Institution: Edinburgh Napier University

Unit of Assessment: 14 – Civil and Construction Engineering

a. Overview

The research being submitted to the Civil and Construction Engineering unit of assessment represents the activities of 14 members of staff. The staff in question comprise four professors, one reader, five lecturers and four researcher PIs. They are associated with two research themes: transport and geotechnics, each of which is organised within a 'Research Institute'. The institutes are aligned with the School of Engineering and the Built Environment, within the Faculty of Engineering, Computing and Creative Industries. The Institutes are responsible for the management and administration of research. Academic staff members are free to align themselves with a research institute, but some research staff are recruited directly to the institutes.

Transport research takes place within the Transport Research Institute (TRI) and can be further subdivided into: (i) maritime economics and logistics (Cullinane, Song, Monios and Wang), (ii) transportation planning and modelling (Saleh, Stewart and Fonzone), and (iii) social, economic and environmental aspects of transport and transport policy (Muneer, Cowie, Cooper and O' Dolan).

Geotechnics research (McDougall, Barreto and Lombardi) takes place within the Institute for Sustainable Construction.

Organisational changes within the University and the strategic repositioning of timber research as specialist aspects of the Forest Products Research Institute (FPRI) have enabled the University to strategically allocate staff to the most appropriate Unit of Assessment. This has resulted in the total number of staff returned in UoA 14 being about half the number submitted to RAE2008, with some staff being reallocated to UoA13 and 16. Over the assessment period the number of transport related staff has remained relatively stable. The major aim of the transport-related part of 2008 submission, such as fostering and growing of niche areas (e.g. maritime transport, taxi studies, social aspects of transport and transport modelling) has been largely achieved.

b. Research strategy

In its strategic review of research, knowledge transfer and commercialisation activities for 2009-2015, Edinburgh Napier University identified the following strategic objectives:

(i) to foster and support high-quality applied and near market research,
(ii) to enhance the research environment, leadership and the quality of research training,
(iii) to be a national leader in knowledge transfer, and
(iv) to embed a culture of enterprise and innovation across the University and to exploit ideas for commercial application.

High quality outputs, whether technical papers, patents, or other practical innovations, are indicative of research and a research culture that have the potential to benefit society, business, and the environment. The supportive research culture is fundamental for the career development of academic and research staff, and the training of high quality research graduates. The institutional perspective is reflected in all the sections of the environment narrative.

The Transport Research Institute (TRI), which is Scotland's largest and longest established transport research group, was inaugurated in 1996 with financial support from the Scottish Higher Education Funding Council as a multi-disciplinary centre of excellence in transport. The

expertise covered by the members of TRI includes engineering, environmental science, economics, business, mathematics, sociology and psychology.

Reflection on RAE 2008

Since 2008, the 'maritime transport' and 'transport modelling' aspects of the Transport Research Institute's work have been reinforced. The Maritime Economics and Logistics group has expanded, with the addition of a new Senior Research Fellow (Wang) and Research Fellow (Monios), financed by successful funding bids, and a Professor (Song), financed from central strategic University funding for research. The appointment of a 'new blood lecturer' (Fonzone) has invigorated the Transportation Planning and Modelling research group.

There has also been strategic growth in two areas. First, taxi studies have been established as an important niche area for research and for the generation of external research and consultancy income. The model for assessing the unmet demand in taxi supply which has been developed now constitutes a market-leading methodology. Significant commercial success has been achieved in applying the model to city taxi studies within the UK and, more recently, in the United States.

Second, in order to develop research at the interface of transport applications and energy engineering, a Professor (Muneer) joined TRI. This has led to the development and invigoration of research in sustainable transport. Significant success in this area has been achieved in winning research funding from various sources.

There have also been changes affecting the non-transport elements of the civil and construction engineering research base since RAE 2008:

(i) recent staff appointments enabled the formation of the Centre for Geotechnics, and
(ii) the Centre is now based within the Institute for Sustainable Construction.

Vision and Strategic Plans up to REF2020

Recent recruitment and existing expertise mean that the UoAs geotechnical research has found new impetus and over the next assessment period up to REF2020 will focus on three main areas:

(i) particle mechanics,
(ii) earthquake engineering and soil dynamics, and
(iii) degradable soils.

