25 YEARS WASHINGTON ACCORD

1989–2014

Celebrating international engineering education standards and recognition

INTERNATIONAL ENGINEERING ALLIANCE

Acknowledgements

The Chairman and Deputy Chairman of the Washington Accord acknowledge the many contributors whose competence and commitment contributed to the success of the Washington Accord:

- The founding signatories
- The signatories and their delegates over the years for their contribution to meetings, forums, workshops and working groups between meetings
- Our predecessors as Chairman and Deputy Chairman
- The various Secretariats:
    - Engineers Canada (1993-1997)
    - Engineers Australia (1997-2001)
    - Abet Inc (2001-2007)
    - The IEA Secretariat provided by IPENZ (2007 - present)
- The IEA Governing Group since 2007
- Some 60 reviewers who have served on visit teams to assess applications for signatory status and periodic review of signatories
- Our colleagues in the other IEA constituent agreements.

> “How do we build mutual understanding among nations about the quality of engineers who enter the globally connected workplace?”

George Peterson, Washington Accord Secretariat, 2001-2007

Neil Caughey

Contents

Foreword

Basil Wakelin, Chair, IEA Governing Group

The Washington Accord is a constituent of the International Engineering Alliance (IEA) which comprises educational accords for professional engineers, engineering technologists and engineering technicians plus two professional engineering and one engineering technologist competency agreements. The IEA is concerned with engineering education and competence across the whole spectrum of engineering.

As a founding member and the most senior of the constituents, the Washington Accord has set the foundation and standards for graduate attributes and accreditation of programmes and defines the educational basis for the International Professional Engineers Agreement and APEC Engineers Agreement on competency.

The international recognition and portability of both educational qualifications and professional competency is becoming increasingly important in this age of global interdependence but unbalanced global development, which requires movement of engineering skills around the world. We cannot afford to waste engineering resources or engineering education and it is now widely recognised that the Washington Accord has made a considerable impact on improvements in engineering education.

We are indeed grateful for the substantial but largely voluntary contributions of many Washington Accord members to the development and maintenance of the standards and processes to date. However, the future educational challenges are still considerable and will continue to depend on the engineering profession to maintain the momentum and standards.

Professor Hu Hanrahan, Chair, Washington Accord

For 25 years the Washington Accord has provided a mechanism for mutual recognition of graduates of accredited programmes among its signatories. This period has seen significant change in the world of engineering work in engineering education. National accreditation systems and the Accord itself have evolved to meet changing needs building on the vision of the original six signatories in 1989. The 1990s saw great debate about engineering education in many countries, culminating in a remarkable consensus to move from input-focused accreditation criteria to an output-based specification. By 2005 the Washington Accord, then with eight signatories and soon to expand significantly in Asia, had developed its Graduate Attributes, summarised in this brochure. These provide an exemplar of an outcomes-based specification for programmes that provide the educational base for professional engineers. The outcomes approach affords education providers freedom in the design of programmes. Best practice in accreditation has been captured in the Accord Rules and Procedures. The Washington Accord, and the associated Sydney and Dublin Accords, are committed to providing the benchmarks for graduates and accreditation practice as globalisation intensifies.

The ongoing development and operation of the Washington Accord rely critically on the signatories' delegates who participate in meetings and working groups as well as the reviewers who make up the teams that evaluate applicants for signatory status and conduct periodic monitoring of signatories. Their valuable contribution is greatly appreciated.

Role of the International Engineering Alliance

The International Engineering Alliance (IEA) is an umbrella organisation for six multi-lateral agreements which establish and enforce amongst their members internationally-benchmarked standards for engineering education and what is termed "entry level" competence to practise engineering. The Alliance, which currently has lead engineering organisations from 23 nations as members (including five G8 and 11 G20 nations), is expanding steadily with China being the latest to apply.

The IEA's vision is to:

Improve the global quality, productivity and mobility of engineers by being an accepted independent authority on best practice in standards, assessment and monitoring of engineering education and professional competence.

The Washington Accord sits under the IEA alongside the Sydney and Dublin Accords.

