



**PROPOSAL TO ESTABLISH A TYPE A CENTRE:  
SASKATCHEWAN CENTRE FOR  
MASONRY DESIGN**

**Prepared for  
University of Saskatchewan Centres Committee**

**PROPOSENTS:**

Dr. Bruce Sparling, Dr. Gordon Sparks, Dr. Leon Wegner,  
Dr. Moh Boulfiza, and Dr. Lisa Feldman

Department of Civil and Geological Engineering

**CONTACT:**

Bruce Sparling, Ph.D., P.Eng, Professor  
Department of Civil and Geological Engineering  
University of Saskatchewan  
57 Campus Drive  
Phone: 966-5366  
Fax: 966-5427  
Email: [bruce.sparling@usask.ca](mailto:bruce.sparling@usask.ca)

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## EXECUTIVE SUMMARY

A proposal for the establishment of the Saskatchewan Centre for Masonry Design (SCMD) as a Type A Centre at the University of Saskatchewan is presented in this report. The SCMD will be housed organizationally within the College of Engineering, will involve scholarly activities primarily of faculty in the Department of Civil and Geological Engineering, and will report to the Dean of Engineering.

The creation of the SCMD was made possible by a \$1.25 million donation to the College of Engineering by the Saskatchewan Masonry Institute (SMI), an umbrella organization representing Saskatchewan masonry contractors, and the Canadian Concrete Masonry Producers Association (CCMPA). This initiative was undertaken by the masonry industry in response to the current shortage of masonry-related educational and research activities at Canadian universities. It was recognized that such a deficiency restricted the economic growth potential of the industry by discouraging the selection of masonry as a building material of choice by informed design professionals and limiting opportunities for technological innovation. The proposed SCMD will become part of an expanding national network of masonry centres representing a variety of industry and university organizations. As such, the SCMD presents an exciting opportunity for the University of Saskatchewan to establish itself as a leading technological resource for an industry that makes significant contributions to the regional and national economies.

The objectives of the SCMD can be subdivided into three broad categories: education, research and the advancement of design / construction standards and practices. Educational activities will include components directed at both undergraduate and graduate students, as well as outreach initiatives aimed at practicing design professionals and contractors. Target research areas have been strategically selected to utilize and enhance existing expertise and facilities, and will include the application of advanced materials, full-scale structural testing and monitoring, durability modelling and improvement, and life-cycle costing and engineering studies. Finally, faculty in the SCMD will be actively involved in the advancement and dissemination of masonry-related design standards and best-practice guides developed by national and international bodies.

The management structure of the SMDC will include a management committee, a director, an industrial advisory committee, a scientific oversight committee, and participating faculty and staff. The management committee will feature membership representing the masonry industry and university, and will be chaired by the Dean of Engineering (or his designate); the committee will be responsible for guiding the strategic direction of the centre and approving funding proposals for centre-related initiatives. Reporting to the management committee, the director will oversee all SCMD operations and prepare annual reports for the committee detailing the centre's activities, financial transactions and proposed upcoming initiatives. To establish links with, and obtain input from, a broader constituency, an advisory committee representing various levels of government, business and professional organizations, and others with ties to the masonry industry will be consulted on an as-needed basis by the management committee. The scientific oversight committee will comprise participating faculty who will help determine the strategic direction of research activities, vet research proposals and act as research leaders for individual projects. Research projects will be selected based on a set of predefined criteria which will include the relevance of potential projects to industry needs, their fit with existing areas of expertise and research facilities, and the uniqueness of the project in terms of the national research milieu.

The primary source of funding for the SCMD will be generated by an endowment created using \$900,000 of the \$1.25 million donation. Of the remaining portion of the donation, \$100,000 will be used for initial operating and set-up costs, while \$250,000 will be used to leverage additional financial support from other sources, including the provincial government, NSERC and the Canadian Mortgage and Housing Corporation, among others to support research activities and enhance equipment and facilities in the existing Structures Laboratory. In addition, the existing Gunnar Hagblom scholarship fund, which is currently valued at approximately \$200,000, will be used to generate additional funds for supporting graduate student research. The majority of SCMD funding will be used to support the teaching and research activities of the centre. In addition, the SCMD will help support travel for faculty to participate in masonry-related conferences, workshops and technical committee meetings, as well as providing seed money for training seminars for local design professionals and contractors.

The activities and accomplishments of the SCMD will be reviewed on an annual basis by the management committee. To the extent possible, the success of the SCMD in achieving its objectives will be quantified in terms of explicit activity milestones and detailed in the annual report to the committee. Ongoing alignment of the SCMD with the Department, College and University strategic directions and priorities will be assessed as part of the regular Integrated Planning processes to be undertaken by the College.

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## **1.0 INTRODUCTION**

### **1.1 Overview**

Although masonry is one of the oldest building materials, recent trends in sustainable building construction practices have spurred renewed interest in masonry's beneficial attributes. In addition to its inherent durability, masonry features advantageous thermal properties for potential energy savings, as well as a superior resistance to environmentally induced deterioration and mould growth. Furthermore, masonry products may be manufactured using recycled materials, can themselves be reused, and satisfy the criterion of being regionally produced, all of which contribute to enhanced sustainability over the life cycle of building infrastructure constructed using masonry.

Masonry products are also well positioned to take advantage of the rapidly evolving advances in materials technology. A wide array of largely untested options are available to improve the performance and economy of masonry assemblies, including chemical admixtures, fibre reinforcing, cementitious substitutes, synthetic lightweight aggregates, and externally applied fibre-reinforced polymer (FRP) strengthening.

In the late 1990's, the masonry industry recognized that its ability to capitalize on technological developments was being impaired by the widespread retirement from Canadian universities of faculty who had been actively engaged in masonry research. Also, the lack of masonry-related education within engineering colleges was discouraging the selection of masonry as a construction material of choice by designers who were unfamiliar with its somewhat unique characteristics. In response, the masonry industry, with leadership provided by the Canada Masonry Design Centre (CMDCC) and the Canadian Concrete Masonry Producers' Association (CCMPA), launched a major initiative aimed at fostering a network of masonry centres at selected Canadian universities. Research Chairs were subsequently established at McMaster University, as well as at the University of Alberta. The proposed Saskatchewan Centre for Masonry Design represents the latest addition to this developing network.

In February of 2009, a donation of \$1.25 million was presented to the College of Engineering, University of Saskatchewan, by the Saskatchewan Masonry Institute (SMI), an umbrella group representing Saskatchewan masonry contractors, and the CCMPA to enable the establishment of the Saskatchewan Centre for Masonry Design (denoted hereafter as the Centre). The Centre will be used to develop and maintain a strong regional base of technical expertise in all aspects relating to the analysis, design and construction of engineered masonry systems. To be housed within the Department of Civil

and Geological Engineering at the University of Saskatchewan, the Centre will provide a wide array of professional training opportunities, promote research and product development for the advancement of the local and national masonry industry, and act as a regional resource centre for the masonry industry. The Centre will also work in close cooperation with the Saskatchewan Masonry Institute and the Canada Masonry Design Centre, as well as with other masonry centres across Canada, to meet the technical needs of the engineering and masonry industries.

## **1.2 History of Masonry Teaching and Research at the University of Saskatchewan**

There has been a long and productive history of research and teaching in structural masonry at the University of Saskatchewan. Working closely with the SMI, as well as with other regional and national organizations, a number of faculty members at the University of Saskatchewan have contributed to building a viable masonry program, starting in the late 1970's. We remain committed to masonry as an area of concentration within the Structures/Materials research group and have identified masonry as an area of potential growth.

During his tenure at the University of Saskatchewan, Dr. Vern Neis led an active research program in structural masonry. Supervising seven M.Sc. students and one Ph.D. students, Dr. Neis published a total of 25 papers in refereed journals and conference proceedings in this area. Funding for Dr. Neis' research was obtained from a variety of sources, including the Saskatchewan Masonry Institute, the Canadian Masonry Research Council, the Regina Masonry Promotion Association, and the Natural Sciences and Engineering Research Council, among others. Dr. Neis taught two graduate courses in structural masonry and contributed masonry material to a senior undergraduate course. In June of 1992, the University of Saskatchewan hosted the Sixth Canadian Masonry Symposium. Approximately 120 delegates from around the world were in attendance.

Upon the retirement of Dr. Neis in 1995, the masonry program at the University of Saskatchewan experienced a temporary decline. Recognizing the importance of this subject to the local industry and to the training of our students, though, ongoing efforts have been underway since that time to revive masonry teaching and research.

With funding provided by Masonry Canada, and in-kind support from local contractors, a study was undertaken in 1998 by Dr. Bruce Sparling and Dr. Leon Wegner entitled "Cost Optimization of Masonry Rainscreen Walls: "Doing More with Less". Subsequently, working with the Saskatchewan Masonry Institute, the Canadian Masonry Research Institute, and the Canadian Masonry Design Centre, faculty in the Department of Civil and Geological Engineering have maintained an ongoing research program, with four M.Sc. students undertaking their research programs in the masonry area:

- Anna Paturova, (2006) “The influence of vertical reinforcement and lateral confinement on the axial capacity of masonry block walls”, M.Sc. Thesis– Supervisor: B.F. Sparling and L. Wegner
- Qi Hu, (2004) “The influence of joint reinforcement on the compressive capacity of concrete block masonry walls”, M.Sc. Thesis– Supervisor: B.F. Sparling and L. Wegner
- Colin Hoepfner, (2003) “Masonry walls externally reinforced with CFRP strips”, M.Sc. Thesis – Supervisor: B.F. Sparling and L. Wegner
- Kawsar Ahmed, (ongoing) “Towards Specific Development Length and Splice Provisions for Reinforced Masonry Construction”, M.Sc. Thesis– Supervisor: L. Feldman.