The success of these areas will be measured by the following indicators: each member of staff being encouraged and supported to achieve the following objectives:

(1) To win two externally funded research contracts during the next five years.
(2) To publish, at least, one refereed journal and one conference paper per annum.
(3) To demonstrate (by publication, invited visit, joint funding or co-supervision) the establishment or continuation of a collaborative relationship with either an academic or industrial partner.
(4) To supervise two PhD completions during the next five years.

The vision for TRI over the next assessment period, based on the success of the Maritime Research and Logistics group and other niche areas, is twofold:

(i) to gain sufficient recognition in Scotland as the national centre of excellence for transport research and consultancy so that TRI is justified in adopting the title of 'Scottish Transport Research Institute', and
(ii) to be recognised as a world leading centre for research in the field of maritime economics and logistics.

In support of the University Strategic Plan and its Research Strategy, TRI has established five strategic objectives:

(1) *To grow research income.* Specific targets for future research funding are:
(a) to continue increasing the absolute value of research funding above the 2012/13 baseline (which itself was the third record year in a row for net TRI income generation),
(b) to continue the growth in EU research funding,
(c) to build on the success in winning Interreg projects by developing these initiatives into successful Horizon 2020 project bids, and
(d) to bid for and win more funding from research councils, charities and similar funding bodies in order to reduce the reliance on EU funding and to enhance the status and reputation of TRI.

(2) *To grow both the number and the quality of research outputs.* Appointments within TRI are based on either publication track record or the presence of significant potential to produce research outputs. The annual staff development exercise, as applied within TRI, focuses to a large extent on past performance and future plans with respect to the production of high quality research outputs.

(3) *To be a preferred partner for research and consultancy.* An integral element of TRI research strategy is to promote the interaction and integration of research and consultancy activities. Wherever possible consultancy projects should yield research outputs and TRI members are encouraged to pursue this aspect from an early stage in commercial negotiations. TRI members have developed close relationships with various transport companies, policy makers and institutions. The large number of EU project consortia in which TRI is involved, invited international keynote speeches at conferences and similar activities provide yet more evidence of TRI success in seeking to be a 'preferred partner' in research and consultancy. A number of formal MoUs have been signed with a variety of international institutions in order to facilitate these research partnerships.

(4) *To be a significant player in the international arena for transport research.* Much of TRI research portfolio is inherently international in nature, with over two thirds of TRI research project funding in 2011/12 having been sourced from the EU. Since the last RAE, TRI has been involved in 26 EU funded projects (for 11 of which TRI has been the lead partner). The international nature of TRI research and consultancy activities and the engagement of staff in international networks for research and consultancy reinforce the University ambitions to become an international university. In this respect, TRI has deliberately instituted policies and allocated resources to promote the internationalisation of TRI. These include the TRI International Visiting Scholar Programme and the TRI Experiential Placements for Overseas Students Programme.

(5) *To develop a sustainable critical mass of research students.* Over the past four years, TRI has independently financed 5 fully-funded PhD scholarships and part-funded another 2 from its own internal budget allocation. The first cohort of PhDs supported by these scholarships is about to graduate.

c. People, including:

i) Staffing strategy and staff development

Edinburgh Napier University received the European Commission HR Excellence in Research Award in December 2010 and retained it in 2012 for recognition of its continued commitment and progress towards implementing the Research Concordat. In addition, commitments to equality and diversity, researcher development at both supervisor and student level are

embedded within the University research culture through initiatives such as RDF by Vitae and Athena Swan. The University is fully engaged in the activities of Universities Scotland's sector-wide Research Training Sub-Committee, which until 2012 was chaired by its Director of Research Strategy, Professor Alison McCleery, and which in 2010 won the THE Award for Outstanding Support for Early Career Researchers.

TRI comprises two groups of staff: (i) staff employed directly by TRI, financed primarily from projects funds, and (ii) staff employed within the School of Engineering and the Built Environment (SEBE), who may also be involved in funded research or consultancy contracts, thus offsetting their teaching duties.

In effect, therefore, staffing strategy and issues of staff development are the responsibility of two organisational units that operate on a matrix-like basis. The Director of TRI provides advice on research-related aspects of the relevant SEBE appointments. However, the appointments within TRI are made exclusively on the basis of criteria such as research funding won, publications and PhD supervisions and completions. Promotions are implemented on a similar basis.