Quality engineers are developed with an accord-recognised degree or equivalent, through experience after graduation to develop both professional and personal maturity, and by meeting an agreed competence typically measured by evaluation against 13 elements.

The IEA's core activities:

- Consistent improvement of standards and mobility
- Defining standards of education and professional competence
- Assessment of education accreditation and evaluation of competence
- Participation in activities that are driven from the engineering profession.

> "The first and subsequent meetings were characterised by a visionary attitude and mutual respect."

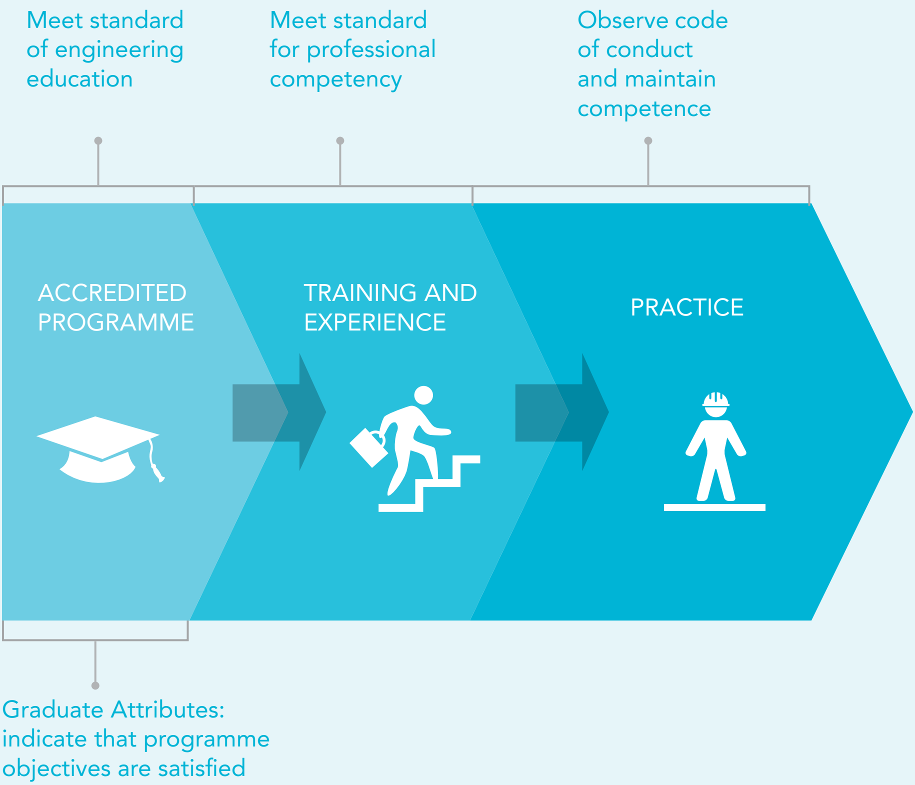
Dr Finbar Callanan,
Former Director General,
The Institution of Engineers of Ireland

Virandra Babu

Overview

The development of a professional engineer to the level required for independent practice or licensure/registration has two stages. The education stage, normally provided by an externally accredited programme of four or five years post-secondary school, is followed by a period of supervised training while gaining experience in engineering practice. The individual may then have his or her competence assessed, and be eligible for recognition as a competent individual engineering practitioner.

Education and Training in the Formation of a Practising Engineer



The Washington Accord is a self-governing, autonomous agreement between national organisations (signatories) that provide external accreditation to tertiary educational programmes that qualify their graduates for entry into professional engineering practice. The signatories undertake a clearly-defined process of periodic peer review to ensure each other's accredited programmes are substantially equivalent and their outcomes are consistent with the published professional engineer graduate attribute exemplar.

Signatories agree to grant (or recommend to the relevant national registration body, if different) graduates of each other's accredited programmes the same recognition, rights and privileges as they grant to graduates of their own accredited programmes. By these provisions, the Accord facilitates mobility of graduates between signatory jurisdictions and deeper understanding and recognition of their engineering education and accreditation systems. Amongst the signatories' educational providers, adherence to local accreditation requirements that are consistent with the professional engineer graduate attribute exemplar contributes to international benchmarking of programme outcomes.