To help foster education in masonry analysis and design, Dr. Sparling received a \$30,000 grant from the Canadian Masonry Research Institute (CMRI) Education Foundation to establish a new undergraduate course in masonry design. The course (CE 498.3) has been offered for the second time as a senior technical elective, with an enrolment of 27 students in the 2008-09 academic year; this course has now been approved by the College to become a regular course (CE 474.3) offered on an annual basis. This initiative has received strong support from the Saskatchewan Masonry Institute, who have sponsored tours of selected construction sites and supplied textbooks free of charge to all the students. A graduate course in structural masonry was also offered in the past year.

In summary, considerable effort has been expended at the University of Saskatchewan to foster a credible research and teaching program in structural masonry. This commitment to masonry has been maintained by a broad-based team of faculty having diverse research interests. Based on this proven level of support within the faculty, as well as the strong links that have been developed with the local masonry industry, the opportunities for a vibrant centre for masonry research and teaching at the University of Saskatchewan are very promising.

### **1.3 Objectives and Proposed Activities of the Saskatchewan Centre for Masonry Design**

The primary objectives of the Saskatchewan Centre for Masonry Design include:

- Exposing undergraduate Civil Engineering students to the fundamentals of masonry analysis, design and construction;
- Providing advanced technical training at the graduate level, including students at the Master’s and Ph.D. levels;

- Fostering and supporting a broad base of state-of-the-art masonry research at the University of Saskatchewan;
- Encouraging the development of innovative masonry products and materials;
- Contributing to the advancement of masonry design standards and aids;
- Facilitating continuing education opportunities for practicing civil engineers, masonry contractors and architects; and
- Collaborating with other regional and national masonry organizations to help disseminate the latest advances in masonry to the practicing profession.

In order to achieve the objectives stated above, the following activities will be undertaken.

1. An undergraduate course in the design of masonry building systems will be offered through the Department of Civil and Geological Engineering, University of Saskatchewan.
2. A more advanced course in engineered masonry design will also be given at the graduate level to students in their Masters or Doctorate programs in Structural Engineering. This course will also be available to practicing professionals seeking to upgrade their technical skills in the area of masonry design.
3. An active masonry research program will be maintained, making use of the existing world-class facilities at the Structural Laboratory in the College of Engineering. Research priorities will be established in close consultation with an industrial advisory committee and are expected to include the following general subject areas:
  - The application of new materials and technologies to masonry building systems, including advanced material characterization using the Canadian Light Source;
  - The durability of masonry systems under adverse conditions;
  - The refinement of knowledge relating to the basic materials science and mechanical properties of masonry structures;
  - The performance of masonry wall systems and building envelopes under various types of environmental conditions; and

- Life cycle engineering (costs and performance) of masonry systems.
4. Financial support will be provided to students taking graduate-level training in the area of engineered masonry design. Such funding is essential for attracting high-calibre personnel capable of performing excellent research and developing the much-needed expertise.
  5. In collaboration with other masonry-related organizations, the proposed Saskatchewan Centre for Masonry will initiate and/or facilitate continuing education programs for practicing engineers, masonry contractors and architects on new developments in masonry building systems. In addition to masonry-related subjects, the Centre will facilitate complementary training opportunities, including:
    - Communication skills training offered in conjunction with the Graham Centre for the Study of Communication; and
    - Entrepreneurship training through the Wilson Centre for Entrepreneurial Excellence.

Faculty associated with the Centre will participate actively in technical conferences and national design standard development activities.

The establishment of the Centre represents a vital step in realizing these objectives. The Centre will provide a mechanism for the coordination of masonry-related activities, for liaison with the masonry industry and other masonry research institutes, for outreach activities, and for the strategic allocation of research resources to faculty and graduate students. Perhaps most importantly, the Centre will act as a catalyst, encouraging innovation and growth within this important industry.

#### **1.4 Classification of the New Saskatchewan Centre for Masonry Design**

In accordance with the University of Saskatchewan Policy on Centres [1], it is proposed to establish the Saskatchewan Centre for Masonry Design as a Type A Centre. The Centre will be housed organizationally within the College of Engineering, will involve scholarly activities primarily of faculty in the Department of Civil and Geological Engineering, and will report to the Dean of Engineering. Alignment of the Centre with departmental and college strategic plans is described in the following section.

The involvement of a significant complement of faculty from the Department of Civil and Geological Engineering with a wide range of research interests lends itself well to the operation of such a centre. As described in Section 5, five faculty members have committed to participating in the Centre's activities, bringing with them expertise in structural analysis and design, advanced materials engineering, durability

modelling, synchrotron research, wind engineering, structural dynamics, full-scale structural monitoring, engineering economics, decision analysis and life-cycle costing, among other areas of specialization.

## **2.0 ALIGNMENT WITH UNIVERSITY, REGIONAL AND NATIONAL PRIORITIES**

### **2.1 Department of Civil and Geological Engineering**

“Infrastructure and Transportation” has been identified as one of three priority research themes within the Department of Civil and Geological Engineering (see Appendix A). Given the aging and deteriorated state of a wide variety of our public and private civil infrastructure inventory, including that of building structures, the need is apparent for innovative approaches to the planning, design, management, rehabilitation and replacement of such infrastructure to maximize the utilization of available resources. The Centre’s research focus on the application of advanced materials, durability modelling and enhancement, improved structural and building envelope systems, and life cycle performance assessments were selected to address issues of critical importance related to the sustainability and renewal of building infrastructure.

Despite the fairly specific mandate of the masonry Centre, the active commitment of five faculty members, representing more than one-quarter of the total departmental compliment, speaks clearly of the broad-based support for this initiative. Included within the participating faculty are those specializing in structural analysis and design, material science, engineering economics and management, as well as structural monitoring and assessment.

### **2.2 College of Engineering**

The proposed activities of the Centre will fall primarily within the college’s Research Theme 2: Environment, Infrastructure, and Sustainable Development, as defined in the College of Engineering 2007-2008 Research Report [2]. The sub-theme of Infrastructure “focuses on the *built environment* ... on which society relies”, an area that clearly encompasses the residential, institutional (i.e. schools, hospitals, etc.), commercial and industrial buildings commonly constructed using masonry materials. Furthermore, the emphasis on materials, specifically on the use of recycled component materials, as well as on life-cycle engineering design principles, will promote improvements in the long-term sustainability of building systems.

In addition, the Centre will contribute to several of the priority areas outlined in the most recent College of Engineering Strategic Plan [3]. Research in advanced materials, including synchrotron-based research, and innovative infrastructure systems are both high-lighted as short-term college research

priorities. Funding generated through the Centre will facilitate the recruitment and retention of exceptional graduate students and postdoctoral fellows, another important college objective. In terms of improvements in the undergraduate student experience, the new course in masonry design creates the opportunity to expose senior Civil Engineering students to the basic principles of building science and LEEDS<sup>®</sup> (Leadership in Energy and Environmental Design) certification, as well to advanced topics in lateral stability and load resisting systems, that otherwise would be unavailable. Finally, the research and continuing education initiatives within the Centre will promote collaborations and partnerships with a variety of external organizations, ranging from engineering and construction firms, masonry suppliers and contractors, and government agencies responsible for building infrastructure (including northern housing, schools and healthcare facilities). As noted earlier, the Centre will also form part of a national masonry research network comprising both university- and industry-based entities.

### **2.3 University of Saskatchewan**

The strategic aspirations of the University have been articulated in a series of documents, including University of Saskatchewan Strategic Directions: Renewing the Dream [4], A Framework for Action: University of Saskatchewan Integrated Plan 2003–07 [5], The Second Integrated Plan 2008-11: Toward an Engaged University [6], and the Research, Scholarly and Artistic Work Foundational Document [7]. Ways in which the Centre will contribute to the advancement of university priority areas, as described in these documents, include the following.

- **Academic pre-eminence:** The Centre will form an integral part of a national research network dedicated to the advancement of knowledge in masonry structures. At present, such research is restricted to a few select institutions, making masonry an attractive niche in which researchers at the Centre can make a substantive contribution.
- **Sense of place:** The Centre will support development and encourage innovation in the masonry industry which, as outlined in the following section, has a substantial impact on the regional economy. In addition, faculty in the Centre will participate in public service and outreach programs aimed at raising the technical awareness of masonry-related issues within the local engineering, architectural and construction industries.
- **Industry partnerships:** The Centre will work in close collaboration with organizations representing the local and national masonry industry, including the Saskatchewan Masonry Institute, The Canadian Centre for Masonry Design, and the Canadian Concrete Masonry Producers Association.

- **Aboriginal initiatives:** Sustainable northern housing and institutional building infrastructure will be one major focus of the life-cycle costing research to be carried out within the Centre. Inherent characteristics of masonry construction offer great potential advantages for remote aboriginal communities, including enhanced building durability, low energy demands, improved indoor air quality, and the opportunity to develop and maintain a skilled local labour force.
- **Enhanced research infrastructure:** To date, \$250,000 of the funding received by the Centre has been specifically earmarked to upgrade the research capabilities and equipment of the Structures Laboratory; it is anticipated that this funding can also be leveraged through other granting agencies. Building on the existing capabilities of the laboratory, this funding will enable us to create a truly world-class masonry research facility.
- **Improved student experience:** The Centre will create opportunities for undergraduate and graduate students to be exposed to the latest developments in building technology. As one example, the undergraduate course in masonry design to be offered through the Centre is one of only a handful of such courses available across the country. Graduate students doing research within the Centre will benefit from participation in the national masonry research network and from the chance to work in a world-class research facility.

