



**Committee for the Evaluation of Civil Engineering Study Programs**

## **General Report**

**September 2011**

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## **Chapter 1- Background**

At its meeting on July 14, 2009, the Council for Higher Education (CHE) decided to evaluate study programs in the field of Civil Engineering during the academic year 2010 – 2011.

Following the decision of the CHE, the Minister of Education, who serves ex officio as a Chairperson of the CHE, appointed a Committee consisting of:

- **Prof. Mirosław Skibniewski**, Department of Civil & Environmental Engineering, University of Maryland, USA– Committee Chair
- **Prof. Jacob Fish**, Department of Civil Engineering and Engineering Mechanics, Columbia University, USA
- **Prof. Laurence J. Jacobs**, School of Civil & Environmental Engineering, Georgia Institute of Technology, USA
- **Prof. Gayle Mitchell**, Department of Civil Engineering, Ohio University, USA\*\*
- **Prof Jeffrey Packer**, Department of Civil Engineering, University of Toronto, Canada\*\*
- **Prof. Rodrigo Salgado**, School of Civil Engineering, Purdue University, USA\*\*\*

**Ms. Yael Franks** - Coordinator of the Committee on behalf of the CHE.

Within the framework of its activity, the Committee was requested to:\*

1. Examine the self-evaluation reports, submitted by the institutions that provide study programs in Civil Engineering, and to conduct on-site visits at those institutions.
2. Submit to the CHE an individual report on each of the evaluated academic units and study programs, including the Committee's findings and recommendations.
3. Submit to the CHE a general report regarding the examined field of study within the Israeli system of higher education including recommendations for standards in the evaluated field of study.

The entire process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (of October 2009).

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\* The Committee's letter of appointment is attached as Appendix 1.

\*\*Prof. Gayle Mitchell and Prof Jeffrey Packer did not take part in the evaluation of BGU and AUC

\*\*\*Prof. Rodrigo Salgado joined the committee for the second round of visits and therefore did not take part in the evaluation of SCE or Technion

## **Chapter 2-Committee Procedures**

The Committee held its first meetings on March 13, 2011 during which it discussed fundamental issues concerning higher education in Israel, the quality assessment activity, as well as Civil Engineering Study programs.

In March 2011, the Committee held its first cycle of evaluation, and visited the Sami Shamoon College of Engineering and the Technion. In May 2011 the Committee conducted its second evaluation cycle, and visited Ariel University Center of Samaria and Ben-Gurion University of the Negev.

During these visits, the Committee met with various stakeholders at the institutions, including management, faculty, staff, and students and also conducted a tour of the campus. The Committee wishes to thank the management of the institutions and the Civil Engineering departments for their self-evaluation reports and for their hospitality towards the Committee during its visits.

This report deals with the general state of Civil Engineering Programs in Israel.

## **Chapter 3 - Evaluation of Civil Engineering Study Programs in Israel**

### **3.1 Introduction to General Report**

- *This Report relates to the situation current at the time of the visit to the institution, and does not take account of any subsequent changes. The Report records the conclusions reached by the Evaluation Committee based on the documentation provided by the institution, information gained through interviews, discussion and observation as well as other information available to the Committee.*

This report discusses some general issues that arose as a result of our evaluations of the four Civil Engineering institutions listed above. These issues include: The extent of Civil Engineering curriculum; Status of Education and Research in Civil Engineering; Student-to-Faculty ratios, Academic Inbreeding, Alumni, and the Scope of Civil Engineering Programs in Israel.

#### **Background**

Civil Engineering is the oldest professional specialty in the field of Engineering. The name of the discipline is meant to distinguish it from the field of Military Engineering, formally dating back to the war of independence of the United States in the XVIII century. First practices related to Civil Engineering date back as far as 4000-2000 BCE and have been evident throughout the history of human kind ever since. Until the modern times, Civil Engineering practice was considered in terminology as synonymous with the practice of Architecture.

Modern Civil Engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like bridges, roads, canals, dams, and buildings. It is traditionally broken into several sub-disciplines, including environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. Civil engineering professional activity takes place on all levels: in the public sector from municipal through to national governments, and in the private sector from individual homeowners all the way through to major international companies.