There are currently 15 signatories to the Washington Accord that together deliver over 7,000 programmes producing graduates that are significantly similar in competencies.

This booklet outlines the history and development of the Washington Accord, as the leading international educational agreement for professional engineering qualifications and as the inspiration for further educational accords and professional competence agreements that collectively work together as the IEA.

> "The education stage is followed by a period of supervised training while gaining experience in engineering practice."

A Brief History

In 1989 the six foundation signatory organisations from Australia, Canada, Ireland, New Zealand, the United Kingdom and United States observed that their individual processes, policies, criteria and requirements for granting accreditation to university level programmes were substantially equivalent. They agreed to grant (or recommend to registering bodies, if different) the same rights and privileges to graduates of programmes accredited by other signatories as they grant to their own accredited programmes.

The signatories committed to: continue to share relevant information; allow their representatives to participate in each other's accreditation processes and attend relevant meetings of their organisations; and to make reference to this agreement in publications listing accredited programmes.

After rather informal operation in its early years, with bi-annual meetings in odd-numbered years and simple rules and procedures, the growth in interest by other organisations indicated the need for more structure and formality. Formal rules and procedures were developed for a six-year peer-review of signatories and for admission of new signatories, following a period in provisional status.

The Sydney and Dublin Accords for engineering technologists and engineering technicians were initiated in 2001 and 2002, respectively. Together with the three agreements for engineering practitioners, the IEA was formed in 2007, and the IEA Secretariat was created to assist with the administration of the accords and agreements and their development.

1989 28 September	1990s onwards	1997–2002	2001 onwards
Washington Accord signed by six organisations	Development of formal peer review processes	New accords and agreements	Development of graduate attribute exemplars

The admission to the Washington Accord of the accreditation organisations in Hong Kong China and South Africa in the late 1990s and Japan, Singapore, Chinese Taipei, Korea and Malaysia took the number of signatories to 11 by 2009. Since that year, the accrediting organisations in Turkey and Russia have become signatories. Currently there are also five organisations with provisional status. Many of the new and provisional signatories were mentored by established ones as they developed their systems.

The adoption of graduate outcome specifications in tertiary education was paralleled by the development of the specification of consensus graduate attributes for the accords. Version 3 was adopted by the accords in 2013 as the exemplar of the educational requirements to be met by signatories.

Whilst accord recognition strictly applies only to education programmes offered within a signatory's territorial boundaries, the need to accommodate developments in cross-border education has required development of rules for out-of-territory accreditation and recognition. The rules agreed to in 2008 also allow for assistance to emerging economies that may be too small to operate their own accreditation system. The rules are currently under review.

The Accord recognises that the members of the European Network for Accreditation of Engineering Education (ENAEE) operate similar accreditation processes to similar standards within Europe, and its authorised members provide the Eur-ACE label to accredited programmes. Four of the Accord members are also authorised members of ENAEE. There is a formal mechanism between the IEA and ENAEE to maximise mutual understanding and potential benefits of the two organisations.

IEA Secretariat established	Development of rules for trans-national accreditation and Accord recognition	Washington Accord signatories reach 15	Relationship with ENAEE
2007	2008 onwards	2012	2013 onwards

Signatories

The signatory for each jurisdiction is the recognised organisation for accreditation of professional engineering qualifications. They are listed by jurisdiction, in order of admission to the Accord, with the current operating name of the accrediting organisation.

1989	**Australia**	Engineers Australia
	Canada	Engineers Canada
	Ireland	Engineers Ireland
	New Zealand	Institution of Professional Engineers New Zealand
	United Kingdom	Engineering Council United Kingdom
	United States	Accreditation Board for Engineering and Technology
1995	**Hong Kong China**	The Hong Kong Institution of Engineers
1999	**South Africa**	Engineering Council of South Africa
2005	**Japan**	Japan Accreditation Board for Engineering Education
2006	**Singapore**	Institution of Engineers Singapore
2007	**Korea**	Accreditation Board for Engineering Education of Korea
	Chinese Taipei	Institute of Engineering Education Taiwan
2009	**Malaysia**	Board of Engineers Malaysia
2011	**Turkey**	MUDEK (Association for Evaluation and Accreditation of Engineering Programs)
2012	**Russia**	Association for Engineering Education of Russia

> “There are currently 15 signatories to the Washington Accord that together deliver over 7,000 programmes.”