All staff within the UoA engage in an annual Professional Development Review to ensure that their career development reinforces the research-oriented strategic objectives set by the Research Institutes, School and Faculty. The wider expectations of a research-intensive academic culture are also inculcated within the staff, so as to ensure the potential for their career mobility.

UoA staff come from about ten different countries and the British staff have significant experience of working overseas in a variety of different cultures. In recognition of its international status TRI has been chosen as a 'preferred partner' by other institutions. Academic and research staff within the UoA make significant contributions to the taught programmes of universities in other countries. Based on the research collaboration within the Northern Maritime University and Know-Me projects, the Bremen University of Applied Sciences (Germany), the University of Gothenburg (Sweden), the Molde Logistics University (Norway) and the University of Iceland have all incorporated material delivered by Edinburgh Napier University staff onto their taught programmes. Several members of the UoA hold honorary and visiting appointments at overseas institutions. Geotechnics staff have actively delivered course material to students on civil engineering programmes of study in China (e.g. Shanghai Normal University).

Visiting scholars are encouraged across the University. The TRI 'International Visiting Scholar '(IVS) Programme was implemented in 2010 and has resulted in many visitors coming to the University for significant periods of time to engage in collaborative research with one or more of the staff. Since 2008 TRI has hosted 22 Visiting Scholars from 17 different countries. Scholars visiting the Centre for Geotechnics have included Fleming, University Saskatchewan, Aug-Oct 2012 and Simoes, Federal University of Minais Gerais, Sept 2013-2014.

ii) Research Students

Doctoral students, guided by their dedicated supervisory team and supported by central training as outlined below, led to the award of 15 doctoral degrees during the current assessment period.

Recruitment and monitoring: University funding is channelled through the Research Institutes, and research studentships are advertised when either University or project funding becomes available. Student progress is monitored every six months, and each supervising team contains an independent Panel Chair, who ensures that the training and development needs of the students are identified and delivered.

Doctoral training: Training and skills development for research students is delivered through several mechanisms: (i) centrally delivered Researcher Development Programme of professional development activities aimed at enhancing research practice, and (ii) Faculty and School based training programmes. This model allows provision of generic and subject-specific skills to be delivered across the university in a tailored manner.

Supervisory training and development: The University 3-day 'Supervising Research Degrees' course has been formally recognised by the Staff and Educational Development Association (SEDA). New research supervisors also receive informal mentoring through participation in supervisor teams, allowing them to be supported as they develop their supervisory practice.

d. Income, infrastructure and facilities

Total research income for the UoA for the REF period was £3,739,042, which equates to £267,074 per researcher for the submission.

The majority of this funding has been won from EU sources, with TRI being project leader for a significant proportion of the consortia involved.

Infrastructure and Facilities

The University as whole has made large scale investment in its three prime sites, which house the three faculties. Merchiston campus, refurbished in 2012-13, houses the Faculty of Engineering, Computing and Creative Industries. All full-time research students have their own allocated work space, with hot desk facilities being provided for part-time students and those normally based overseas.

There is a library based at each of the three main campuses (24hr at the Merchiston campus). At each library there is a named contact for specialist subject support and 1:1 advice. There are also open computing areas (24hr at Merchiston), internet cafes and support for University desktop, installation of staff PCs, problem fixes, security, etc.

Whilst research is managed within the Research Institutes, a range of laboratory infrastructure and testing facilities are available both within the university and at remote locations. University facilities include large scale structures, geotechnics, materials, timber and hydraulics and rolling road laboratories.

Despite the fact that most of TRI work is not asset-intensive, in recent years there have been significant investments made in support of its developing work in the area of 'sustainable transport'. In 2010, TRI provided financial support for the refurbishment of the University's environmental engineering laboratory. In 2012, TRI won funding from the Scottish Government to support the installation of electric vehicle charging infrastructure at each of 3 of the University's campuses. In 2013, TRI purchased an electric vehicle which is used for experimental purposes.