Civil engineering education worldwide is well established at all levels; bachelors, masters and doctoral. According to unpublished UNESCO estimates, there are over 1,000 civil engineering undergraduate (bachelor's degree level) academic programs worldwide, including over 200 such programs in the United States alone. Approximately 60-65% of colleges and universities offering undergraduate civil engineering degrees offer also graduate level programs at the master's degree level, with a smaller proportion offering doctoral level degrees. These numbers do not include related programs in applied technologies, which do not require similar academic prerequisites in mathematics and science and which are offered typically only at a bachelor's degree level.

### **Types of Academic Institutions offering Degree Programs**

The four academic institutions offering Civil Engineering degree programs in Israel fall into two categories: colleges that are not research oriented institutions focusing on undergraduate studies in the field, and research universities focusing on undergraduate and graduate degrees.

The first category includes Sami Shamoon College of Engineering (SCE) and Ariel University Center of Samaria (AUC), while the second includes Technion – Israel Institute of Technology and Ben Gurion University of the Negev (BGU). All four institutions possess a substantial physical infrastructure dedicated to the operation of their programs. Three of the four institutions are located in major urban areas of the country, and one is located in the northeastern area of Samaria beyond the ‘green line.’ The level and quality of academic instruction in these institutions is generally compatible with prevailing international norms of instruction, although only one institution’s academic programs represent comprehensive offerings in all areas of Civil Engineering.

### **State of the Teaching Programs in Civil Engineering**

Undergraduate degree programs in Civil Engineering, i.e. B.Sc. programs at the Technion and at BGU, as well as B.Tech. programs at SCE and AUC, appear to be well conceived and executed in regard to their technical content and the extent of coverage. There is substantial theoretical foundational coursework underpinning subsequent laboratory instruction constituting the curricula. All of the four institutions have less than sufficient coursework that can be categorized as general education, aimed at fostering broader understanding of societal, economic and global issues of relevance to the civil engineering profession. The committee feels that such coursework should be designed and introduced into the Civil Engineering curricula.

Graduate programs in the field are offered mainly in only one of the institutions in Israel. The other 3 institutions do not offer formal graduate programs as part of their Civil Engineering curricula, although have strongly expressed their ambitions to initiate such offerings in the future.

### **Scope of Civil Engineering Programs**

The civil engineering programs at the three younger undergraduate institutions have all developed largely around the structural engineering and construction management specialties, mirroring to significant extent these parts of the Technion program. Although there appears to be a great need in Israel for graduates from these two areas, it may be prudent for the programs to think strategically for the future as to how each program could differentiate itself in other areas of civil engineering, such as geotechnical, environmental, transportation infrastructure, materials, etc. Opportunities also could be explored in all institutions for new synergistic courses and research such as development and use of sensor technology for structures.

### **State of the Research Activity in Civil Engineering**

Research activity in Civil Engineering is conducted at a world class level, including environmental, structural, civil engineering materials and construction management, but it

exists mainly in one of the institutions. There is a need to update several laboratory facilities at that institution by means of major infrastructure awards. A second institution offers research programs in a limited number of specialties at a level of quality compatible with prevailing international norms.

### **State of Civil Engineering Faculty**

There is an acute shortage of highly qualified Civil Engineering faculty in all academic specialties. Except for one institution, there is an excessively high student-to-faculty ratio to properly fulfill their educational mandate, with the situation exacerbated by an aging complement of academics nearing retirement. There is only one producer of graduate degrees in Civil Engineering, and the numbers of Ph.D. students in Israel is currently insufficient. This creates an acute problem of academic inbreeding, as virtually all nationally trained academics are alumni of only one institution, and this also makes it harder to assume faculty positions in the remaining three institutions in the near future. This is a problem which requires an urgent solution, perhaps through aggressive recruitment of new faculty from among the Israeli and Jewish Diaspora overseas, and/or non-Hebrew speaking faculty from abroad. As another measure to help address this issue, it would be desirable for Ben Gurion University to increase the number of its faculty and to offer its M.Sc. program. Eventually, BGU should develop its own Ph.D. program in Civil Engineering, as this would help resolve this crucial problem with the supply of qualified faculty candidates. To prevent further inbreeding, it may also be helpful to encourage each Ph.D. graduate of an Israeli institution such as the Technion to complete a post-doctoral appointment abroad before assuming a faculty position in Israel.

### **Alumni Surveys and Networks**

In general, most of the programs lack sufficient connectivity with alumni and industry. Development and utilization of alumni/industry advisory boards would help the programs in strategic planning, provide additional learning opportunities for students, such as field trips, senior design experiences and leadership, enhance placement of graduates, assist with program funding and serve as a source of adjunct or specialty class presenters. Tracking of program graduates through surveys or similar would help the programs better determine curriculum needs or changes.

