foundations, some 6 pages in length of a total of 447 pages, excluding appendices. Although not specifically referenced in the 1985 Code, guidance on methods of geotechnical investigation and analyses was available in the Canadian Foundation Engineering Manual, published by the Canadian Geotechnical Society in March 1978.

Then as now, geotechnical engineers were typically retained either directly by the property owner/developer or as subconsultants to a prime consultant, often an architect or civil engineering consultant. However, prior to 1988, the scope of the geotechnical engineer's services was frequently limited to investigation and provision of a geotechnical report providing an interpretation of anticipated subsurface conditions and recommendations on site preparation and foundation design. Although recommended by legal professionals and engineering organizations, many geotechnical engineers did not enter into formal contracts with their clients, unless the client insisted. In those cases, the contract was typically based on the client's contract terms and conditions. More commonly, geotechnical engineers provided their clients with a proposal and cost estimate letter, with no specific contractual terms and conditions. In some cases, geotechnical services were provided based on a "handshake" or telephone conversation.

Typically, the regulatory authorities did not require confirmation that projects had been reviewed and constructed in accordance with the geotechnical engineer's recommendations. At most, some municipalities or regulatory agencies required a short letter from the prime consultant confirming that the work had been carried out in accordance with the approved plans. Further, it was not uncommon for the owner/developer or prime consultant to exclude geotechnical engineers from involvement during the construction of the projects, in particular for those projects where subsurface conditions were considered to be favourable by the owner or prime consultant. Although contrary to the 1985 BC Building Code, some owners or their consultants specified pile capacities on their drawings and contractors then installed and certified achievement of these capacities without independent monitoring or review. This practice continued until about the early 1990's, when contractors became aware of the conflict of interest risks and liabilities they were accepting in doing so.

As described in some of the 1988 papers, geotechnical engineers were exposed to claims. However, such claims were generally less frequent than at present and typically involved other members of the project team rather than third parties. Then as now, the major factors resulting in claims were miscommunication or differing expectations of the various parties. In particular, cutting back on the scope of the investigations and design services, whether carried out voluntarily or at the request of the client, and/or recommending lower cost methods without clear, written identification and acceptance by the owner of the risks as well as the benefits of these approaches resulted in the transfer of risk and liabilities to the geotechnical engineer. Claims were brought against the engineer when the risks had adverse impact on project schedules and costs.

2 STATION SQUARE COLLAPSE AND THE CLOSKEY COMMISSION ENQUIRY

On April 23, 1988, the roof of the newly constructed Station Square (Save-on Foods) building collapsed on opening day. Fortunately, but by sheer good luck that an overhead sprinkler line burst, alerting staff and customers in the building to the impending failure, the roof collapse did not result in loss of life or large numbers of injuries. However, this sudden, very public collapse of a new building resulted in public outcry and questioning by society of the reliance on trust that professions will effectively govern and discipline themselves to protect the public safety and interest.

On May 6, 1988, less than two weeks after the Station Square collapse, the Provincial government ordered a formal Inquiry into the building collapse, with Mr. Dan Closkey serving as Commissioner. The terms of reference of this Inquiry were:

- *"to report on any and all circumstances surrounding, leading to or having any causal connection with the collapse of a portion of the Station Square Development"* and
- *"to ascertain and recommend measures that could serve to prevent similar tragedies in the future."*

The Inquiry held ten days of hearing between the end of May and early July 1988, during which 47 witnesses voluntarily gave testimony, including the engineers responsible for the structural design and an independent review of the Station Square development. The final report of the Inquiry was issued on August 26, 1988. In summary, the Inquiry concluded that the roof collapse was caused by a combination of various changes or errors in both design and construction, of which

- *"Any one alone would not have resulted in collapse, being partially compensated by factors of safety. However, taken together, failure was inevitable."*

The Inquiry Report contained a series of some 19 recommendations on changes in the way in which building projects are developed, designed and constructed, with emphasis on the establishment of clear and well-defined lines of communication and responsibility of the various persons or groups involved in such building projects. These various recommended changes were summarized in the Report as follows:

1. Provision be made for the audit of structural engineering drawings and calculations for major buildings selected by municipalities and reviewed by independent engineers, with the cost borne by a special levy on municipal building permits.
2. Structural engineers to be required to pass a special examination before becoming professionally qualified, and should be required to carry specified limits of professional liability insurance.
3. A provincial manual of recommended construction practices and procedures to be developed to clarify responsibilities of owners, architects, engineers and suppliers in construction projects.
4. The Minister of Municipal Affairs, Recreation and Culture to appoint a three-member task force to oversee implementation of the recommendations.
5. Standard documents under the building code to be used throughout the province for major buildings, to assign responsibilities among owners, architects and engineers.
6. Architects and engineers to be primarily responsible for ensuring compliance with the building code for major buildings, with building inspectors to play a secondary administrative role.
7. To strengthen standards within the engineering profession, engineering firms to be registered with the APEBC (now APEGBC), in addition to registration of individual engineers. The Association to be authorized to prescribe a minimum fee schedule, to be approved by Cabinet.
8. Provincial standards of practice to be established for major building design and calculations.
9. Municipal bylaws to be updated to refer to the current B.C. Building Code.
10. Steel industry construction manuals to be revised to provide more accurate assistance to engineers.

The recommendations of the Station Square Report were reviewed in detail by industry, regulatory and professional bodies in British Columbia. After a series of discussions of the merits, issues, and concerns related to time and cost implications, as well as the potential for additional fragmentation of responsibility for building projects, it was decided not to proceed to the recommendation (No. 1) for independent audits or reviews of building design. However, of note for geotechnical engineers, the City of Seattle and some other municipalities in Washington have a comparable requirement for independent review of designs and calculations for temporary excavation and shoring, while some other US jurisdictions (Phoenix) require independent review of structural plans and analyses.

Consensus developed that the Engineer(s) of Record and other professionals involved in building projects should have clear, well-defined primary responsibility for the design and review of building projects. Some other recommendations, such as a prescribed minimum fee schedule were in conflict with Federal Government competition laws and regulations, while others were beyond the effective control of the professional bodies, municipal and provincial authorities.

Although the 1985 BC Building Code remained in force and contained no specific provision for allocation of responsibilities of the owners, architects and various engineering or other professionals, a number of municipalities and other regulatory authorities developed various "letters of assurance" and required that most or all engineers, including geotechnical engineers issue these "letters" as a requirement for the owner/developer to obtain a building permit. However, there was no consistency or uniformity between the "letters" required by differing authorities in the responsibilities of the various parties involved in the building projects or in the wording of the documents. Some of these documents required confirmation of field reviews while others did not and some documents did not differentiate clearly, in some cases

not at all, between the responsibilities of the various professionals involved in a project. These variable "letters of assurance" resulted in confusion and potential for error or misunderstanding by both professionals and building officials in determining what was actually needed and required. As a result, the risk of and potential for responsibility and liability increased significantly due to these uncertainties.

3. 1992 BRITISH COLUMBIA BUILDING CODE AND LETTERS OF ASSURANCE

Due to the concerns and input on the part of both the various professionals and the municipalities or other stakeholders about the high degree of variability and potential unknown liabilities resulting from the variable "letters of assurance" being used, the Ministry of Municipal Affairs developed the 1992 B.C. Building Code, which was issued in 1995. This 1992 Building Code specifically included the requirement for use of standardized Letters of Assurance A, B-1, B-2 and C (now C-B) in which the responsibilities of the various design professionals, as well as coordinating professional or owner are identified. These Letters of Assurance applied to all municipalities or similar regulatory authorities covered by the Municipal Act. The City of Vancouver, which operates under a Charter, developed and required the use of generally comparable Letters of Assurance.

