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## ***Canadian Construction R & D Performers and Funders***

*A Report and Inventory Prepared for the  
Institute for Research in Construction  
by Revay and Associates Limited, 1999*

# **CANADIAN CONSTRUCTION R & D PERFORMERS AND FUNDERS**

A REPORT AND INVENTORY PREPARED FOR THE  
INSTITUTE FOR RESEARCH IN CONSTRUCTION,  
NATIONAL RESEARCH COUNCIL CANADA



REVAY AND ASSOCIATES LIMITED  
MONTREAL-OTTAWA-TORONTO-CALGARY-VANCOUVER

April 15, 1999

## **CANADIAN CONSTRUCTION R&D PERFORMERS AND FUNDERS**

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## INTRODUCTION

A comprehensive national survey in 1982-83 was reported on in Construction R.D. & D. in Canada. Subsequently the Institute for Research in Construction (IRC) of the National Research Council Canada has periodically commissioned a survey of construction R&D organizations in the country to:

- identify them and their main areas of R&D interest
- facilitate networking through the naming of principal contacts
- track trends among the various sectors.

Previous published compilations of "The Top Fifty"<sup>1</sup> were based on 1987 and 1992 activities. The present compilation is based on 1998 activities.

As before, "Construction" has been broadly defined to include all types of building and engineering construction projects and "Construction R&D" to include research and development work related to all aspects of the construction process.

- e.g.
- Construction materials, components, systems and equipment
  - Construction project planning, design, management and on-site construction
  - The operation, maintenance, servicing and protection of completed construction facilities
  - Software

The focus has been on technology, rather than on social or economic research. Participants have been asked to exclude testing and other than primary technology transfer activities.

Previous compilations of "The Top Fifty" were made available to interested parties in hard copy form, on request. In order to encourage networking and a broader dissemination of the survey data, IRC has provided the detailed data from the current study to the Canadian Construction Research Board (CCRB) for incorporation into its Canadian Construction Research Network (CCRNET). CCRNET has been developed as a construction research map for CCRB by the Construction Technology Centre Atlantic (CTCA). The detailed survey data may be seen at the CCRNET web-site (<http://ctca.unb.ca/ccrnet/top50.cfm>).

This data will be continuously updated on the web-site. In addition, there is the capability for any organization to add data on research projects directly on-line to the web-site.

Of the organizations responding to the survey, those with annual expenditures of \$500,000 or more on construction R&D during 1998 have been selected for analysis in this report.

The organizations qualifying for inclusion in the new compendium were again coded in

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<sup>1</sup> All four surveys have been conducted by Revay and Associates Limited

broad categories with the same criteria used in the previous editions:

- |      |               |  |
|------|---------------|--|
| i.e. | Major Centres | - Construction R&D annual outlays of over \$10 million |
|      | Large Scale   | - \$1 million to \$10 million                          |
|      | Medium Scale  | - Under \$1 million                                    |

The designation of "Small Scale" is reserved for possible future use but it should be noted that modest R&D programs may well be responsible for important technological advances.

It is hoped that the publication of this report and the operation of CCRNET will help to uncover additional organizations that should be included.

A sincere expression of appreciation is extended to members of the IRC staff and to all those in the R&D organizations who participated in the survey. Without their prompt cooperation, the assignment could not have been executed.

## PRINCIPAL FINDINGS

### 1. Widespread Downsizing

Although there are some exceptions, the general trend experienced among the 1992 "Top Fifty" has been a significant decrease in construction R&D activities in 1998, compared to their level six years ago. This trend exists in all categories and in all sectors, with the exception of Federal Government agencies.

The overall breakdowns on this basis are as follows:

	<u>1987</u>	<u>1992</u>	<u>1998</u>
Major Centres	7	6	4
Large Scale	27	40	25
Medium Scale	<u>16</u>	<u>4</u>	<u>16</u>
	<u>50</u>	<u>50</u>	45
Nil Reports			<u>5</u>
			<u>50</u>

The four "Major Centres" are repeaters from the two previous "Top Fifty" inventories — the NRC Institute for Research in Construction, Natural Resources Canada (formerly Energy, Mines & Resources Canada), Hydro-Québec and Forintek.