The Accord requires a body that wishes to become a signatory to first apply for provisional status. The body must demonstrate it has an accreditation system that meets basic requirements. To proceed to signatory status the body must demonstrate substantial equivalence of its standards and processes in a review by a team drawn from the signatories, and be approved by unanimous agreement of the signatories.

The following organisations hold provisional status:

Bangladesh	Board of Accreditation for Engineering and Technical Education
China	China Association for Science and Technology
India	National Board of Accreditation
Pakistan	Pakistan Engineering Council
Philippines	Philippine Technological Council
Sri Lanka	Institution of Engineers Sri Lanka

Graduate Attributes

The graduate attributes adopted by the Washington Accord signatories are generic to the education of professional engineers in all engineering disciplines. They categorise what graduates should know, the skills they should demonstrate and the attitudes they should possess. The graduate attributes have been refined over more than a decade and in 2013 were adopted by the signatories as the exemplar (or reference point) against which substantial equivalence of their own accreditation requirements are to be assessed. In addition, the graduate attributes are intended to assist signatories and provisional members to develop outcomes-based accreditation criteria for use by their respective jurisdictions.

The key features of the graduate attributes are summarised in the following tables. A defining characteristic of professional engineering is the ability to work with complexity and uncertainty, since no real engineering project or assignment is exactly the same as any other (otherwise the solution could simply be purchased or copied). Accordingly, the attributes place as central the notions of complex engineering problems and complex problem solving.

The Washington Accord Graduate Attribute Profile has 12 elements, supported by a Knowledge Profile, WK1-WK8, and a definition of the Level of Problem Solving, WP1-WP7, both given below:

Engineering knowledge	WA1: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems.
Problem analysis	WA2: Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4).
Design/ development of solutions	WA3: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations (WK5).

Investigation	WA4: Conduct investigations of complex problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
Modern tool usage	WA5: Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations (WK6).
The engineer and society	WA6: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems (WK7).
Environment and sustainability	WA7: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts (WK7).
Ethics	WA8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7).
Individual and teamwork	WA9: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
Communication	WA10: Communicate effectively on complex engineering activities with the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
Project management and finance	WA11: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects and in multi-disciplinary environments.
Life-long learning	WA12: Recognise the need for, and have the preparation and ability to engage in, independent and life-long learning in the broadest context of technological change.

The Washington Accord Knowledge Profile has eight elements:

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline.
WK2	Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge that supports engineering design in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; and the impacts of engineering activity - economic, social, cultural, environmental and sustainability.
WK8	Engagement with selected knowledge in the research literature of the discipline.

Complex engineering problems have a range of attributes. At least some of the following may be encountered within a professional engineering education programme:

Depth of knowledge required	WP1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals-based, first principles analytical approach.
Range of conflicting requirements	WP2: Involve wide-ranging or conflicting technical, engineering and other issues.
Depth of analysis required	WP3: Have no obvious solution and require abstract thinking and originality in analysis to formulate suitable models.
Familiarity of issues	WP4: Involve infrequently encountered issues.
Extent of applicable codes	WP5: Outside problems encompassed by standards and codes of practice for professional engineering.
Extent of stakeholder involvement and needs	WP6: Involve diverse groups of stakeholders with widely varying needs.
Interdependence	WP 7: High level problems including many component parts or sub-problems.

The attributes of complex engineering activities, some of which might reasonably be encountered by a professional engineering undergraduate (eg. during capstone design or a period of industry experience):

Range of resources	EA1: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies).
Level of interactions	EA2: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues.
Innovation	EA3: Involve creative use of engineering principles and research-based knowledge in novel ways.
Consequences to society and the environment	EA4: Have significant consequences in a range of contexts, characterised by difficulty of prediction and mitigation.
Familiarity	EA5: Can extend beyond previous experiences by applying principles-based approaches.