## **2.4 Regional and National Relevance**

As a construction material, masonry offers a number of competitive advantages for the local economy [8]. First of all, masonry construction is a relatively labour-intensive process compared to competing building wall systems, thereby fostering the establishment of a large and highly skilled work force. Furthermore, masonry units and related products, as well as their constituent materials, are generally manufactured within the prairie region, contributing to the regional industrial base. As a result, the direct and indirect effects of masonry construction generate roughly five times the amount of person-hours of employment within the province per dollar spent as does steel stud construction (the major competing construction system).

Furthermore, masonry possesses many of the attributes that are recognized as contributing to environmental sustainability in construction, as outlined in the Leadership in Environmental Design and Leadership (LEED) certification program [9]. In addition to containing non-toxic ingredients, masonry is highly resistant to the growth of mould and exhibits attractive natural textures and colouring that can eliminate the need for painting or other finishes, thereby promoting enhanced indoor air quality.

Masonry's superior thermal mass and resistance characteristics contribute to a reduction in both heating and cooling demands. By virtue of their durability and natural constituents, masonry units are readily re-used or recycled. Finally, the local manufacture of masonry components decreases transportation requirements.

Activities undertaken within the Centre, ranging from research into innovative systems to the dissemination of technological advances, will enhance the regional economic impact of the masonry industry. In addition, research into advanced materials, durability modelling and the life-cycle performance of masonry systems will contribute to improvements in sustainable building practices.

### **3.0 EDUCATION AND OUTREACH ACTIVITIES**

#### **3.1 Undergraduate and Graduate Education**

The education of undergraduate and graduate engineering students has been identified by the masonry industry as one of the cornerstones to continued economic viability. A lack of familiarity with the product is known to discourage structural designers from making the selection of masonry as a construction material. Furthermore, a better understanding of masonry fundamentals will foster more efficient and innovative uses of masonry within building systems.

To address this objective, an undergraduate course in the structural design of masonry will be offered on an annual basis to senior civil engineering students. This course, CE 474.3 Design in Masonry, will be offered as a senior technical elective and is expected to attract 20-25 students per year. A summary of the course objectives is provided below:

CE 474.3 Design in Masonry: This course will provide an introduction to the analysis and design of structural masonry components and building systems. The fundamental principles covered in CE 418.3 (Design in Reinforced Concrete) will be extended to flexural members, walls and columns constructed from masonry components, in accordance with the requirements of CSA Standard CSA-S304.1-04 (Design of Masonry Structures). Lateral load resisting systems in low-rise buildings will be discussed, emphasising the role and behaviour of shear walls and horizontal diaphragms. Elementary concepts of building science will also be introduced, focusing on heat and moisture flow through building envelopes. Elements of sustainable construction, including the LEED certification program, will be discussed.

As a major component of the course work, students will complete the design of selected components of a masonry building in accordance with the requirements of the relevant building codes and standards. In addition, students will also obtain hands-on experience with constructing masonry wall specimens and will have the opportunity to tour a local masonry building site.

Funds generated through the Centre will be used to reimburse the Department of Civil and Geological Engineering for all costs incurred relating to the undergraduate course. This will include salary costs for a sessional lecturer to compensate for faculty involvement in CE 474.3, as well as all teaching assistant costs and laboratory-related expenses. The Saskatchewan Masonry Institute is sponsoring the purchase of design text books for the students, as well as coordinating the laboratory and tour activities.

More highly specialized training in masonry design will be available through a graduate program to be offered as an integral part of the Centre's activities. In addition to a graduate level course in masonry analysis and design, graduate students will be involved in research programs coordinated through the Centre. Students within this program will benefit from exposure to leading edge projects and research facilities, as well as from contact with researchers from other masonry centres across the country. As detailed in Section 6, a substantial portion of the Centre's funds will be designated for the support of graduate student training and research.

### **3.2 Continuing Education and Outreach Activities**

To address the existing deficit in masonry training within the local engineering, construction and architectural communities, the Centre will facilitate a variety of continuing education initiatives. Working with national masonry organizations, including the Canadian Centre for Masonry Design, the Centre will facilitate visits by recognized experts in the field of masonry design and construction in order to conduct workshops and presentations aimed at practicing professionals. The timing and content of these continuing education activities will be guided by input received from the Centre's Management Committee (as described in Section 5), as well as by requests from the local industry.

More formal educational opportunities will also be available for practicing engineers interested in taking part in the undergraduate or graduate masonry courses described previously. Furthermore, non-technical continuing educational opportunities will be made available through affiliated programs at the University of Saskatchewan, such communications skills training at the Graham Centre for the Study of Communication and entrepreneurship training through the Wilson Centre for Entrepreneurial Excellence.

Wherever possible, local practitioners will be invited to participate in selected research projects, either in an advisory or a more active role, depending on the type of project undertaken and the interests of the participants. As an example, an advisory panel consisting of a local design engineer, architect, construction manager and school committee facilities manager is currently being assembled to help guide a pilot study comparing the life-cycle costs of various types of school buildings in Saskatchewan.

On a national level, faculty at the Centre will contribute to the development of design codes and standards that govern the use of masonry within the building industry. The advancement of these design guidelines is a critical factor in encouraging innovation and best practices within the industry while, at the same time, maintaining adequate levels of public safety. At present, two faculty associated with the proposed Centre have been invited to serve on Canadian Standards Association (CSA) Committees related to masonry design: Dr. Bruce Sparling on CSA Standard S304.1 (Design of Masonry Structures), and Dr. Leon Wegner on CSA Standard A179 (Mortar and Grout for Unit Masonry). Dr. Sparling was also a member of the scientific committee for the recent Canadian Masonry Symposium held in Toronto in June, 2009.

### **3.3 Engineer-in-Residence Program**

A long-term goal of the Centre is to establish an “Engineer-in-Residence” program. In this program, a recent graduate engineer will be hired for a limited term of approximately three years to work on various projects within the Centre while simultaneously completing a Master’s degree. The appointment may be renewed for a further four year term if the student decides to continue on in a masonry-related Ph.D. program. It is anticipated that the Engineer-in-Residence will act as a technical resource for local practitioners, as well as for the national masonry industry, in addition to participating in a variety of research projects and other initiatives being carried out in the Centre. By combining practical experience with the opportunity for advanced technical training, the proposed “Engineer-in-Residence” program will become a very attractive option for a graduating engineer, helping to recruit top students to the Centre. Having such a person available will also provide additional capabilities and flexibility in terms of the types of activities that can be undertaken by the Centre.

## **4.0 RESEARCH ACTIVITIES**

### **4.1 Strategic Research Themes**

Strategic research areas to be pursued within the Centre have been identified based on the following guiding principles.

- Research areas should be selected to make best use of the existing expertise of one or more of the participating faculty. While collaboration with other researchers, as well as other research groups, will be encouraged, it is expected that each research project will be led by one member of the Centre with the requisite academic or experiential background. The research profiles of faculty members associated with the Centre are provided in Section 5.

- Research themes should be chosen to make optimum use of available facilities and physical resources. In addition to our well-equipped structural and materials testing laboratories within the College of Engineering, this would also include the unique opportunity of having access to the Canadian Light Source for advanced material testing and characterization. As noted previously, however, one objective of the Centre is also to upgrade laboratory capabilities to create a truly world-class masonry testing facility.
- Research carried out at the Centre should complement, rather than reproduce, that being undertaken elsewhere. Given the limited size of the national masonry research community, a coordinated approach among research institutions is necessary to maximize potential benefits to the industry.

To help define potential research themes, consultation was carried out with industry representatives at the Canadian Masonry Design Centre, the Canadian Concrete Masonry Producers Association and the Saskatchewan Masonry Institute, as well as with researchers at other Canadian institutions. Based on this process, and on the guiding principles outlined above, the strategic research areas described below were selected for the Centre.

**Testing of Full-Scale Masonry Wall Systems:** The 7.5 m vertical clearance and large “strong floor” available in the Structural Laboratory make this one of the few facilities with the capability for testing slender masonry wall systems with realistic proportions. Since there is little experimental data regarding the behaviour of very slender walls under various loading conditions, design standards have, by necessity, adopted conservative restrictions that limit the economic competitiveness of such systems. Innovative ways of strengthening full size masonry walls is also a subject of considerable interest, as is the contribution of arching to the resistance of slender walls. Projects in this research theme will be led by Dr. Bruce Sparling, Dr. Leon Wegner and Dr. Lisa Feldman, all of whom have had considerable experience with physical testing of large-scale structural components.

**Advanced Materials:** For the most part, the materials used in masonry construction have not changed significantly within recent memory. With the rapid advances in material science, however, there is a tremendous opportunity to utilise new materials, or old materials used in new ways, to improve the performance and competitive advantage of masonry. This may include the introduction of chemical admixtures, as well as synthetic or natural reinforcing fibres, to modify the properties of the masonry units, grout and mortar. Alternative reinforcing materials such as fibre-reinforced polymers (FRP), which are strong, light-weight and corrosion resistant, will also be investigated. Recycled materials may also prove to be a cost effective and environmentally friendly replacement for conventional aggregate.

Projects in this research theme will be led by Dr. Leon Wegner and Dr. Moh Boulfiza who have extensive backgrounds in advanced materials. Dr. Boulfiza also has experience in Synchrotron testing, which is expected to play a significant role due to the proximity of the Canadian Light Source.

**Durability of Masonry Systems and Components:** One of the natural advantages of masonry as a building system is its inherent durability. However, much work remains to be done in the area of durability modelling and testing to investigate how the durability of masonry units, embedded components, and wall systems can be improved. Dr. Boulfiza, who has done work in deterioration modelling in reinforced concrete bridge decks, is the researcher who will be leading projects in this area.