The subsequent updates to the B.C. Building Code, in 1998 and 2006, have maintained the Letters of Assurance, with only minor adjustments, such as electronic versions, to facilitate use.

In the case of geotechnical engineers, a qualified, registered professional is required to accept responsibility for the design and field reviews of temporary, as well as the permanent geotechnical aspects of the project. As part of the 1992 B.C. Building Code, a Guide was published, which describes the responsibilities of the various parties involved in a building project, as well as the scope and definitions of the Letter of Assurance. However, this Guide does not address or define the scope of work normally required for a typical project, or the various phases of the project from feasibility level to detailed design and construction. In addition, the meaning and requirements of the various items listed under Geotechnical - Temporary and Permanent was not described or defined in the Guide. As an example, under the item "dewatering" some regulatory authorities asserted that geotechnical engineers are professionally responsible and liable for collection, control and permitting for water generated from precipitation, snowmelt and minor seepage although this work typically requires no engineering design, and is normally the responsibility of the contractor.

4. GUIDELINES FOR ENGINEERING SERVICES FOR BUILDING PROJECTS

As a result of the recommendations of the Closkey Inquiry Report, and the consensus that that engineers and other professionals should have clear, well-defined responsibility for design and field review of building projects, APEGBC, in consultation with other professional bodies, established a sub-committee consisting of individual engineer members and Association staff. In February 1993, the Association finalized and published the Guidelines for each of Structural, Mechanical and Electrical Engineering Services for Building Projects. These Guidelines presented the standards of practice which engineers should meet and follow in providing professional engineering services. They also describe and define the responsibilities of the various participants commonly involved in a building project, as well as the scope of services a professional engineer would normally be expected to provide for the various disciplines or differing aspects of the project. Although no guidelines for geotechnical engineering services were developed as part of these 1993 publications, the Guidelines for Structural Engineering Services made several references to geotechnical engineering input requirements.

Commencing about 1994, the Association established a Task Force consisting of practicing geotechnical engineers, plus structural engineering representatives. Utilizing the previously developed (1993) Guidelines, together with the National Practice Guideline for the Geotechnical Engineer of Record developed by ASFE (Professional Firms Practicing in the Geosciences), a series of draft guidelines were prepared and circulated to other geotechnical and structural engineers for comment and input, in addition to that of the Association. Following consensus, the Guidelines for Geotechnical Engineering Services for Building Projects was published in March 1998. Similar to the previously published Guidelines covering other engineering disciplines, the Geotechnical Guidelines presented the standards of practice which engineers should meet and follow in providing professional engineering services, definition of the responsibilities of the various participants commonly involved in a building project, as well as the scope of services a professional engineer would normally be expected to provide.

In addition, based on experience related to misunderstanding or misinterpretation of the various items identified in the Letters of Assurance applicable to geotechnical engineers, Appendix A of the Geotechnical Guidelines provides clarification and definitions of these terms set out in Schedules B-1, B-2 and C which relate to current geotechnical engineering practice in British Columbia. Of specific relevance, Appendix A identifies that environmental aspects related to soil and groundwater contamination do not form part of the geotechnical items in the Letter of Assurance schedules or the normal scope of work for geotechnical investigation and design. The Guidelines also describe the respective scope of work and responsibilities of the Geotechnical Engineer of Record for the building project and that of Specialty Engineers who may be retained to provide geotechnical services for other aspects of the project.

5. LANDSLIDES AND LANDSLIDE ASSESSMENT GUIDELINE

Although geotechnical engineers, among others, have been conducting investigations and assessments of slope stability and landslide potential for many years, both for urban residential areas and for other uses (roads, dams and the like), no specific requirements for such analyses for residential development had been established. Various pieces of provincial legislation, and some municipal bylaws, required that landslide assessments be carried out by Professional Engineers and more recently, by Professional Geoscientists, to determine if a residential development will be "safe" from the effects of landslides.