Of the two other "Major Centres" in the 1992 inventory, funding of construction R&D by the Natural Sciences and Engineering Research Council of Canada fell just below the \$10 million level in 1998. The other "Major Centre" in 1992 was Powertech Labs Inc., a subsidiary of B.C. Hydro. In 1998 its outlays for construction R&D fell below \$1 million.

The number of "Large Scale" organizations has also fallen below the 1987 and 1992 levels. A dozen of the "Large Scale" organizations in 1992 are now only "Medium Scale." Five of the "Top Fifty" in 1992 no longer had construction R&D programs in 1998 and a sixth has closed down in 1999.

A breakdown by sectors using the above categories of organizations executing construction R&D is as follows:

YEAR	1987				1992				1998			
Category	Major	Large	Medium	Total	Major	Large	Medium	Total	Major	Large	Medium	Total
Sector												
Fed. Gov't Agencies	3	5		8	3	4		7	2	5		7
Prov. Gov't Agencies		4	3	7		6	2	8		3 <sup>2</sup>	4	7
Hydro	1	2		3	2	3		5	1	2	1	4
Oil and Gas		5		5		3		3		1	1	2
Mfrs and Services	2	5	3	10	1	7		8	1	4	3	8
Universities		4	5	9		11	1	12		10	2	12
Associations		2	1	3		3		3			1	1
Consult. Engineers	1		4	5		3	1	4			4	4
Totals	7	27	16	50	6	40	4	50	4	25	16	45

## 2. Increased Incidence of Joint Ventures/Partnerships

Because of financial cutbacks, research organizations have been forced to adopt innovative arrangements to generate the necessary funding to finance their operations. Projects may have five or more financial contributors and/or research partners. Networks have been established to pool resources and reduce duplication of effort. Work previously contracted out may now be performed by partners or joint venturers.

This trend is manifested at all levels of government and in new organizations formed to coordinate the funding and execution of research activities. Examples of the latter include the Centre d'Expertise et de Recherche en Infrastructures Urbaines (CERIU); the new Centre of Excellence, ISIS Canada (Intelligent Sensing for Innovative Structures); and the privately endowed Construction Research Institute of Canada (CRIC).

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<sup>2</sup> ORTECH is included, but has now been privatized.

More and more companies and municipal governments are involved in construction R&D partnerships. These are often related to construction works which would be built anyway and it is difficult to quantify the R&D element but their partnerships are part of an encouraging trend.

### 3. Greater Focus on Repair and Renovation Construction Reflected in R&D Programs

Subsequent to the previous "Top Fifty" survey (1992), the value of the Canadian construction program decreased and the relative importance of repair and renovation work increased, compared to new construction. More recently the value of the annual overall construction program has again exceeded the \$100 billion level, but the emphasis on repair and renovation work has continued. References to "rehabilitation", "maintenance", "indoor air quality", "infrastructure remedial work" etc. in construction R&D programs are now more prevalent than in the past.