**Full-scale Monitoring of Structural Systems and Building Envelopes:** With recent advances in sensor and data acquisition technology, it is now feasible to monitor full-scale building system performance under operational conditions. This enables the calibration and verification of theoretical models, many of which contain significant uncertainty. Dr. Leon Wegner has been a project leader in Structural Health Monitoring (SHM) for bridges with the ISIS Canada Networks of Centres of Excellence, working with Dr. Bruce Sparling. Similar techniques can readily be applied to the structural and building envelope systems of masonry buildings to improve our understanding of how these systems behave under realistic usage and environmental loading, as well as how this behaviour may change over time.

**Life Cycle Costing and Engineering:** A recent trend in the management of civil infrastructure has been a move toward the explicit consideration of “cradle-to-grave” life cycle costs in decisions relating to the design, maintenance, rehabilitation, replacement and decommissioning of public assets. Driven in large part by the desire to bring public accounting practices in line with industry standards, the new emphasis on life cycle costing recognizes that operational, maintenance and other downstream costs represent annualized expenses that are every bit as real as those related to initial capital costs. Furthermore, it is widely accepted that life cycle costs can be identified and quantified in a rigorous and objective manner that can be used for budgeting and policy making purposes.

While life cycle cost principles are now widely used by public agencies responsible for roadway networks, and more recently for bridges and municipal works, their application to building infrastructure has lagged significantly. In most cases, only initial capital costs are considered when comparing competing building systems and construction methods. This short term approach is an obvious disadvantage for masonry construction, since the inherent durability and superior environmental performance of masonry wall systems is not properly recognized.

Led by Dr. Gordon Sparks, the Life Cycle Engineering Research Group in the Department of Civil and Geological Engineering, has had extensive experience in applying “Decision Analysis” (DA) principles in the evaluation of the life cycle performance of both established and innovative construction techniques in roadway, municipal and bridge infrastructure. The DA approach allows for the evaluation of complex systems (i.e. systems involving a large number of inter-related parameters) featuring considerable uncertainty in a transparent and economically defensible manner. As a result, owners and designers are provided with a tool capable of quantifying and comparing the probable life cycle performance of various design options, thereby promoting more well-informed and comprehensive decision making strategies.

#### **4.2 Research Project Identification, Selection and Execution**

An emphasis will be placed on research that is aligned with meeting the needs of industry. Projects may be brought forward by researchers or industry proponents, and will go through a two-stage approval process.

Initially, a one page expression of interest must be submitted to the Director of the Centre (see Section 5.1). The expression of interest must provide a brief description of the project background, scope and objectives, how the project fits in with the Centre’s strategic research themes, and potential benefits to the masonry industry and university. All such submissions will then be vetted by the Scientific Committee, as described in Section 5, to evaluate how the project fits in with the Centre’s objectives and priorities.

If the initial review is favourable, the project will be assigned to one or more of the participating faculty, who will act as project leaders and will prepare a more detailed research proposal, which will include the following information:

- Project description and background (including a brief literature review);
- Objectives and scope;
- Proposed methodology;
- Definition of project elements, tasks and delivery milestones;
- Description of project team and potential collaborators;
- Project budget (including funding requested from the centre and coming from other sources);
- Anticipated project outcomes and benefits; and
- Terms and conditions of project execution (if applicable), including intellectual property ownership, patents, etc.

These detailed proposals will be reviewed by the Scientific Committee, who may request additional information or clarification. Once the proposals are received, and deemed to be complete, the Scientific Committee will make an initial recommendation concerning funding priorities. This recommendation will be taken forward by the Director to the Management Committee, who will approve all research projects prior to the commitment of funding from the Centre.

An annual report must be submitted by project leaders outlining progress that has been made over the past year, how that progress compares with proposed goals and milestones, and any difficulties and delays that have been encountered and have affected the project schedule. Funding, even for multi-year projects, must be renewed on an annual basis by the Management Committee, subject to satisfactory progress, demonstrated continued need, and continued relevance of the project.

## **5.0 CENTRE GOVERNANCE AND MANAGEMENT**

### **5.1 Management Structure**

A schematic illustrating the management structure of the Centre, along with lines of responsibility, is shown in Figure 1. As suggested in this figure, there will be a clear separation between the governance and operational functions within the Centre. The Management Committee, with input from the Director and Advisory Committee, will be responsible for establishing the strategic direction of the Centre, while the Director will oversee all the operational functions. A description of the composition and responsibilities of each group identified in Figure 1 is provided below.

#### **5.1.1 Management Committee**

The Centre will be overseen by a Management Committee composed of senior representatives from the university and the masonry industry. The Management Committee will be responsible for the overall strategic direction of the Centre, with the Dean of Engineering (or the Dean's designate) acting as the Chair. The Committee will be responsible for approving the appointment of the Director and new Committee members, and will meet at least once per year to review the Centre operations and leadership, and approve plans for the budget, proposed research projects, major equipment purchases and training initiatives. The Committee will also approve the membership in the Advisory Committee and to meet with the Advisory Committee on an as-needed basis.

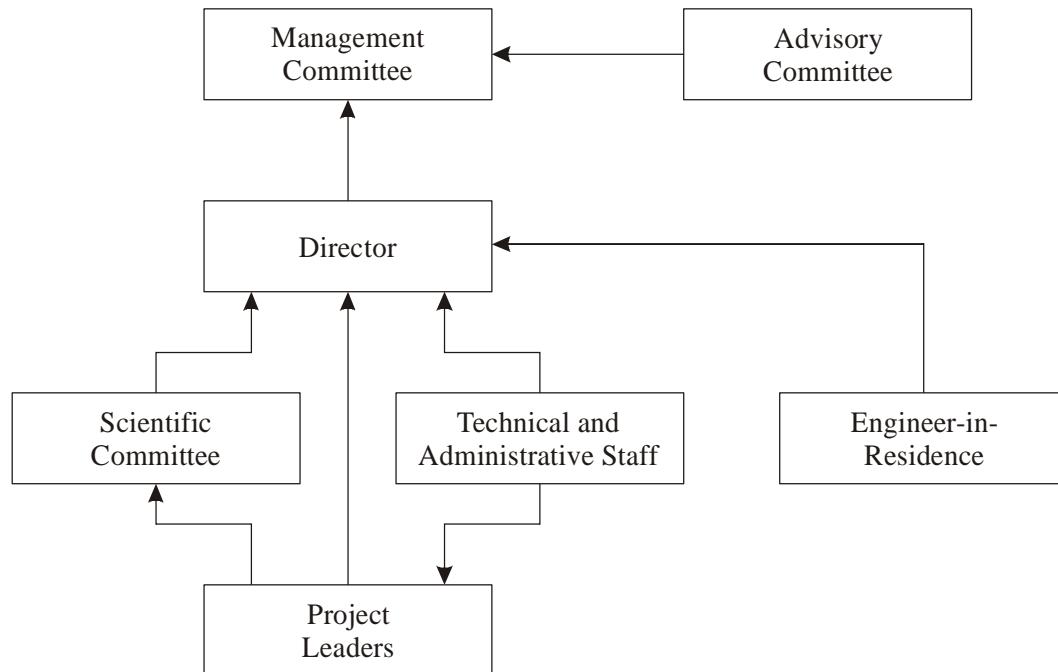


Figure 1. Management structure for the Centre

The initial Management Committee will include of the following members:

- Dean, College of Engineering, or the Dean's designate (Chair)
- University of Saskatchewan representative
  - Proposed: Associate Vice-President, Facilities Management Division
- Department of Civil and Geological Engineering representative
  - Chair, Research Affairs Committee
- Director, The Wilson Centre for Entrepreneurial Excellence, University of Saskatchewan
- Senior masonry researcher from another Canadian university
- Masonry industry representatives:
  - Executive Director, Saskatchewan Masonry Institute (SMI)
  - President, SMI Board of Directors
  - Treasurer, SMI Board of Directors
  - Member at large (to be nominated by the SMI)
  - Technical representative, Canadian Masonry Design Centre

Management Committee members will be appointed for a two year term that may be renewed at the recommendation of the Committee Chair and with the approval of the Committee. Once the Management

Committee has been established, it will be responsible for formulating a specific set of operating guidelines and procedures.

The Centre will observe the policies and procedures established at the University of Saskatchewan. In addition, the Management Committee will recognize the authority of the University's Board of Governors to oversee and direct all matters respecting the management, administration and control of the university's property, revenues and financial affairs.

### **5.1.2 Advisory Committee**

The Advisory Committee will be formed to solicit input from a broader constituency related to various aspects of the masonry industry. Potential membership could include representation from local and provincial governments, local business associations, structural engineers, architects and contractors. The Advisory Committee, which will be convened at the direction of the Management Committee, will provide feedback to the Management Committee concerning potential opportunities and strategic directions for the Centre, but will not have any responsibility for the management or operation of the Centre.

### **5.1.3 Director**

The Management Committee will appoint a Director for the Centre on a three year term that may be renewed at the recommendation of the Management Committee Chair. The Directory will be responsible for oversight of the operations of the Centre, and will report to the Chair of the Management Committee. The Director will be responsible for all administrative activities Associated with the Centre and will assemble the annual report to the Management Committee which will include an annual summary of activities (including financial statements), review of projects undertaken, and a business plan for the upcoming year. Dr. Bruce Sparling will act as the founding Director of the Centre.

Dr. Bruce Sparling is also the primary contact person for the Saskatchewan Centre for Masonry Design initiative.

### **5.1.4 Scientific Committee**

The Scientific Committee will consist of faculty from the Department of Civil and Geological Engineering who will participate in the Centre. The Scientific Committee will be responsible for reviewing research project proposals and making recommendations regarding funding priorities to the Director, who will take those recommendations to the Committee. The Scientific Committee will also help establish the strategic direction and priorities for research to be undertaken through the Centre.