## Concluding Recommendations

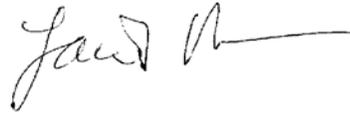
- Address the need to find urgent solutions for the acute shortage of highly qualified Civil Engineering faculty in all academic specialties. This would solve the problem of the high student-to-faculty ratio.
- Initiate and sustain aggressive efforts for recruitment of new faculty from among the Israeli and Jewish diasporas overseas and/or non-Hebrew speaking faculty from abroad.
- Address the issue of insufficient numbers of Ph.D. students in Israel. This will help the supply of potential future faculty for Israel's academic programs in Civil Engineering.
- After the solution has been found to the shortage of qualified faculty, consider increasing the current number (4) of Civil Engineering undergraduate programs at Israeli institutions of higher education. This should help address the sustained, growing demand for civil engineering professionals in the country.
- Design and introduce quality general education coursework into the Civil Engineering curricula in all of the four institutions
- Offer more available coursework at the Ph.D. level
- Encourage the existing international graduate program in Civil Engineering to expand in size, scope and diversity of students
- Think strategically for the future as to how each program could differentiate itself in other areas of civil engineering, such as geo-environmental, sustainable transportation infrastructure, innovative materials, etc.
- Explore opportunities for new synergistic/cross-disciplinary courses and research in all institutions
- Encourage each Ph.D. graduate of an Israeli institution to complete a post-doctoral appointment abroad before assuming a faculty position in Israel. This would also help the acute problem of academic inbreeding.

**Signed by:**



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Prof. Miroslaw Skibniewski,  
Chair



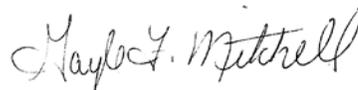
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Prof. Jacob Fish



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Prof. Laurence J. Jacobs



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Prof. Gayle Mitchell



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Prof. Jeffrey Packer



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Prof. Rodrigo Salgado

## Appendix 1: Letter of Appointment



May, 2011

שר החינוך  
Minister of Education

وزير التربية والتعليم

Prof. Miroslaw J. Skibniewski  
Department of Civil & Environmental Engineering  
A. James Clark School of Engineering  
University of Maryland, College Park  
USA

Dear Professor Skibniewski,

The State of Israel undertook an ambitious project when the Israeli Council for Higher Education (CHE) established a quality assessment and assurance system for Israeli higher education. Its stated goals are: to enhance and ensure the quality of academic studies; to provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel; and to ensure the continued integration of the Israeli system of higher education in the international academic arena. Involvement of world-renowned academicians in this process is essential.

This most important initiative reaches out to scientists in the international arena in a national effort to meet the critical challenges that confront the Israeli higher educational system today. The formulation of international evaluation committees represents an opportunity to express our common sense of concern and to assess the current and future status of education in the 21<sup>st</sup> century and beyond. It also establishes a structure for an ongoing consultative process among scientists around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial endeavor.

It is with great pleasure that I hereby appoint you to serve as the chair of the Council for Higher Education's Committee for the Evaluation of Civil Engineering Studies.

The composition of the Committee will be as follows: Prof. Miroslaw J. Skibniewski (Chair), Prof. Jacob Fish, Prof. Laurence J. Jacobs, Prof. Gayle Mitchell, Prof. Jeffrey Packer and Prof. Rodrigo Salgado.

Ms. Yael Franks will coordinate the Committee's activities.

In your capacity as the chair of the Evaluation Committee, you will be requested to function in accordance with the enclosed appendix.

I wish you much success in your role as chair of this most important committee.

Sincerely,

Gideon Sa'ar  
Minister of Education,  
Chairperson, The Council for Higher Education

Enclosures: Appendix to the Appointment Letter of Evaluation Committees

cc: Ms. Michal Neumann, The Quality Assessment Division  
Ms. Yael Franks, Committee Coordinator

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November 2009

## **Appendix to the Letter of Appointment for Evaluation Committees (Study Programs)**

### **1. General**

On June 3, 2003 the Council for Higher Education (CHE) decided to establish a system for quality assessment and assurance in Israeli higher education, which came into effect in the academic year of 2004-2005. Within this framework, study-programs are to be evaluated approximately every six

The main objectives of the quality assessment activity are:

- To enhance the quality of higher education in Israel;
- To create an awareness within institutions of higher education in Israel to the importance of quality evaluation and to develop an internal culture of self-evaluation, as well as the required mechanisms;
- To provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel;
- To ensure the continued integration of the Israeli system of higher education in the international academic arena.