Perspectives

How do we build mutual understanding among nations about the quality of engineers who enter the globally connected workplace? The Washington Accord agreement answered the question. Begin by building bridges toward mutual recognition of the substantial equivalence of engineering education. The fundamental supports for this bridge are globally accepted attributes expected of successful engineers.

The founding signatories of the Washington Accord agreed that graduates of each other's accredited programmes were expected to possess these attributes and therefore were prepared to enter engineering practice. The Washington Accord model has become the international gold standard for mutual recognition of engineering education.

George Peterson
Washington Accord Secretariat, 2001-2007

I remember my years as chair at a time of international co-operation with like-minded colleagues. We worked together to our mutual benefit, making a global contribution to the competence and recognition of the global engineering profession. The importance of this and the contribution of engineers are increasingly recognised.

There are many examples of crucial team efforts but I believe the devising and steering through of a paid standing Secretariat was very important. The Secretariat made all other work more effective and achievable. There were two aspects of the Washington and other Accords and forums in the Alliance that impressed me most: the acknowledgement of each other's cultures and the joint work to encourage new members to participate in the work and leadership needed. Many Asian countries went swiftly from applicants to active participants and leaders, improving and extending our activities. For all these reasons I found this a most stimulating part of my career.

Dr Peter Greenwood
Washington Accord Chair, 2002-2007

When Professor Jack Levy convened the first meeting of representatives of the initial six countries to discuss a possible accord, we hardly foresaw the international success it would eventually become. I remember very well how the first and subsequent meetings were characterised by a visionary attitude and mutual respect which greatly expedited the early development of the Accord.

Another significant and lasting memory for me was chairing the meeting in Dublin which welcomed Hong Kong into the Accord as the first new member after the original six. It was indeed a genuine pleasure and privilege to work with so many dedicated colleagues and good friends during those early formative years.

Dr Finbar Callanan
Former Director General, The Institution of Engineers of Ireland
(Now Engineers Ireland)

> "The Washington Accord model has become the international gold standard for mutual recognition of engineering education."

Other Accords and Agreements

The IEA is a group of self-regulating educational Accords and professional competence recognition agreements which have a substantially equivalent view of what constitutes an acceptable professional engineering education and professional competence.

The Sydney and Dublin Accords

The Sydney Accord was signed in 2001 to cover equivalence and international recognition for educational programmes for engineering technologists or incorporated engineers (under the United Kingdom definition). Currently there are nine signatories representing Australia, Canada, Ireland, Hong Kong China, Korea, New Zealand, South Africa, the United Kingdom and United States, and one organisation with provisional status (Chinese Taipei). Canada is represented by the Canadian Council of Technicians and Technologists; all others are signatories to the Washington Accord. Most Sydney Accord qualifications are degrees of three years duration post-secondary school. The graduate attribute specification refers to broadly-defined engineering problems.

The Dublin Accord was signed in 2002 to cover equivalence and international recognition of engineering technician qualifications. The current eight signatories, for Australia, Canada, Ireland, Korea, New Zealand, South Africa, the United Kingdom and United States, are the same organisations as the signatories to the Sydney Accord and Washington Accord. Most Dublin Accord qualifications are diplomas of two years duration post-secondary school. The graduate attribute specification refers to well-defined engineering problems.

The Engineers Competence Agreements

The International Professional Engineers Agreement (IPEA) was originally created in 1997 as the Engineers Mobility Forum agreement and adopted its new name in 2012. This is a multi-national agreement between engineering organisations in the member jurisdictions. The agreement creates the framework for the establishment of an international standard of competence for professional engineering, and then empowers each member organisation to establish a section of the International Professional Engineers (IntPE) register.

Members have full rights of participation in the agreement; each operates a national section of the IntPE register; registrants on these national sections may receive credit when seeking registration or licensure in the jurisdiction of another member.