A listing of the Scientific Committee along with their areas of expertise, is as follows:

- Dr. Bruce Sparling: structural dynamics, wind engineering (Associate Researcher, Boundary Layer Wind Tunnel Laboratory, U.W.O.), structural health monitoring, structural masonry;
- Dr. Gordon Sparks: life cycle costing and engineering, decision analysis, engineering economics, entrepreneurship.
- Dr. Leon Wegner: advanced composite materials and structural systems, structural health monitoring, structural masonry;
- Dr. Moh Boulfiza: durability and deterioration processes in reinforced concrete systems, advanced concrete materials, synchrotron-related materials research
- Dr. Lisa Feldman: bond and development of reinforcement, evaluation of historical structures, prestressed concrete

#### **5.1.5 Policy on Conflict of Interest**

In the event of any issues relating to potential conflict of interest regarding the management or operation of the Centre, the Director and/or members of the Management and Research Committees will be expected to openly declare the potential conflict of interest and excuse themselves from any decisions associated with that conflict.

## **6.0 PROPONENTS AND CONSULTATION PROCESSES**

### **6.1 College of Engineering**

The present proposal for the establishment of the Saskatchewan Centre for Masonry Design was developed and vetted by the Scientific Committee, as listed above, all of whom are members of the Department of Civil and Geological Engineering, University of Saskatchewan. A conceptual plan for the Centre was presented to the remainder of the Department at its annual retreat in May, 2009. Although a formal vote of approval was not taken at that time, there was a general consensus expressed supporting the establishment of the Centre. A letter of support from Dr. Jim Kells, Head of the Department of Civil and Geological Engineering, is attached in Appendix B.

Dr. Janusz Kozinski, Dean of the College of Engineering, was instrumental in leading negotiations with the Saskatchewan Masonry Institute and other industry groups that resulted in the \$1.25 million donation for the establishment of the Centre. Dr. Kozinski was also consulted regularly regarding the proposed objectives, activities and administrative structure of the Centre. A letter of support from Dr. Kozinski is included in Appendix B.

Within the college, close collaboration is anticipated with the Thermal Science and Energy research group within the Department of Mechanical Engineering. The considerable expertise in building science within this group would be a valuable resource for the full-scale building system monitoring research theme discussed in Section 4.1.

## **6.2 Consultation with the Masonry Industry**

Following initial negotiations with Dr. Kozinski, a preliminary proposal for the Centre was submitted to the Saskatchewan Masonry Institute in July, 2008. Feedback on the proposal was solicited from the Canadian Masonry Design Centre, representing the Canadian Masonry Contractors Association, and the Canadian Concrete Masonry Producers Association, among others. Suggestions received as a result of that consultation process were then incorporated into a modified proposal, which was presented in draft form to the Saskatchewan Masonry Institute membership at its annual meeting in November, 2009.

The masonry industry will continue to play a major role in setting the strategic direction of the Centre through its representation on the Management Committee. In addition, ongoing interaction with the Directory and with Project Leaders will provide the opportunity for direct participation in the Centre's educational and research initiatives.

## **6.3 Others Within the University**

Although the activities of the Centre will be concentrated in areas of primary interest to the College of Engineering, there are significant opportunities for collaboration with other groups on campus. A number of potential linkages are listed below. It is anticipated that further collaborative opportunities will be identified as the Centre becomes operational.

Indigenous Land Management Institute (ILMI): Sustainable residential and institutional building infrastructure is a topic of particular importance for aboriginal peoples in northern communities. The durability and favourable thermal properties of masonry construction, combined with the potential for developing a skilled local workforce, suggests that masonry may be a viable building alternative. To make inroads against conventional wood-frame construction, though, it will be necessary to demonstrate that the economic, social and environmental benefits over the service life of the building (the so-called "triple bottom line") are sufficient to overcome the barrier of initial capital cost. Prof. Tom Allen of the ILMI has identified the life cycle engineering and costing initiatives within the Centre as working in support of ongoing projects of the ILMI. Work of this nature clearly fits into the ILMI objective of "collaborating with communities and governments in making informed policy and economic decisions by

conducting the necessary applied research”. A letter of support from Prof. Allen is included in Appendix B.

The Wilson Centre for Entrepreneurial Excellence (WCEE): One of the stated objectives of the Centre is to encourage the development of innovative masonry products and materials. Such activities align naturally with the mission of the WCEE to promote innovation and entrepreneurship within the University of Saskatchewan community. A letter of support from Prof. Sanj Singh, Director of the WCEE, is included in Appendix B.

## **7.0 FUNDING PLAN**

### **7.1 Overview**

The resources required to achieve the stated objectives will be provided jointly by the masonry industry and the University of Saskatchewan, with additional funding sought from outside agencies. The budget for the Saskatchewan Centre for Masonry, as outlined below, is based on the anticipated financial requirements over an initial five year operating period. A brief discussion of long term funding requirements projections beyond that period is also provided.

Industrial sponsorship in the form of a donation to be paid over a five year period totalling \$1,000,000 has been received from the Saskatchewan Masonry Institute, with a further donation over the same five year period of \$250,000 received from the Canadian Concrete Masonry Producers Association. The SMI donation has been broken up into two parts: \$100,000 to fund the initial operating costs associated with the establishment of the Centre, and a \$900,000 endowment fund that will be used to generate ongoing operating funds for the Centre. The CCMPA donation will be directed towards the upgrading of research facilities associated with the Centre, as well as being used to leverage funds from other agencies. Other sources of funding are also currently being pursued to raise additional endowed funds to enable the expansion of the Centre’s activities.

To oversee operations of the Centre and deliver the associated educational components (i.e., one undergraduate and one graduate courses, as well as graduate student supervision), the College of Engineering will allocate the equivalent of one-half of a senior faculty position, along the necessary administrative support, laboratory technician support, and access to classroom and laboratory space and equipment. Since these “in-kind” contributions will be provided from existing resources within the College and Department, no addition funding or personnel is required from the University.

## **7.2 Annual Target Funding Plan: Existing Resources Over Initial Five Year Period**

The goal over the initial five year period is to establish the SCMD as a nationally recognized centre of excellence for masonry research and training. This will entail the development of active research programs in specific target areas, as well as the upgrading of existing laboratory facilities to world-class standards. The non-endowed funding provided by the SMI and CCMPA will play vital role in this initial period, facilitating the required growth in the research activities of the SCMD and enabling access to leveraged funding from other agencies. It is anticipated that approximately one-half of the CCMPA donation (\$125,000) will be used to leverage funds for acquisition of new laboratory equipment (for example, the CFI grant application referred to in Section 7.3), while the remainder will be used to generate matching funds for collaborative research grants.

Projected revenues from existing sources, including in-kind support from the University of Saskatchewan, are summarized in Table 1. Corresponding projected expenditures are provided in Table 2. Both the revenues and expenditures will increase over this five year period as the endowment is received from the SMI in annual increments of \$180,000.

For the graduate student funding plan, it has been assumed that three M.Sc. students will be funded for the first two years of the Centre's operation. After that, it is assumed that one Ph.D. student and two M.Sc. students will be funded each year. If this mix of students were to change, the funding plan will be adjusted accordingly and/or additional funds will be sought from other sources. It is proposed that funding for M.Sc. research projects be limited to a maximum of two years, while Ph.D. research projects be funded for a maximum of three years.

## **7.3 Other Anticipated Funding Sources**

The \$250,000 donation from CCMPA will be used to leverage additional funds from granting agencies such as the Natural Sciences and Engineering Council (through programs such as Collaborative Research and Development Grants), the Canadian Foundation for Innovation (CFI), Canadian Mortgage and Housing Corporation, MITACS and the National Research Council (through programs such as the Industrial Research Assistance Program). As part of this initiative, a CFI grant application has recently been submitted requesting \$204,000 to upgrade the hydraulic loading actuators and data acquisition system in the Structures Laboratory, using \$67,000 from the CCMPA donation.

Table 1. Projected revenue from existing sources – Initial five year operating period.

Revenue Item	Year					Total
	1	2	3	4	5	
<b>1. Industrial Funding:</b>						
• Initial operating funds	20,000	20,000	20,000	20,000	20,000	100,000
• Interest from endowment (4.5% on \$180,000/yr)	8,100	16,200	24,300	32,400	40,500	121,500
• CCMPA donation	50,000	50,000	50,000	50,000	50,000	250,000
Total industrial funding =	78,100	86,200	94,300	102,400	110,500	471,500
<b>2. Gunnar Hagblom Scholarship:</b>						
• Interest from endowment (4.5% on \$133,000)	6,000	6,000	6,000	6,000	6,000	30,000
• Expendable account	15,000	15,000	15,000	15,000	15,000	75,000
Gunnar Hagblom funding =	21,000	21,000	21,000	21,000	21,000	105,000
<b>3. University: In-kind Support:</b>						
• Faculty salary (50% senior faculty)	63,000	63,000	63,000	63,000	63,000	315,000
• Administrative support (10% of clerical assistant)	3,700	3,700	3,700	3,700	3,700	18,500
• Lab technician support (10% of technician)	6,000	6,000	6,000	6,000	6,000	30,000
• Space utilization: <sup>†</sup>						
➤ Undergraduate classroom	3,175	3,175	3,175	3,175	3,175	
➤ Graduate classroom	2,900	2,900	2,900	2,900	2,900	
➤ Laboratory space (25% of Structures Lab)	59,000	59,000	59,000	59,000	59,000	
➤ Office space	2,500	2,500	2,500	2,500	2,500	
• Library & IT support	N/A	N/A	N/A	N/A	N/A	
Total in-kind support =	140,275	140,275	140,275	140,275	140,275	701,375
<b>Total Revenue: Existing sources</b>	<b>239,375</b>	<b>247,475</b>	<b>255,575</b>	<b>263,675</b>	<b>271,775</b>	<b>1,277,875</b>

<sup>†</sup> From Trevor Robertson, Manager, Space Management and Planning, Facilities Management Division

Table 2. Projected expenditures based on existing resources – Initial five year operating period.