However, acceptable levels of "safety" had not been defined or adopted for most, if not all, of British Columbia. Since it is not the role or within the authority of a professional engineer or geoscientist to define such levels of "safety", but that of the local or provincial government bodies representing societal values, the lack of accepted and adopted levels of landslide safety leaves the professional involved in landslide assessment in a difficult position, with potentially high risk and liability.

Due to a series of recent landslide events, some of which resulted in injury and death as well as property damage, in 2005 the Association established a task force of geotechnical engineering and geoscience professionals to develop draft guidelines for landslide assessment. The initial draft documents were reviewed by an Internal Review Task Force consisting of other geotechnical and geoscience professionals, as well as other stakeholders, plus an External Review Group. The Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia was published in March 2006. This Guideline provides a summary of relevant legislation governing or applicable to landslide assessment, as well as the roles and responsibilities of the various parties involved in a proposed residential development which is or may be subject to landslide hazard. It also provides a description of the overall objectives and standards of professional practice related to landslide hazard and risk assessment, although it identifies that professional judgment should determine the specific methods of investigation and analyses. The Guideline also presents recommendations on the typical information to be provided in a landslide assessment report, including the limitations, assumptions and uncertainties associated with the hazard identification and risk assessment.

While this Guideline provides professionals with a description of the standard of practice, to date there is no consensus related to the level of risk considered "safe" within British Columbia. Ministerial Order No. 268, issued by the Minister of Forests and Range and Minister for Housing, and dated December 7, 2006 and the Building Policy Branch Information Bulletin, dated December 14, 2006 titled "Assessment of Seismic Slope Stability" state that the risk of geotechnical slope hazard occurrence under earthquake loading conditions must be based on ground motion values having 10 percent probability of occurrence in 50 years, although this differs from that required for design of structures under the 2006 BC Building Code. Some municipalities or other regulatory authorities, such as North Vancouver District, apply criteria related to the risk of death of an individual, with differing criteria for existing and proposed residential developments.

Irrespective of the specific risk criteria utilized, geotechnical and geoscience professionals involved in landslide assessment remain exposed to risk and potential liability due to the inherent limitations resulting from variations or uncertainties associated with soil and groundwater properties, frequency of past landslide events and the applicability to future development, among other aspects or factors.

6. 2006 COURT OF APPEAL JUDGMENT – PARSONS V. FINCH

About 1993, an owner (Parsons) retained an engineer (Finch) to carry out a geotechnical investigation and report, as required by the municipality in support of a Building Permit application to construct a single family residence, as well as a field report once the site was prepared in accordance with the engineer's recommendations. The engineer provided a report presenting recommendations on excavation of peat and preparation of the site, signed and sealed plans of the structure and of the foundations as modified by him, including certification that the structural and geotechnical components of the plans and supporting documents were in compliance with the BC Building Code. The engineer also provided a field report when the site preparation had been completed giving his assurance that he had conducted a subsurface investigation and that site preparation for the building had been carried out in accordance with his recommendations. Following completion of construction of the residential building, it experienced significant and variable settlements. The owner retained another engineer to conduct an inspection after the settlements had become apparent. This second engineer determined that the extent of peat removal had been variable and provided an opinion that both the initial site investigation and the field inspection during site preparation had been inadequate. The remedial work necessary to maintain the house in a habitable state was expected to be in excess of $300,000.

The owner filed suit against both the engineer and the municipality, claiming negligence on the part of the municipality. In 2005, when the claim against the municipality was dismissed by the court, the owner filed an appeal. In late 2006, the BC Court of Appeal also dismissed the claim against the municipality. The various reasons given for the dismissal are summarized as follows:

- The municipality was not negligent since it made a policy decision to utilize a "professional design" process as set in its bylaw since the structural components of the building fell within Part 4 of the BC Building Code and the building inspector had determined that a subsurface

investigation was warranted. As a result of this policy decision, the municipality was immune from negligence liability in failing to inspect the site preparation.

