

**Progress Report
WFEO Action Pledge for Nairobi Work Program
Date: November 25, 2011**

Name of Organization: World Federation of Engineering Organizations

Date: November 25, 2011

Title of Initiative:

Adaptation of Sustainable Infrastructure to Climate Change Impacts

Elements of Action Pledge on which progress is reported here:

Element #1: To develop and implement engineering tools, policies and practices for risk assessment and adaptation of existing and new civil infrastructure to climate change.

Element #2: To build knowledge, experience and appropriate techniques to enhance the technical capacity of engineers to adapt civil infrastructure to climate change, particularly within developing and least developed countries

NWP work areas to which the updates are relevant:

Methods and tools, climate change risks and extreme events, adaptation planning and practices

Activities Undertaken and Key Outputs

Action Pledge Element #1

Activity #1: Further Development and Evaluation of the PIEVC Engineering Protocol

This protocol is the intellectual property of Engineers Canada, which is a member of the WFEO. It is available for international use through a license agreement with Engineers Canada at no financial charge. Contact David Lapp, P.Eng., Manager, Professional Practice (david.lapp@engineerscanada.ca)

In the fall of 2011, Version 10 of this Protocol was completed based on the results of over 20 case studies of infrastructures in Canada as well as a case study in Costa Rica. The Protocol and its worksheets are now available in three languages – English, French and Spanish.

The Protocol was originally developed to assess the climate risks to four categories of infrastructure including buildings, roads, bridges and associated structures, stormwater and wastewater collection and treatment systems as well as water resources (potable water, dams, flood and coastal structures). Its use has now been expanded to other types of infrastructure systems, including a project currently underway to evaluate airport infrastructure. Another case study is underway for a public high rise apartment building that should provide learnings for these types of buildings in other countries.

Activity #2: Engineering Vulnerability Assessment Case Studies of Individual Infrastructure

Several new case studies of infrastructure engineering vulnerability assessment in Canada were completed in 2011 using the PIEVC Engineering Protocol:

1. City of Toronto Department of Transportation – assessment of three urban road culvert systems
2. British Columbia Ministry of Transportation and Infrastructure – Yellowhead Highway road infrastructure assessment
3. Town of Prescott ON – assessment of the town's stormwater collection and treatment system.
4. Town of Castlegar BC – assessment of the town's stormwater management system in a mountainous region
5. Cities of Laval and Trois Rivieres Quebec – assessment of their stormwater collection and treatment systems using the French version of the Protocol
6. City of Calgary AB – assessment of their entire potable water collection, treatment and transmission system including the source watersheds
7. District of Shelburne NS – assessment of the design for a new sewage treatment plant

These reports are available through David Lapp, FEC, P.Eng., Engineers Canada. Several more case studies are underway and will be reported in the next period.

Activity #3: Development of a Triple Bottom Line Costing Module

This new tool will evaluate the costs of adaptation recommendations from the engineering vulnerability assessment using the Protocol. It is a complimentary tool that will provide order of magnitude costs for adaptation recommendations from combined social, environmental and economic perspectives – **the triple bottom line**. It will include cost estimates for not adapting the infrastructure i.e. not implementing the adaptation recommendations arising from the vulnerability assessment.

The tool is currently under development and will be ready for testing by April 2012.

Action Pledge Element #2

Activity #1: PIEVC Engineering Protocol Training Workshops - Canada

From November 2009 to May 2011, Engineers Canada held sixteen (16) one-day training workshops across Canada for engineers and other professionals on the theory and application of the PIEVC Engineering Protocol for infrastructure climate risk assessment. Over 650 engineering and other professionals participated in these very successful workshops. The one-day workshop includes presentations on the principles of risk assessment, the PIEVC Engineering Protocol and up to several Canadian case studies. It includes two small group exercises to define infrastructure components and climate elements as well as estimating risks. Copies of slide presentations are available upon request to Engineers Canada. (david.lapp@engineerscanada.ca)

Activity #2: PIEVC Engineering Protocol Training Workshops - International

The WFEO Committee on Engineering and the Environment, chaired by Engineers Canada, held a two-day training workshop for more than 40 civil, mechanical and electrical engineers in March 2011 organized through the national civil engineering association in Tegucigalpa, Honduras.