Expenditure Item	Year					Total
	1	2	3	4	5	
<b>1. Research:</b>						
• Student support <sup>†</sup>	48,000	48,000	51,000	51,000	51,000	249,000
• Lab equipment	25,000	25,000	25,000	25,000	27,500	127,500
• Materials, supplies & labour	1,500	5,000	5,500	9,000	10,000	31,000
• Software, texts, journals, etc.	600	700	800	900	1,000	4,000
Total research:	75,100	78,700	82,300	85,900	89,500	411,500
<b>2. Education &amp; Outreach:</b>						
• Reimbursement to Civil Engg. (sessional & TA's for undergrad class)	10,000	10,000	10,000	10,000	10,000	50,000
• Direct costs of courses (undergrad & grad)	2,500	2,500	2,500	2,500	2,500	12,500
• Professional seminars	0	2,500	2,500	5,000	5,000	15,000
• Travel, conferences, etc.	6,000	6,000	7,500	7,500	10,000	37,000
Total education & outreach:	18,500	21,000	22,500	25,000	27,500	114,500
<b>3. Administration &amp; Other:</b>						
• Salaries (faculty, clerical, technicians)	72,700	72,700	72,700	72,700	72,700	363,500
• Administrative support (Department & College)	1,000	2,000	3,000	4,000	5,000	15,000
• Space utilization (lab, classroom, office)	67,575	67,575	67,575	67,575	67,575	337,875
• Research support activities	1,000	2,000	3,000	4,000	5,000	15,000
• Office equipment	2,000	2,000	3,000	3,000	3,000	13,000
• Membership fees	1,500	1,500	1,500	1,500	1,500	7,500
Total administration:	145,775	147,775	150,775	152,775	154,775	751,875
<b>Total Expenses: Existing sources</b>	<b>239,375</b>	<b>247,475</b>	<b>255,575</b>	<b>263,675</b>	<b>271,775</b>	<b>1,277,875</b>

<sup>†</sup> Based on \$16,000/yr per M.Sc. student and \$19,000/yr per Ph.D. student.

It is expected that, due to the strong support and links with industry enjoyed by the Centre, that \$40,000-\$60,000 in additional annual funding will be generated in this manner. This additional funding will be used primarily to support and enhance the research enterprise of the Centre through support of highly qualified personnel, the purchase of research-related equipment and the establishment of a dedicated administrative support structure for masonry research.

Additional funds will also be pursued from the national and provincial governments, as well as from the construction industry, for the establishment of a Life Cycle Engineering and Costing (LCEC) research group within the Centre. Working in cooperation with the Saskatchewan Centre of Excellence in Transportation and Infrastructure, the LCEC group will work in support of innovative and sustainable masonry construction methods, with an emphasis on northern institutional buildings and housing. It is expected that the LCEC initiative will require approximately \$50,000 - \$100,000 in additional annual funding.

At its March Annual General Meeting, the SMI confirmed its intention to fund an NSERC Industrial Research Chair in masonry at the University of Saskatchewan. At the present time, the SMI has committed to providing \$100,000/yr for five years for the Chair, in addition to its previously announced support for the Centre (i.e. the \$900,000 over five years).

#### **7.4 Long Term Funding Plan**

At the end of the initial five year operating period, it is expected that the SCMD faculty will have established a strong record in masonry research. As a result, opportunities for external funding from peer-reviewed sources such as NSERC will be significantly enhanced at this stage. Base funding from the SMCD endowed funds and the university will therefore be used primarily to ensure that the educational and outreach activities of the Centre are carried out. Funding for the majority of the research activities of the Centre will be raised from grants from external agencies. At the same time, ongoing major expenditures on equipment and infrastructure are not anticipated beyond the initial five year period unless a new source of revenue can be found specifically for that purpose.

### **8.0 REPORTING AND SYSTEMATIC ASSESSMENT**

The Director will submit an annual report to the Management Committee summarizing the operations, activities and financial transactions of the Centre over the previous year; in addition, the report will recommend proposed initiatives for the upcoming year and will include a proposed budget for

consideration by the Committee. To the extent possible, the activity level of the Centre will be evaluated in terms of explicit measures of success, including the following:

- The number of undergraduate and graduate students enrolled in courses offered;
- The number of graduate and undergraduate students, postdoctoral fellows and research associates involved in sponsored research projects, as well as the number of these successfully completed;
- The number of refereed journal papers, conference papers and presentations, and research reports produced;
- A listing of new equipment or facilities obtained;
- A description of special activities undertaken;
- The number of training workshops provided and/or facilitated, including the number of participants and any feedback obtained;
- The amount of matching investment dollars attracted to the Centre;
- The number of successfully commercialized products and services, including the number of patents awarded; and
- Awards received by participating faculty and students.

Systematic assessment of the Centre for the purposes of university integrated planning will be carried out as part of the overall College of Engineering assessment, and will be performed under the direction of the Dean of Engineering. The assessment will consider whether the Centre is meeting its objectives, as defined in this proposal, in an effective manner, as well as whether the Centre continues to be aligned with strategic priorities set forth for the university and college and is meeting the needs of the masonry industry.

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**APPENDIX A**

**Research Priorities, Department of Civil & Geological Engineering**



## MEMORANDUM

**TO:** Janusz Kozinski, Dean, College of Engineering  
Executive Committee, College of Engineering

**FROM:** Lee Barbour, Head, Department of Civil and Geological Engineering

**DATE:** September 14, 2007

**SUBJECT:** Summary Report on Two Issues:  
Undergraduate Enrollment Quotas and Research Priorities

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You requested in your email of September 03, 2007 that the departments develop position papers on two issues of immediate importance for the college. The college is also developing position papers on these issues with a view that these issues would be discussed and acted upon at a September 17, 2007 meeting of the College Executive. Your email described these two position papers as follows:

- **'Research Priorities'** paper; It is likely that we may propose a set of 'short-term priorities' based on our current strengths & needs, and a set of 'long-term priorities' taking into account our evolution, location, and potential partnerships. The underlying principle of this paper will be inclusiveness. We will try to define the priorities that would help stimulate our faculty to collaborate and benefit from these collaborations. We will also try to identify possible incentives.
- **'UG Enrollment paper'**; This paper and your comments will constitute the base for our response to the Provost concerning potential permanent increase in our enrollment. We should take into account potential implications and consequences of our decisions. I am, in principle, in favor of a reasonable increase in our admissions because it would be in line with our proposal for a new program (Env. Eng), as well as a set of new and/or expanded options (Advanced Materials/Nano, Sustainability, Leadership, Mechatronics, etc). It would also give us strong arguments for new faculty space, lecture halls, teaching/research labs, and buildings. It is true that we would likely struggle a bit prior to getting these new arrangements in place, but if we kept the status quo our arguments for getting the truly new space, not bits & pieces here & there, would not carry the same strength. One implication of possible enrollment increase would likely involve teaching in early mornings and during summers, which is normal at other universities.

I prepared a memo to my department which contained much of the information that I am providing to you in this memo. We met as a Department on September 13, 2007 to discuss these two major issues.

### UG ENROLLMENT

Assistant Dean Reeves was able to provide the department a full summary of the background information on the UG Enrollment issue, along with an oral summary of the memo entitled "*Measures to Address Enrolment Issues*" prepared by Asst. Deans Reeves, Gander, and Maulé. We understood from this presentation that a permanent increase in our UG Enrollment is unlikely. Consequently, we will not prepare a formal 'paper' on this issue, but rather simply provide a few comments related to what now appears to be the primary concern; the need to accommodate additional students within our programs (Civil and Geological) in order to accommodate the movement of the current overload into their preferred discipline areas in 2<sup>nd</sup> year.

The department was quite concerned about the implications of this loading on our ability to deliver our current program. Areas of particular concern included faculty loading for the increased number of large (+100 enrollment) classes, the ability to offer sufficient laboratory sections to accommodate practical laboratory instruction, and the scheduling of these

large classes and additional laboratory sections. It was suggested that removing the ‘alternate week’ laboratory scheduling on large classes, as is currently used for many classes, might provide additional flexibility for multiple lab sections, albeit with increased scheduling difficulty.

In principle, however, the department felt it was important that we do all we can to meet the commitment made to the 2<sup>nd</sup> year students and to help the College through this difficulty situation. Although we have not undertaken any studies as to how we might accommodate a higher 2<sup>nd</sup> year quota, we will in principle, try to accommodate a reasonable number of students (e.g. 100) based on what the executive feel is required in order to relieve student pressures. We will expect that additional resources will be available to help us cope with this overflow situation.

## **RESEARCH PRIORITIES**

It didn’t appear feasible to develop a position paper on research priorities with sufficient detail or with sufficient time to receive department ‘approval’ for the impending Executive meeting. Consequently, this memo simply summarizes the key features of our research and strategic plan priorities as they have been evolving. This summary is my own attempt to summarize these issues - hopefully they reflect our most recent discussions within the department..

### **a) Background:**

The departmental planning activities as part of the University’s Integrated Planning (IP) program included the following:

- Solicitation of planning ideas from the department by the head
- Posting of all planning ideas on PAWS for department comment and reflection
- Development of IP templates by the head in concert with individual faculty
- Departmental IP workshop on April 10, 2007 to discuss IP process and review templates
- Departmental meeting on July 26, 2007 in which IP initiatives were reviewed

I acknowledge that this amount of dialogue and interaction on IP was quite deficient and I accept responsibility for not being able to get the department more engaged in this discussion. That being said, we can only continue to work with what is on the table, while being open to any new ideas or suggestions that may arise in these closing opportunities for dialogue.