Specialist geotechnical equipment includes: (i) mercury intrusion porosimeter, (ii) medium-scale facilities for the simulation of dynamic behaviour of offshore monopile foundations under wave loading, (iii) distinct element modelling software has been developed in-house and (iv) a large scale gas tight compression cell for degrading, gassing materials designed in-house and since been commissioned for use at University of Saskatchewan.

e. Collaboration and contribution to the discipline or research base

Collaborations

Among other research and consultancy projects, staff from the UoA have led and/or participated in 26 EU research projects. Virtually all research collaboration and the production of research outputs take place within an international context. TRI members are active in

international research associations and networks. For example, a TRI member (Cooper) chairs the taxi studies committee of the U.S. Transportation Research Board. In addition, the TRI Director (Cullinane) serves on the councils of various bodies and is also regularly invited as an external member of Professorial appointment panels and promotion panels, both within the UK and overseas.

Indicative Journal editorial activities
McDougall - Géotechnique Advisory Panel (2007-9), Géotechnique Symposium in Print Panels 2009 & 2011.
Many members of TRI serve on the Editorial Advisory Boards of international peer-reviewed journals and are active in reviewing research proposals not only for the UK research councils, but also for the research councils of France, Canada, Hong Kong, Norway and Italy.

Indicative examples of journal refereeing
A number of UoA staff have acted as journal referee for submitted papers to a variety of international journals:
Barreto –Geotechnique, Canadian Geotechnical Journal, Geomechanics & Geoengineering, KSCE Journal of Civil Engineering (KSCE = Korean Society of Civil Engineering), European Journal of Engineering Education and the Proceedings of ICE – Management, Procurement & Law.

McDougall – Geotechnique, Computers & Geotechnics, ASCE Journal of Geotechnical and Geoenvironmental Engineering, ASCE Journal of Environmental Engineering, ICE Waste and Resource Management.

Conference organisation
TRI has organised numerous conferences including: Intermodal Strategies for Integrating Ports & Hinterlands (Edinburgh, Oct 2010); International Association of Maritime Economists Annual Conference (Santiago, Oct 2011); TRI & Institute of Chartered Shipbrokers Joint Forum (Edinburgh, 2010); TRI and Royal Meteorological Society Conference on Reducing the Impact of Emissions from Aviation and Shipping (Edinburgh, Sept 2011); TRI and Transport Statistics Users Group Annual Scottish Statistics Seminar (2008-2013). TRI has also just won a contract from Transport Scotland (part of the Scottish Government) to organise the Annual Scottish Transport Applications and Research Conference (the biggest annual transport conference in Scotland).

Barreto - in 2012 Edinburgh Napier University hosted GM3, the 10th UK Travelling Workshop in Geo-Mechanics: “From micro to macro”.

McDougall - in 2013, HPM5, the 5th International Workshop on the Hydro-Physico-Mechanics of Landfills, was held at the university.

Indicative keynote presentations/lectures
Cullinane delivered numerous keynote speeches at international conferences including:

- keynote on ’The Measurement of Port Efficiency’ to the United Nations Conference on Trade and Development (UNCTAD) in December 2012
- keynote on Global Dynamics of Maritime Transport and Port Competition/Co-operation in Northeast Asia: Strategic Options for Korean Ports, Korea Forum for Progress International Conference, Korea’s New Engines of Growth: Airlines and Maritime Logistics Services, Seoul, Republic of Korea, December 2009

McDougall - keynote or invited presentations were given at the 1st Middle European Conference on Landfill Technology at Hungarian Academy of Sciences in 2008 and Coupled Phenomena in Environmental Geotechnics in 2013.

Other

Cullinane - co-authored reports for the Swedish Government Transport Administration and the European Panel for Sustainable Development and has delivered keynote speeches to the UN, the OECD/ITF and the Australian Government.

Lombardi - Foreign Researcher at Yamaguchi University (Japan) having been awarded two grants from Centre of Urban Earthquake Engineering of Tokyo Institute of Technology (Mar 2010 and Mar 2011) and scholarship from Il Circolo Cultural Italian Association (London, May 2011).

McDougall - chair of the IWWG Landfill Modelling Task Group from 2011-2013.

TRI staff have sat on research evaluation committees for institutions, agencies and governments external to the UK and the TRI Director (Cullinane) sits on a Panel for REF2014. At least two TRI members (such as Cullinane) have had roles as government advisers within the past 5 years within Scotland, the UK and overseas.