- The municipality met an appropriate standard of care in that municipal staff ensured that a geotechnical report was prepared and provided, that information related to bearing capacity of the foundations was present on the drawings provided by the engineer, and that the necessary letters of assurance of work carried out, including field reviews, were provided by the engineer in conformity with the building bylaw.
- The municipality had advised the owner in writing that it would rely on the geotechnical reports, plans and field reviews provided to it by the engineer in issuing the Building Permit and that the municipality would conduct no geotechnical inspections itself.
- Although the owner alleged that the plans for the foundations of the house did not conform to the Building Code, the municipality is immune from liability as a result of Section 755.4, enacted in 1990, of the Municipal Act (now the Local Government Act), which states:

If a municipality issues a building permit for a development that does not comply with the Provincial building code or other applicable enactments respecting safety, the municipality must not be held liable, directly or indirectly or vicariously, for any damage, loss of expense caused or contributed to by an error, omission or other neglect in relation to its approval of the plans submitted with the application for permit if:

a) *A person representing himself or herself as a professional engineer or architect registered as such under Provincial legislation certified, as or on behalf of the applicant for the permit, that the plans or aspects of the plans to which the non-compliance relates complied with the then current building code or other applicable enactment to which the non-compliance relates, and*

b) *The municipality, in issuing the building permit, indicated in writing to the applicant for the permit that it relied on the certification referred to in paragraph (a).*

Since the engineer had certified on behalf of the owner that the plans for the construction of the house complied with the code and the owner acknowledged that they had been advised in writing that the municipality was relying on the engineer's certification, the municipality was immune from liability.

7. SUMMARY – CHANGES IN RISKS AND LIABILITY

The most important and effective means of minimizing exposure to the risk of claims and liability against geotechnical engineers is a combination of suitable technical analyses and reporting for the specific project, together with development and maintenance of good communication with the client, including clear definition of the scope of work to be carried out, as well as the limitations, uncertainties, and risks associated with interpretation of subsurface conditions and the various options or alternatives considered for use.

Of the various changes that have occurred since the 1988 VGS Symposium on Risk and Liability, the incorporation of standardized letters of assurance as part of the BC Building Code, together with the development and publishing of Guidelines for Engineering Services for Building Projects has been generally positive with respect to risk and liability. These documents and practice guidelines provide a clear definition of the responsibilities of the various parties involved in a project, and provide a basis for discussion and agreement between these parties, and potentially the courts, on the standard of care expected of geotechnical engineers.

The more recent Guidelines for Landslide Assessment also provide a positive influence in identification of the responsibilities of the various parties and standards of practice considerations. However, the continuing lack of a consensus or established criteria on the level of safety at municipal and provincial levels, combined with the inherent uncertainties with or lack of information related to landslide hazard and risk analysis leave geotechnical engineers and geoscientists exposed to risk and liability resulting from both differing expectations and interpretations by other parties.

Unfortunately, a series of other factors or developments have arisen or expanded, which result in some or significant increase in the risk of claims and associated liability. There is a general increase in use of litigation throughout society, which has adverse impact on geotechnical engineers. In addition, the relatively recent availability or use of contingency fee services by the legal profession provides claimants with a "no cost" means to advance claims, which must be defended at the engineer's or their insurer's cost. Given the court's reluctance to dismiss anything other than the most frivolous of claims, geotechnical engineers, or their insurer, often must make a business decision whether or not to reach a settlement with a claimant. Although the risk of class action claims against geotechnical engineers does not appear to be high at present, other professionals, in particular architects and building envelope specialists, have been significantly impacted and the potential for inclusion of geotechnical engineers as part of an overall claim against all parties involved in a project remains significant.

Another negative risk factor for geotechnical engineers, in common with other professionals, is the long term liability of professionals in relation to other parties involved in projects. Many, if not all, developers establish project specific companies which are dissolved or left with no assets within a relatively short period of time following completion of the project. Some contractors and other parties establish similar corporate structures and, in any case, typically are subject to relatively short warranty periods for poor or unsuitable workmanship. As described above, municipalities and other equivalent regulatory authorities can transfer responsibility and liability to geotechnical engineers and other professionals and, based on the recent BC Court of Appeal judgment, can obtain immunity from claims, whether or not the municipality errs in accepting non-Code compliant designs or conducts

inspections of the projects.