The format was similar to the Canadian workshops except that the hands-on exercises used a local example for a power supply infrastructure project in Central America. One of the trainers was the Project Manager from the Costa Rica Colegio who also presented results from their project (see Activity #3)

Activity #3: Costa Rica Knowledge Development and Capacity Building Project

The overall goal of this project was to build the capacity for Costa Rican engineers to lead engineering vulnerability assessments of the country's civil infrastructure to the impacts of future climate change. The project was started in August 2010 and completed in April 2011. The project was led by the Costa Rica Colegio of engineers and architects in partnership with AyA, the national water authority and the Costa Rica Meteorological Service. In total 13 professional engineers and other professional practitioners in Costa Rica participated significantly in the project and an initial capacity to undertake vulnerability assessments of infrastructure using the Protocol was developed.

The case study included the delivery of three sets of hands-on workshops at the beginning, middle and end stages of the project as well as continuing advice and consultation as the assessment progressed. The last trip in March 2011 included a final workshop to complete the conclusions on engineering vulnerabilities with engineering-based recommendations to address these vulnerabilities. Presentations to senior government decision-makers were included in the final trip.

In September 2011, Engineers Canada signed a three-year license agreement with the Colegio for the use and sub-licensing of the Protocol for infrastructures in Costa Rica. Personnel from the Colegio will also assist the WFEO/Engineers Canada with similar knowledge development and capacity building projects in Latin America and Caribbean nations.

The long-term goal is to successfully transfer the application of the PIEVC Engineering Protocol to newly developed and developing countries to provide a low cost assessment tool to plan cost-effective adaptation of existing and planned infrastructure to the impacts of future climate change.

Potential application/implication for the adaptation community under the NWP

Academics

The PIEVC Engineering Protocol could be applied to research vulnerabilities of other types of infrastructure not covered by the project in Canada. It could also be used as a teaching tool for the principles of risk assessment as it relates to infrastructure and climate change impacts.

Practitioners

Development of a tool and applications that enable engineers, planners and decision-makers to assess the engineering vulnerabilities and account for climate change impacts on civil infrastructure in design, operations and maintenance

Enable practitioners to demonstrate due diligence in considering climate change for infrastructure needed for insurance and liability concerns

Enable procurers to specify requirements to consider climate change risks in the design or retrofitting of infrastructure.

Policy-makers

Results will lead to recommendations on adjustments or reviews of selected infrastructure codes, standards and practices.

Results will lead to recommendations and implementation of policies and procedures to conduct climate risk assessment as part of any procurement or operational review of civil infrastructure

Educators

Case study results can be used to develop presentations, workshops and course materials in climate change risk assessment as it relates to civil infrastructure. Personnel who worked on these case studies could be invited to serve as guest speakers or even trainers.

Journalists

There is considerable potential for articles in technical publications and at conferences.

Plans for the Next Steps

Planned Activity #1 – Completion of the Triple Bottom Line Costing Tool for Infrastructure Adaptation Remedial Actions

Description:

The Protocol will be enhanced to enable order of magnitude estimates of the economic, social and environmental (“triple bottom line”) costs to implement design, operations and/or maintenance options for recommended remedial actions to address the engineering vulnerabilities identified in the assessment, including the costs of “no action”.

Construction of the module is underway and initial testing will be completed by April 2012. The intent is to further test with already completed case studies to ensure the outputs are representative and provide the right information for decision-makers. The evaluation of the tool will include an assessment of the cost-effectiveness of doing this kind of evaluation for adaptation recommendations. Such analysis may not be appropriate or cost-effective for certain recommended actions

Outputs:

The expected outcome is a series of Microsoft Excel spreadsheets with instructions on use and application. It will be made available as part of the PIEVC Engineering Protocol under a license agreement at no cost with Engineers Canada.

Planned Activity #2 – Development of a Knowledge Base of Infrastructure Climate Change Engineering Vulnerabilities

Description:

The results of case studies of individual infrastructures will be consolidated into an electronic knowledge base, initially compiled in Microsoft Excel. A second generation of this knowledge base will likely be migrated to Microsoft Access to enable more automated compilation of results and analysis of particular climate or infrastructure parameters of interest. The knowledge base is being initially populated with results of the Canadian case studies. Its first application is to evaluate the need for reviews of infrastructure codes, standards and related instruments based on component that are highly vulnerable or at high risk from particular climate parameters..