There were 8 initial ‘brainstorming’ IP initiatives created for departmental consideration as follows:

- Initiative 1: GeoE Petroleum Option
- Initiative 2: GeoE Mining Option
- Initiative 3: Professional Masters Program
- Initiative 4: E-Learning Graduate Courses in Geotech/Geoenvironmental
- Initiative 5: Environmental Engineering Undergraduate Program
- Initiative 6: Transportation Research Centre
- Initiative 7: Administrative Restructuring
- Initiative 8: Industrial Liaison Committee

I believe the templates which summarized each of these initiatives, including their connection to university priorities and themes were circulated to the department heads previously. There have been some suggestions for modification for these but no final commitment (for or against) any of these initiatives.

### **b) Research Themes:**

The Departmental Strategic plan developed in 2003 (2003-2007 Strategic Plan) suggested two key research themes: *“natural and engineered earth systems (environmental, fluid mechanics and hydraulics, geotechnical, geo-environmental, and hydrology), and those focusing on the design, maintenance and rehabilitation of civil infrastructure (materials, municipal, structures and transportation).”*

The initiatives suggested in that plan also included initiatives surrounding increasing industry participation in both the Undergraduate (teaching) and Graduate (research) programs. They encouraged curriculum and course delivery changes which enhanced student preparation for industry and industry participation with students supported by the increased use

of E-learning strategies. It is interesting to see how the current discussion around strategic planning has mirrored many of these previous (and ongoing) initiatives.

Although our discussions have not been exhaustive, it appears to me that in the current planning cycle that there are 3 general research themes within the department around which most of the faculty can identify. Without agonizing too much over the wording I have summarized these as: Infrastructure(Transportation), Environment(Water), and Geological Engineering(Mining and Petroleum). I will briefly expand on each of these, although it would be wise to have people in these groups create summary paragraphs which more accurately captures these themes.

#### Infrastructure and Transportation

We have clearly seen the growing urgency within the province and country to deal with aging infrastructure. The rapidly deteriorating roadway system within the province (which has recently been subjected to a series of debilitating floods) and the recent bridge failures in Canada and the United States have put this issue at the forefront of both provincial and national infrastructure concerns.

The 'structures' group has continued to develop a clear presence in this area with a rapidly growing, focused research group on problems such as bridge infrastructure within the province. They have teamed up with faculty from the areas of transportation, asset management, and engineering economics in this work and this has provided them with a profile in national research networks such as ISIS. The research and professional practice of faculty from the transportation area has also provided the department with significant visibility in the areas of rehabilitation of road infrastructure.

A pending faculty hire in the area of Infrastructure Management and Engineering Economics will provide further strengthening of this research theme. Recent difficulties in establishing a firm 'arrival' date for the selected candidate for this position also opens up the possibility of converting this faculty position to a more senior position. In addition, this area would clearly have potential to win a CRC Chair. We may not be in a position to submit a CRC nomination in time for the current deadline (September 28, 2007) but there will be a second call in the spring which is focused more on submissions based on suggested 'areas' of focus rather than strictly on a nomination for a specific person.

The consolidation of these strengths into one research group and a primary research theme within the department seems appropriate.

***This theme area is judged to be one in which there are immediate opportunities and one which needs to be a 'short-term' priority area which will need immediate action and investment.***

#### Environment (Water)

Faculty within the water/environment areas recently prepared a memo reminding me of the importance of keeping the 'water' theme as a priority within the department. This theme integrates a large volume of work taking place within our department and provides a key linkage to university priorities and initiatives such as the Centre for Hydrology, Toxicology Research Centre, and the new School of the Environment. It is also essential to establish this priority in support of the College initiative to develop an undergraduate environmental engineering program. It clearly falls in areas of provincial and national priority given growing concerns over severe climate (floods, droughts) and the influence of climate change on society. The group's memo also highlighted how NSERC GSC-06 will split into two sub-committees centered around 'infrastructure' and 'environment'.

The recommendation of the water/environment faculty was that this theme area would focus on issues of environmental protection, water and sustainable resource development (e.g., mining, forestry). In this recommendation research supported by the mining sector which addresses environmental issues (e.g. mine closure, reclamation covers, etc) would be related to this theme.

The challenge, as I see it, in developing this theme, will be to develop an identifiable research group which has increasing presence and visibility. Much of the research in this area to date has been undertaken by individual faculty members or ad-hoc groups of 2 or 3 faculty members on specific projects.

***This theme area is judged to be one in which there are opportunities but one in which there will need to be 'longer-term' planning for future action and investments.***

#### Geological Engineering (Mining and Petroleum)

The 2003-2007 Strategic Plan included this summary: *“The U of S Geological Engineering Program is the only one between Ontario and Vancouver, B.C. We produce engineering graduates that support key industries in the Saskatchewan and national economy. The program had 40 graduates between 2000 and 2002. Of these 40, 39 have obtained jobs in Geological Engineering.”* This statement would be strengthened considerably by the recent demands for geological engineering graduates and the fully subscribed quota in the geological engineering program.

This research theme area would be the smallest group within the department, encompassing the research activities of only 3 to 4 faculty members. However this current size, should not blind us to its importance within the college or university plans, and more importantly, its priority within the provincial and national economy.

It is critical that the departmental initiatives in this area link to the Mineral Research Centre being considered by the college. The provincial economy is currently dominated by activity within the mining and petroleum sector and demand for training (undergraduate students, masters students and professional upgrading) has never been higher. Our rock mechanics laboratory is a unique facility within all of western Canada and the expertise of our faculty members in the rock mechanics and petroleum areas are unique within the province if not western Canada. This area also overlaps with Environment in the opportunities provided by environmental research related to mining and the environment. There are current funding offerings from the oilsands industry alone in the range of 300k+/year over 3 – 5 years which could be leveraged towards an industrial chair or research professorship.

This is a theme area in which I believe we must make some strategic investments. The technician in the Rock Mechanics Lab will be retiring as of the end of September, 2007. He holds a post-graduate degree and has a high profile with industry. We are working together with the Geoeng faculty to develop a plan for retaining his expertise to ensure smooth operation of the laboratory during this time of transition. We will also be re-evaluating the needs and opportunities for expanding the level of research activity and resources in this laboratory through possible reconfiguration of the Rock Mechanics Laboratory technician position.

***This theme area is judged to be one in which there are immediate opportunities but one which needs a ‘long-term’ plan in order to guide investment and action over the next few years.***

### **c) Specific Initiatives:**

A number of ‘next steps’ within these research theme areas are summarized below. It is important to communicate that the ‘short-term’ steps and investments outlined below are not an attempt to establish the relative importance of the various research theme areas, but rather, simply reflect the practicality and reality of the current opportunities.

It is difficult to know how to ‘package’ the initiatives we have discussed over the past months in a way that highlights areas of priority. I have tried to sketch out some practical steps which would support the priorities we have developed during the next cycle of IP. These are likely to be illustrative at best, but hopefully it shows how the various initiatives we discussed previously may be integrated.

#### **Development of ‘Business’ Units:**

I apologize for a term which might be a bit foreign to academics (business) but I couldn’t come up with a better one at the moment. The basic ‘idea’ is that each group would work to establish a ‘front office’ for their group which provides a first point of contact for industry (visible office space, identifiable person) and some shared research support and management resources (research staff, equipment).

Each of the research theme groups are asked to start developing a business plan which lays out specifics regarding group structure, budget and personnel requirements, potential income streams, cost sharing, market, etc. It is difficult for many of us to envisage how this ‘front office’ for each group would be developed. Consequently, a priority in this planning cycle would be to use the opportunity provided in the Infrastructure and Transportation area as a prototype of this approach as described below.

#### **Creation of the Transportation Infrastructure Institute (TII)**

The research theme area of Infrastructure (Transportation) highlights research for a wide variety of infrastructure related issues in which roadways are one sub-sector. However, the department was in agreement that there is a unique, current, opportunity to establish a research ‘beach head’ within the broader theme of infrastructure, focusing on the specific challenges facing the province in the area of transportation/roadways.

The move and redevelopment of the Transportation Centre will provide a unique opportunity to develop a prototype of a stand alone 'business' office for one of our research groups. In fact, Curtis Berthelot has developed a draft business plan for this type of institute and appears to have obtained the support of provincial cabinet and 'shadow cabinet' members for cornerstone funding. The details on this plan will be available shortly. The comments below only provide some general context for further discussion.

The intent would be to reform the existing Transportation Research Centre into a broader center of research related to the transportation infrastructure sector. This research would cut across all sub-disciplines within the department (e.g. transportation, structures and materials, geotech/geoenv, hydraulics, etc), the college (e.g. advanced materials, IT and computer technology) and the university (e.g. CLS). The idea would also include rebuilding the historic linkages and active interaction we once had with Saskatchewan Highways and the consulting community (e.g. the geotechnical consulting community).

An attractive program of professional upgrading, internships, and international exchanges could also be developed as part of this centre, including opportunities for 'Engineers in Residence' as part of graduate teaching and research collaborations. The department already has an international collaborative research program with Queen's University, Belfast which is focused on 'transportation geotechnics'.

Cornerstone funding could be developed through the province and transportation/construction related industries with further matching from the federal government. The new space available on the 2<sup>nd</sup> floor of the Animal Sciences building will create visibility, profile, and office space for administrative / research management support

Research management and support staff could be hired through joint matching funding from Institute, Department, College and University along with industrial or government funds. A proposal to develop a CRC chair in this area will be initiated immediately.