### 4. Sector Trends among Construction R&D Performers

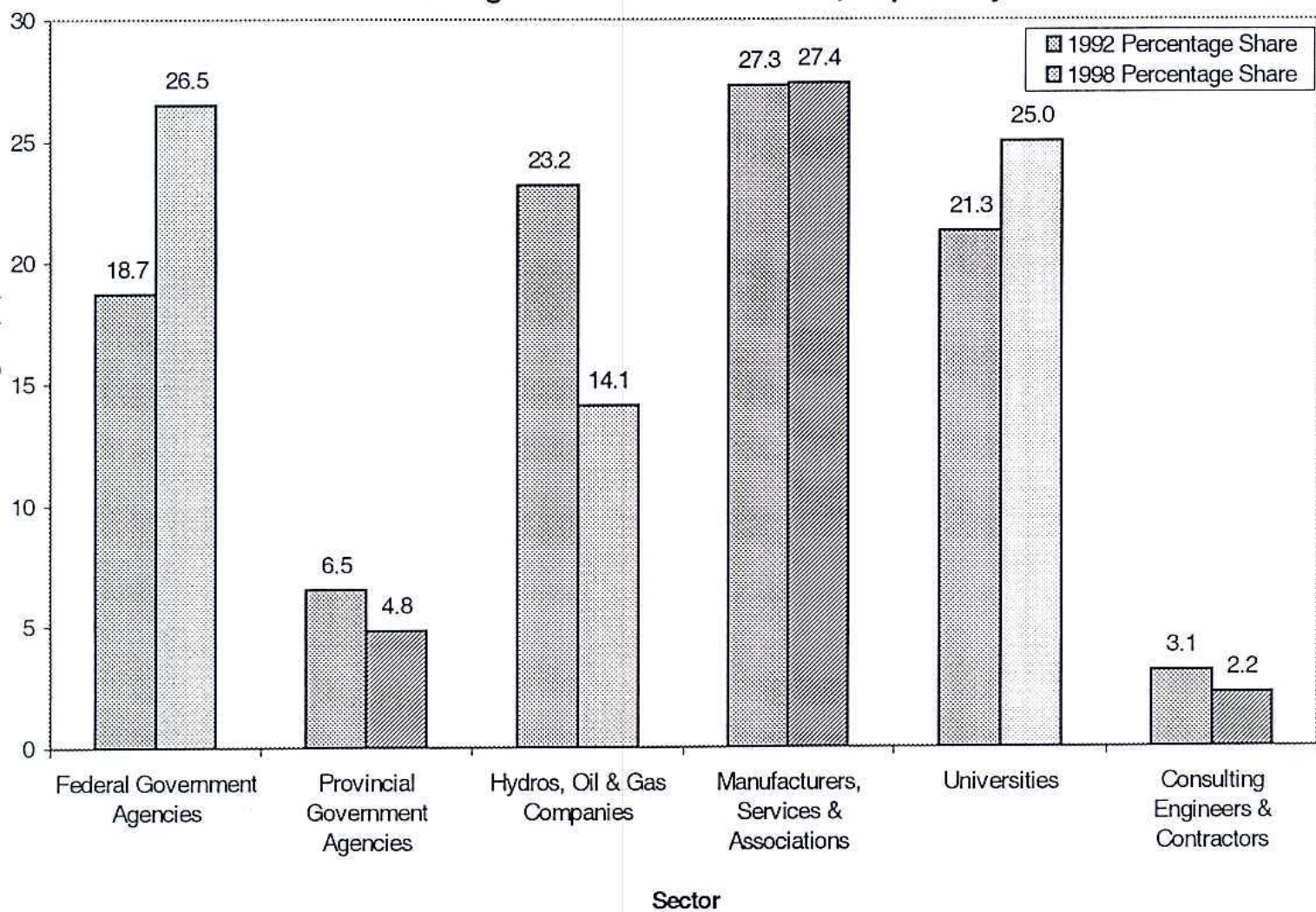
Participants in the survey were asked to report on the share of their construction R&D program that was conducted in-house and the principal agents for work that was contracted out. This was done with a view to eliminating any double-reporting of construction work when aggregating the estimated totals for each sector. Using a threshold of \$500,000, the rough totals and percentage shares of the construction R&D performers included in the 1992 and 1998 surveys, by sectors, are as follows:

Construction R&D Sector	Construction R&D Performed In 1992	% Share in 1992	Construction R&D Performed in 1998	% Share in 1998
Federal Government Agencies	\$26,000,000	18.7	\$31,900,000	26.5
Provincial Government Agencies	\$9,000,000	6.5	\$5,775,000	4.8
Energy Companies	\$32,200,000	23.2	\$16,950,000	14.1
Mfrs., Services & Associations	\$38,000,000	27.3	\$33,058,000	27.4
Universities	\$29,550,000	21.3	\$30,129,000	25.0
Consulting Engineers & Contractors	\$4,250,000	3.1	\$2,610,000	2.2
<b>TOTALS</b>	<b>\$139,000,000</b>	<b>100%</b>	<b>\$120,422,000</b>	<b>100%</b>

In summary, Federal Government agencies were the sole sector to show a significant increase in 1998 over 1992 in dollar and/or percentage share terms. The university sector showed a small increase in dollar terms and a modestly higher percentage of the reduced total. The share for the Manufacturers, Services and Associations maintained virtually the same percentage share but, like all of the remaining sectors, reported lower dollar outlays. (It should also be noted that no adjustment has been made for inflation).

The trends in percentage shares are shown graphically in Figure 1.

**FIGURE 1**  
**Construction R & D Performers with Annual Outlays of \$500,000 or More —**  
**Percentage Shares for 1992 and 1998, respectively**



## **SECTOR LISTINGS**

The construction R&D organizations participating in the survey with outlays in 1998 of \$500,000 or more are listed below by sectors, together with a brief commentary.

### **1. Federal Government Agencies**

National Research Council Canada (NRC)  
Industrial Research Assistance Program (IRAP)  
Institute for Research in Construction (IRC)

Natural Sciences and Engineering Research Council of Canada (NSERC)

Natural Resources Canada (NRCan)  
Canada Centre for Mineral and Energy Technology (CANMET)

Public Works and Government Services Canada (PW&GSC)  
Technology Directorate

Atomic Energy of Canada Limited (AECL)

Canada Mortgage and Housing Corporation (CMHC)

Department of National Defence

The National Research Council Canada was again the largest performer of construction R&D in Canada in 1998. Its Institute for Research in Construction devoted some \$15 million of its total operating cost of \$22 million to research and immediate technology transfer activities. In addition, the NRC Industrial Research Assistance Program qualified as a "Large Scale" organization, with some \$3.5 million allocated to construction-related research grants and Industrial Technology Assistance services.

Natural Resources Canada performed or funded construction R&D through various programs, aggregating some \$13 million in 1998. Its largest components were the Program for Energy Research and Development (PERD) and the CANMET Materials Branch. The PERD budget for construction in 1998 was \$6.75 million, compared to \$15 million in 1992. The Natural Sciences and Engineering Research Council of Canada contributed an estimated \$9.75 million last year to the university community in grants, research partnerships and the ISIS Centre of Excellence program. Atomic Energy of Canada Ltd., Public Works and Government Services Canada and Canada Mortgage and Housing Corporation were all "Major Centres", with aggregate outlays of some \$12.5 million in 1998.

## 2. Provincial and Municipal Government Agencies

Alberta Department of Transportation and Utilities

Alberta Research Council

Ministry of Transportation of Ontario

Quebec Ministry of Research, Science and Technology

Fonds pour la formation de chercheurs et l'aide à la recherche (Fonds FCAR)

Saskatchewan Research Council

Ville de Montréal

Whereas four provincial ministries qualified as "Large Scale" in 1992, only one of them did so in 1998 — the Ministry of Transportation of Ontario. The closure of this Ministry's Research and Development Branch was, however, recently announced. The Alberta Department of Municipal Affairs — Housing Division (previously "Large Scale") filed a nil report. Four provincial Research Councils were included in the 1992 "Top Fifty" organizations. Of these the largest was in Ontario. It has been privatized and now operates under the name of Bodycote Ortech Inc. It has maintained its construction-related research activities at the \$4 million per year level.