If there is interest in the knowledge base framework it could be customized for use internationally or by other countries.

Outputs:

A library of data on climate change vulnerabilities for each of the four infrastructure categories is being assessed through the PIEVC Engineering Protocol,

Planned Activity #3 – Engineering Vulnerability Assessment Case Studies of Individual Infrastructure

Description:

There are currently six case studies that are in progress and will be completed in the first quarter of 2012. By March 31, 2012 the total number of completed case studies will be 23, across four infrastructure categories.

Further case studies on a cost-recovery basis will be encouraged and supported by Engineers Canada. These will include new infrastructure categories such as airports, coastal ports and utilities. The number of case studies in 2012 is dependent on securing funding from the infrastructure owner or a third party e.g., government or financial institution.

Outputs:

Case study reports will be placed on the website www.engineerscanada.ca and www.wfeo.net as they become available. Results will be entered on the national knowledge base (Planned Activity #2)

Planned Activity #4 – Honduras Knowledge Development and Capacity Building Project

Description:

This project will conduct an engineering vulnerability assessment of four highway bridges in Honduras using the PIEVC Engineering Protocol. The objectives are to achieve knowledge development and build the capacity for Honduran engineers and others involved in the administration, operation and maintenance of transportation infrastructure (highway bridge infrastructure) to assess the impacts of current and future climate and to recommend adaptation actions based on the vulnerability assessment. The work will be conducted through a series of joint workshops similar to the Costa Rica project. It is hoped to engage the Honduras meteorological service and the Caribbean Community Climate Change Committee as a partner in the project.

The project goes further in that the results of the assessments will be used to evaluate and recommend changes to the codes, standards, engineering practices and related instruments used for highway bridges. It will also review construction and procurement practices to assure that climate change will be considered in future planning, design and operations.

The project will commence in January 2012 and continue until the end of March 2013.

Outputs:

These include reports on the results of the vulnerability assessment of the four bridges, with Executive Summaries in English and Spanish. Presentations on the results will be prepared in both languages and presented at regional Forums and at UNFCCC side events.

Planned Activity #5 - PIEVC Infrastructure Engineering Vulnerability Assessment Training Workshop Development and Delivery - Canada

Description:

Two workshops are confirmed for early 2012. The first is organized for professional practitioners involved in the planning, design, operation and maintenance of airport infrastructure. This workshop will introduce the Protocol and its principles and applications to personnel who will then undertake an assessment of airport infrastructure.

The second workshop is directed to all staff, including municipal engineers who working at municipalities in Canada in the planning, design, operation and maintenance of municipal infrastructure. If this workshop attracts sufficient participants, the intention is to offer it to the more than 3,000 municipalities across Canada on a cost-recovery basis.

Other workshops will be arranged on a demand or opportunity basis with cost-recovery achieved through registration fees or sponsorship.

Outputs:

Workshop materials that would be re-used with limited revisions for other provinces and territories in Canada.

Workshop materials developed that could be re-used with revisions for other countries.

Planned Activity #5 – Knowledge Development and Capacity Building for Infrastructure Vulnerability Assessment in Newly Developed and Developing Countries

Description:

The overall goal is to build the capacity for engineers to lead engineering vulnerability assessments of their civil infrastructure to the impacts of future climate change. Each country will complete a vulnerability assessment for one of their key infrastructures that can be used as an example for follow-on assessments. Initially projects will be proposed using the model that was successfully executed in Costa Rica. However there may be adjustments needed based on local circumstances

These projects will be undertaken on an opportunity basis subject to the availability of funding and qualified personnel.

Outputs:

Training workshops for practitioners will be delivered in the newly developed and developing countries with a particular focus on Latin America and Caribbean nations. The Costa Rica case study will be used as a prime example of the application of the Protocol in the region. These workshops include a presentation on the local and/or regional climate to improve awareness and knowledge of the impact of current and future climate on infrastructures.

Reports on engineering vulnerability assessments of individual infrastructures will be completed in newly developed and developing countries and executive summaries will be made available through the WFEO website (www.wfeo.net) under the Committee on Engineering and the Environment.

Workshop materials will be developed in English, French and Spanish that could be re-used with some revisions for similar projects in other countries.