This initiative would be primarily related to Initiative 6 (Transportation Research Centre) but would also likely integrate concepts from Initiative 3 (Professional Masters Program), Initiative 4 (E-Learning Graduate Courses) and Initiative 8 (Industrial Liaison Committee).

#### Geological Engineering (Mining and Petroleum)

The 'business plan' for this area will be fully developed during this planning cycle; however, I do want to encourage us to consider some specific activity in this area given its growing importance as described above. Initiatives 1 and 2 (GeoE Petroleum and GeoE Mining options) were focused primarily on enhancing the training opportunities for undergraduate specialization in mining related areas. I will support these initiatives; however, I think this group should incorporate these ideas into a more comprehensive business plan.

This group has a unique window in which to consolidate/organize/integrate their activities. Some of these opportunities include:

- Establishing their linkage/interaction with Mineral Research Center
- Expanding their contribution to professional development including not only the UG options but graduate training/workshops etc.
- Maximizing the 'business' opportunity provided by the existing rock mechanics laboratory, enhanced by expanding facility for testing related to CO<sub>2</sub> sequestration.

#### Graduate Studies Initiatives:

One of the general areas of investment described below is related to enhancing our connections and interactions with industry. One clear message from industry has been the need for advanced training of professionals, particularly in the areas related to Civil Engineering consulting practice and mining.

Our previous integrated plan (2003-2007) included consolidating course offerings (with identification of 'core' classes), use of alternate year graduate classes, increasing use of our seminar series for graduate training (e.g. research methods, proposal development etc), shortening of graduate student tenure, increased emphasis on Advisory committee function, etc.

The changes we have made in these areas are positive. However, it is essential that we provide a more effective option for professional upgrading and post-graduate training. We need to reconfigure the current MEng program with some of the following features:

- Smaller number of courses (6 plus project)
- Flexible course offerings including flexible schedule course times, web-based options, short-duration workshop type courses, etc.
- Projects developed in concert with employers
- Enhanced tuition levels with return of tuition revenues to the department for reinvestment

The development of a 'professional masters' would enhance our interactions with industry, provide additional revenue streams, and would help develop teaching tools which would provide more flexibility to faculty.

We recently received a large UofS/Provincial TEL award to begin the development of a web-based core curricula in the Geotechnical Engineering area which should help us prototype some of the course delivery options.

#### **d) Other Initiatives:**

There are other 'priorities' which may not be germane to the discussion on research priorities. However, to ensure a full picture and to put 'all of our cards on the table' so to speak, the following section summarizes some other initiatives being discussed within the department.

##### Industrial Liaison

I believe we are in danger of losing our connection with industry unless we find effective ways of increasing our level of interaction with industry. When I began my career at the university more than 20 years ago, the interactions between industry (primarily the consulting industry) and the university in the areas of professional practice, research, and professional training, were more integrated and ongoing, but without any formal structure or processes. Consultants frequently sent us their best new employees as graduate students, interacted with us on research projects, and involved faculty in professional practice.

Curtis Berthelot has been asked to serve on the department executive with a view to redefining the 'research' portfolio more in terms of facilitating our connection and interaction with industry in the areas of research as well as training. This is essentially the area defined previously by Initiative 8 (Industrial Liaison Committee).

We are asking Curtis to recruit a group to work with him in developing the objectives and activities for this area; however, it is likely that two of the priority areas for industry would involve collaborative research and the training of professionals (both graduates and professional upgrading). The latter priority would be supported well by Initiatives 3 (Professional Masters Program) and 4 (E-Learning Graduate classes).

##### Undergraduate Initiatives:

Our previous integrated plan (2003-2007) had a long list of suggestions such as course delivery (web based teaching aids), tutorial resource center models, increased continuous evaluation and interactive feedback, integration of common course material, industrial involvement, increased use of technical support in laboratory and teaching assistance, etc.

We have made good progress in many of these areas. We could continue to enhance these offerings through exploration of the GEOE 'options' (petroleum, mining) and our support to the college in developing an environmental engineering undergraduate program.

It would likely be prudent to also show support of increased student services and support. We could do this through our administrative restructuring (streamlining of policies/procedures for undergraduate student processes such as advising, pre-reqs etc) and the renovations for the new office.

##### Administrative Support:

Administrative services is one of the areas in which we have already made changes (and consequently, one area in which we could propose new initiatives we are confident of completing) These changes are also tied to enhanced student services (UG and G) through administrative support to GAC and UAC chairs. We can also show some restructuring associated with the office space relocation.

#### **d) College Report Template:**

Kyla was kind enough to take our original 8 idea templates and try to organize them according to the proposed structure for the college strategic plan which includes: Over arching Goals, Objectives (through which these goals are achieved, Strategy (For identifying priorities) and Actions (related to the selected strategy).

I have included her summary, with a few additional changes, as follows:

❖ **Objective: Improve Research Program**

- Strategy: Expand industry and government liaisons
  - Action: Create a Transportation Infrastructure Institute
  - Action: Develop business plan for Geological Engineering
  - Action: Create 'Front Offices' for major research theme areas
  - Action: Establish a Industry Liaison Committee to facilitate collaborative research

❖ **Objective: Improve Department Academic Programs**

- Strategy: Improve undergraduate programs
  - Action: Add GeoE Petroleum / GeoE Mining Options
  - Action: Leadership role in the Environmental Engineering Program
  - Action: Form Industry Liaison Committee to facilitate "Engineers in Residence"
- Strategy: Improve graduate programs
  - Action: Redevelop MEng as Professional Masters
  - Action: Add E-learning graduate courses in Geotech/Geoenvironmental

❖ **Objective: Improve Departmental Administration**

- Action: Administrative Restructuring
- Action: Industry Liaison Committee to enhance industry, gov't interactions

## CLOSING

This summary (although exhausting) was not intended to be exhaustive. It hopefully reflects the discussions within the department and summarizes some of the specific initiatives that we would like to pursue in the coming days. I welcome any and all comments, critiques or suggestions.

**APPENDIX B**  
**Letters of Support**

March 5, 2010

Centres Subcommittee  
Planning and Priorities Committee of Council

Attn: Prof. Jay Kalra

Dear Prof. Kalra:

**RE: Letter of Support for Saskatchewan Centre for Masonry Design**

On behalf of the College of Engineering, please consider this letter as support for the establishment of the Saskatchewan Centre for Masonry Design as a Type A centre operating within the College of Engineering. The proposed Centre represents a tremendous opportunity to collaborate with an important local industry to enhance the training of highly qualified personnel, foster technical innovation to improve the competitive position of the regional and national economy, and establish the University of Saskatchewan as a leading research institution in the field of masonry design.

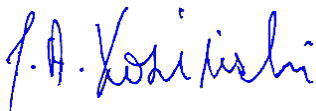
Working closely with the Saskatchewan Masonry Institute, as well as with several organizations representing national masonry industry, I have been intimately involved in the negotiations leading to the generous industrial donation that enabled the creation of this Centre. As such, I can attest to the strong industry support for this endeavor and the desire of the masonry community to see the University of Saskatchewan established as a masonry centre of excellence.

The proposed Centre capitalizes on the existing expertise of significant group of faculty within the College of Engineering who are already actively involved in fulfilling the centre's objectives. The Centre will also provide a strong supporting structure for anticipated future expansion in terms of both activities and personnel. In addition, funding generated through the Centre will be used, in part, to upgrade the research infrastructure and capabilities within the College.

As described in the proposal, the mandate of the Centre is aligned with several strategic priorities of the College, including the enhancement of the student experience, the promotion of sustainable infrastructure, advanced materials research, and the development of innovative technologies for the economic benefit of the province. It will also facilitate the creation of linkages with industry and other research institutions.

If I may provide you with any further information, please do not hesitate to contact me.

Sincerely,



Dr. Janusz A. Kozinski  
Dean & Professor  
College of Engineering



UNIVERSITY OF  
SASKATCHEWAN

Indigenous Land  
Management Institute

Tom Allen  
Indigenous Land Management Institute  
University of Saskatchewan  
October 21, 2009

I am a Commitment Leader in Aboriginal Engagement at the University of Saskatchewan and one of the pillar leaders in the Indigenous Land Management Institute, and I am writing to express support for the formation of the Masonry Centre at the University of Saskatchewan.

The implementation of the Masonry Centre, along with the life cycle engineering and costing initiatives, will work in support of aboriginal initiatives that we currently have underway at the Indigenous Land Management Institute (ILMI). Of particular interest to ILMI is in the development of northern housing and institutional buildings that are sustainable into the future and provide the required level of service while minimizing life cycle costs. Aboriginal peoples have also identified infrastructure as a key concern, and the move to identifying the life cycle costs of this infrastructure would support decision makers going forward.

Sincerely,

Tom Allen  
Indigenous Land Management Institute  
University of Saskatchewan

Sanj Singh  
Director  
The Wilson Centre for Entrepreneurial Excellence  
25 Campus Drive,  
Saskatoon, SK S7N 5A7  
Phone: 306.966.8675  
Fax: 306.966.2516  
singh@edwards.usask.ca

October 20, 2009

**Expression of Support**

I am the Director of The Wilson Centre for Entrepreneurial Excellence at the University of Saskatchewan and I am writing to express our support for the formation of the Masonry Centre at the University of Saskatchewan.

The implementation of the Masonry Centre, along with the proposed life cycle engineering and costing initiatives, is clearly of interest to The Wilson Centre for Entrepreneurship. A portion of the Centre's mandate is to develop new products and methods; this mandate coincides well with the creation of the Masonry Centre.

Sincerely,

Sanj Singh  
Director