A most welcome addition to the current list of participating provincial agencies is the Quebec Ministry of Research, Science and Technology and its "Fonds pour la formation de chercheurs et l'aide à la recherche" (Fonds FCAR), which operates in similar fashion to the Natural Sciences and Engineering Research Council of Canada. Fonds FCAR's funding of construction R&D activities at Quebec universities in 1998 exceeded \$1 million. Another new listing in this report is the City of Montreal — the first municipal government to qualify in the series. Its construction R&D outlays in 1998 also exceeded \$1 million (largely contracted-out).

## 3. Electricity, Oil and Gas

Hydro-Québec

Institut de recherche électrique de Québec (IREQ)

Ontario Hydro Technologies

Petro-Canada Inc.

Asphalt R&D Laboratory

Powertech Labs Inc.

Manitoba Hydro

Husky Oil

TransCanada PipeLines Ltd.

Hydro-Québec is responsible for the bulk of the construction-related research activities in the energy sector. In 1998 its outlays amounted to some \$15 million.

4. **Manufacturers and Services**

Forintek Canada Inc.

General Electric of Canada Inc.

Bodycote Ortech Inc.

C-FER Technologies

Alcan International Ltd.

Kingston Research and Development Centre

Stelco Inc.

Canam Manac Group Inc.

Lafarge Canada Inc.

Nexfor Technologies

Dow Chemical Canada Ltd.

Centre d'Expertise et de Recherche en Infrastructures Urbaines

Bell Canada/Nexacor Realty Management Inc.

Forintek's construction-related research program has decreased since 1992 but still qualified in 1998 as a "Major Centre" — i.e. over \$10 million. MacMillan Bloedel Ltd.'s laboratory was closed down in 1998; previously the firm had been a major player in this sector among the "Top Fifty". The Centre for Frontier Engineering Research was shown with the University for Alberta's listing in the 1993 report, but

now operates as C-FER Technologies Ltd. and continues as a "Large Scale" organization. ORTECH International has been privatized and now operates as Bodycote Ortech Inc.

5. **Universities**

Memorial University of Newfoundland

Centre for Cold Ocean Resources Engineering (C-CORE)

Dalhousie University

Faculty of Engineering (Dal Tech)

University of New Brunswick

Department of Civil Engineering

Construction Technology Centre Atlantic (CTCA)

Université Laval

Département de génie civil

Université de Sherbrooke

Faculté de science appliqué

Université du Québec à Montréal

École de Technologie Supérieure (ETS)

École Polytechnique de Montréal

Département de génie civil

Concordia University

Department of Building, Civil and Environmental Engineering

McGill University

Department of Civil Engineering and Applied Mechanics

University of Ottawa

Department of Civil Engineering

Queen's University

Department of Civil Engineering

University of Toronto

Department of Civil Engineering

McMaster University  
Department of Civil Engineering

University of Western Ontario  
Department of Civil Engineering  
Boundary Layer Wind Tunnel  
Centre for Studies in Construction

University of Manitoba  
Department of Civil and Geological Engineering  
ISIS Canada

University of Calgary  
Department of Civil Engineering

University of Alberta  
Faculty of Engineering  
Construction Research Institute of Canada

University of British Columbia  
Department of Civil Engineering

New listings for the Universities of Calgary, Manitoba, Toronto, Ottawa and Québec and Dalhousie and Queen's Universities are features of the 1998 survey. The ISIS Centre of Excellence based at the University of Manitoba has the same type of NSERC funding previously enjoyed by the Centre of Excellence on High Strength Concrete based at the University of Sherbrooke.

A noteworthy development during 1998 was the creation of the Construction Research Institute of Canada with an endowment of \$5 million. The institute's director and two research assistants are located at the University of Alberta; to date five other universities are also participating in the Institute's program.

## 6. **Associations**

### Transportation Association of Canada

Three associations were included in the previous "Top Fifty" inventory. All were "Large Scale". However, only the Transportation Association of Canada remains (and now as "Medium Scale"). The Canadian Electricity Association's research role has been transformed from a funder to a facilitator. The Welding Institute of Canada went into receivership some time ago.