As a result, geotechnical engineers, and other professionals, often are "the last man standing" when a claim arises at some time after the project is completed. This is particularly onerous in British Columbia, which maintains the legal doctrine of "joint and several liability", in which a defendant with assets or insurance, such as a geotechnical engineer, can be responsible for 100 percent of the claim, even if only 1 percent responsible, if other parties are no longer available or have no assets.

8. MITIGATIVE MEASURES

As a result of the increased risk of claims and liability or the need to consider negotiating a settlement agreement, many geotechnical engineers and firms have established terms and conditions under which they will carry out work for clients. Since the geotechnical involvement and fees are often a very small proportion of the overall cost or value of a project, these terms and conditions may include limitations on the maximum amount for which the geotechnical engineer will be liable, the maximum time over which a claim can be advanced, and limitations on who may use or the time over which a report or other document prepared by the geotechnical engineer remains applicable. While these limitations do not apply to third party claimants, these contract terms and conditions do reduce the risk and magnitude of liability to the various parties involved in a project, typically the source of most claims.

To identify the current trends in standard client-consultant conditions, a brief survey of a selected number of engineering consultants was undertaken.

Based on the information obtained, which was shared with the consultants as it was developed, some consultants (typically, but not exclusively, the smaller engineering firms) modified their contract terms to those shown in the table presented below. Seven of the fourteen firms revised their standard conditions with respect to limit of liability, and four of the fourteen firms revised their time limit for claims. No firms increased their limit of liability or their limit for claims. All firms were aware of the need for some form of non-reliance clause for third party exposure.

The common theme in the discussions during the survey was that these terms and conditions were typically applicable to projects such as houses, condominiums, apartment blocks, or private commercial enterprises, but not normally to projects for municipal, provincial, or federal governments. Civil engineering consultants also routinely request increased limits, and can be difficult to deal with, given their apparent willingness to offer higher limits of liability to their clients.

9. CONCLUSIONS

From a geotechnical engineer's perspective, there have been significant changes in the regulatory environment in the last 20 years. These changes have had a significant effect on risk and liability issues. While the opportunity for increased involvement in projects has been positive in some respects, the practical aspects of risk and liability have continued to worsen, primarily due to a general increase in litigation within society. As a consequence, geotechnical engineers have now recognized that they must place limits on their exposure to becoming the project "insurer" through the transfer of risks and liability from owners, developers, or other parties to construction who would otherwise be held responsible. Such limitations are now a normal part of current geotechnical engineering practice.

Table 1. Summary of Current Trends in Limitations of Liability.

Consultant	Limit of Liability	Time Limit for Claims	Third Party Reliance
AMEC	lesser of $50,000 or fees	1 year	non reliance in report
Beacon Geotechnical	$50,000 or fees	2 years	non reliance in attachments
Calibre Geotechnical	$50,000 or fees	2 years	non reliance in attachments
Cascade Geotechnical	$50,000 or fees	2 years	non reliance in attachments
EBA	Fees	2 years	non reliance in attachments
Geonorth	$50,000	2 years	non reliance in report
Geopacific	lesser of $50,000 or fees	2 years	non reliance in report
Golder Associates	Greater of $50,000 or fees	2 years	non reliance in text and attachments
Horizon Engineering	lesser of $50,000 or fees	2 years	non reliance in report
Interior Testing	$5000	2 years	non reliance in attachments
Jacques Whitford	lesser of $50,000 or fees	6 months	non reliance in text
Levelton	$50,000	2 years	non reliance in report
Thurber	Fees	2 years	non reliance in attachments
Trow Consultants	lesser of $50,000 or fees	2 years	non reliance in attachments