**It is not the CHE's intention to rank the institutions of higher education according to the results of the quality assessment processes. The evaluation Committee (hereinafter "Committee") should refrain from formal comparisons.**

### **2. The Work of the Evaluation Committee**

- 2.1 The Committee shall hold meetings, as needed, before visiting the institution, in order to evaluate the material received.
- 2.2 The Committee shall visit the institutions and the academic units being evaluated – if possible - within 4-6 months of receiving the self-evaluation reports. The purpose of the visit is to verify and update the information submitted in the self-evaluation report, clarify matters where necessary, inspect the educational environment and facilities first hand, etc. During the visit, the Committee will meet with the heads of the institution, faculty members, students, alumni, administrative staff, and any other persons it considers necessary.
- 2.3 The duration of the visits (at least one full day) will be coordinated with the chairperson of the Committee.

- 2.4 Following the visit, the Committee will submit the CHE with:
1. A final report on each of the evaluated departments,
  2. A general reports on the state of the discipline in the Israeli higher education system. The general report will include recommendations to the CHE for standards and potential state-wide changes in the evaluated field of study.
- 2.5 The reports will be sent to the institutions and the academic units for their response.
- 2.6 The reports and Committee's findings will be submitted to the CHE and discussed within its various forums.

### **3. Conflict of Interest Policy**

- 3.1 In order to avoid situations that may question the credibility and integrity of the evaluation process, and in order to maintain its ethical, professional and impartial manner, before issuing their Letter of Appointment members and chairperson of the evaluation Committee will sign a Declaration on Conflict of Interest and Confidentiality.
- 3.2 In the event that a member of the Committee is also a current or former faculty member at an institution being evaluated, he/she will not take part in any visits or discussions regarding that institution.

### **4. The Individual Reports**

- 4.1 The final reports of the evaluation Committee shall address every institution separately.
- 4.2 The final reports shall include recommendations on topics listed in the guidelines for self-evaluation, including:
- The goals, aims and mission statement of the evaluated academic unit and study programs
  - The study program
  - The academic faculty
  - The students
  - The organizational structure
  - Research
  - The broader organizational structure (school/faculty) in which the academic unit and study program operate
  - The infrastructure (both physical and administrative) available to the study program
  - Internal mechanisms for quality assessment
  - Other topics to be decided upon by the evaluation Committee

### **5. The Recommended Structure of the Reports**

#### ***Part A – General background and executive summary:***

- 5.1 General background concerning the evaluation process; the names of the members of the Committee and its coordinator; and a short overview of the Committee's procedures.
- 5.2 A general description of the institution and the academic unit being evaluated.

5.3 An executive summary that will include a brief description of the strengths and weaknesses of the academic unit and program being evaluated.

**Part B – In-depth description of subjects examined:**

5.4 This section will be based on evidence gathered from the self-evaluation report and the topics examined by the Committee during the site visit.

5.5 For each topic examined, the report will present a summary of the Committee's findings, the relevant information, and their analysis.

**Part C – Recommendations:**

5.6 This section will include comprehensive conclusions and recommendations regarding the evaluated academic unit and the study program according to the topics in part B.

5.7 Recommendations may be classified according to the following categories:

- ***Congratulatory remarks and minimal changes recommended, if any.***
- ***Desirable changes recommended*** at the institution's convenience and follow-up in the next cycle of evaluations.
- ***Important/needed changes requested for ensuring appropriate academic quality*** within a reasonable time, in coordination with the institution (1-3 years)
- ***Essential and urgent changes required, on which continued authorization will be contingent*** (immediately or up to one year).
- ***A combination of any of the above.***

**Part D - Appendices:**

5.8 The appendices shall contain the Committee's letter of appointment and the schedule of the on-site visit.

**6. The General report**

In addition to the individual reports concerning each study program, the Committee shall submit to the CHE a general report regarding the status of the evaluated field of study within the Israeli institutions of higher education. The report should also evaluate the state and status of Israeli faculty members and students in the international arena (in the field), as well as offer recommendations to the CHE for standards and potential state-wide changes in the evaluated field of study.

**We urge the Committees to clearly list its specific recommendations for each one of the topics (both in the individual reports and in the general report) and to prioritize these recommendations, in order to ease the eventual monitoring of their implementation.**

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