The current 16 members are Australia*, Canada*, Chinese Taipei* (Chinese Institute of Engineers), Hong Kong China*, India (Institution of Engineers India), Ireland, Japan* (Institution of Professional Engineers Japan), Korea* (Korean Professional Engineers Association), Malaysia*, New Zealand*, Singapore*, South Africa, Sri Lanka, the United Kingdom and the United States* (National Council of Examiners for Engineering and Surveying). There are three provisional members from Bangladesh, Pakistan and Russia*. Where the representative member is not indicated, it is the same as the Washington Accord signatory. Representatives marked * are also members of the APEC Engineer agreement which operates to the same standard of competence as the IPEA, and has, in addition, members from Indonesia, the Philippines and Thailand. The APEC Engineer agreement was established in 2000 by the member economies of the Asia-Pacific Economic Co-operation agreement.

The International Engineering Technologist Agreement (IETA) (formerly the Engineering Technologist Mobility Forum) was formed by five of the foundation signatories of the Sydney Accord to provide equivalent standards and registers for engineering technologists. The current members represent Canada, Hong Kong China, Ireland, New Zealand, South Africa and the United Kingdom. Australia is a provisional member.

IEA Accord Signatories and Agreement Members

As at June 2013

WA = Washington Accord **SA** = Sydney Accord **DA** = Dublin Accord
IPEA = International Professional Engineers Agreement
IETA = International Engineering Technologist Agreement
APEC = APEC Engineer agreement

● = Signatory/Member ● = Provisional Status

		Signatory/Member	Provisional Status
Australia	Engineers Australia	WA, SA, DA, IPEA, APEC	IETA
Bangladesh	Bangladesh Professional Engineers, Registration Board (BPERB)		WA, IPEA
Canada	Engineers Canada	WA, IPEA, APEC	
Canada	Canadian Council for Technicians and Technologists (CCTT)	SA, DA, IETA	
China	China Association for Science and Technology (CAST)		WA
Chinese Taipei	Institute of Engineering Education Taiwan (IEET)	WA	SA
Chinese Taipei	Chinese Institute of Engineers (CIE)	IPEA, APEC	
Hong Kong China	Hong Kong Institution of Engineers (HKIE)	WA, SA, IPEA, IETA, APEC	

India

National Board of Accreditation (NBA) WA

Institution of Engineers India IPEA

Indonesia

Institution of Engineers APEC

Ireland

Engineers Ireland WA SA DA IPEA IETA

Japan

Japan Accreditation Board for Engineering Education (JABEE) WA

Institution of Professional Engineers Japan (IPEJ) IPEA APEC

Korea

Accreditation Board for Engineering Education of Korea (ABEEK) WA SA DA

Korean Professional Engineers Association (KPEA) IPEA APEC

Malaysia

Institution of Engineers Malaysia (IEM) WA IPEA APEC

New Zealand

Institution of Professional Engineers New Zealand (IPENZ) WA SA DA IPEA IETA APEC

Pakistan

Pakistan Engineering Council (PEC) WA IPEA

Philippines

Philippines Technological Council (PTC) ● WA ● APEC

Russia

Association for Engineering Education of Russia (AEER) ● WA ● IPEA ● APEC

Singapore

Institution of Engineers Singapore (IES) ● WA ● IPEA ● APEC

South Africa

Engineering Council of South Africa (ECSA) ● WA ● SA ● DA ● IPEA ● IETA

Sri Lanka

Institution of Engineers Sri Lanka (IESL) ● WA ● IPEA

Thailand

Council of Engineers (COE) ● APEC

Turkey

Association for Evaluation and Accreditation of Engineering Programs (MÜDEK) ● WA

United Kingdom

Engineering Council (EngC) ● WA ● SA ● DA ● IPEA ● IETA

United States

Abet Inc ● WA ● SA ● DA

National Council of Examiners for Engineering and Surveying (NCEES) ● IPEA ● APEC

INTERNATIONAL ENGINEERING ALLIANCE

International Engineering Alliance Secretariat

PO Box 12 241
Wellington 6144
New Zealand

P +64 4 473 9444
F +64 4 474 8933
E secretariat@ieagreements.org

www.ieagreements.org

JUNE 2014 | REF 10175