Appendix II: Summary of External Reports Relevant to the Review

The following are selected extracts from a number of reports related to research in ground and structural engineering, including a number signposted by the review panel in July 2009. The extracts were chosen by EPSRC with relevance and brevity in mind. Hyperlinks to the relevant reports are included where possible.

Contents

1. "International review of Engineering", Royal Academy of Engineering and EPSRC (2004)

http://www.epsrc.ac.uk/AboutEPSRC/IntRevs/2004EngIR/InternationalReviewReport.htm

This is a review of engineering research in the UK jointly commissioned by EPSRC and the Royal Academy of Engineering. As part of the review, the panel visited the following groups within civil engineering:

Pennine Water Group, University of Sheffield
Built and Human Environment, University of Salford
Institute of Building Technology and Sustainability, University of Nottingham
Civil and Environmental Engineering, University of Southampton
Earthquake Engineering, University of Bristol
Environmental and Water Resource Engineering, Imperial College
Virtual Reality and Architecture, University College London
Structural Engineering, Imperial College
Ground Engineering, Imperial College

Selected findings of the report are:

- There are world class groups in civil engineering: structural, transportation, geotechnical, earthquake, environmental, urban design.
- There is a positive correlation between research excellence/quality and external research impact for the groups observed
- Characteristics of highly regarded engineering research groups are: Basic technical core competency; Excellent people, resources, high quality infrastructure; Strong leadership, shared vision, good strategic plan and management; Strong interaction with external stakeholders that influences practice and commercialisation; Well attuned to needs of stakeholders and ability to adapt to market changes; Strengths in both analysis and creative

synthesis; Ability to draw excellent postgraduate students and postdoctoral researchers from home and abroad, through a fine worldwide reputation; Strong, supportive university environment.

The following recommendations are made:

- "We observed much excellent engineering research during this evaluation. We recommend that the UK continues to support the excellent engineering research being carried out in universities."
- "We observed relatively little interaction between basic science and engineering. We recommend that academia, industry and government develop strategies to encourage increased linkage of engineering research to more basic mathematical, physical, chemical and biological sciences, so that scientific and engineering discoveries may stimulate even more and broader discoveries and their applications."
- "We observed that engineering research is not well understood or appreciated by industry and the public and we observed relatively little engineering outreach to the public. We recommend that programmes be developed so that creative engineering research in academia is recognised and utilised by industry and the public, both to plan for future directions and to create new and improved products, services and infrastructure more rapidly."
- "We observed relatively few organised activities to attract engineering undergraduates. We recommend that additional programmes be implemented to increase the number of male and especially the number of female engineering undergraduates entering UK universities."
- "We observed less high-quality, longer-term university-industry interaction focused on basic advances and more interaction aimed at a shorter-term payoff. We believe that smooth connectivity between industry and academia facilitates knowledge transfer. We recommend that industry hires more engineers with advanced degrees to provide the UK with a greater competitive advantage."
- "We observed that some new (expensive) fields of research could not be pursued widely in academia. We recommend that cooperative facilities open to all qualified researchers be established in selected promising new fields requiring expensive research equipment."
- "We observed that while some research groups and universities did recognise the value of intellectual property, others did not. We recommend that universities place more emphasis on the development and utilisation of intellectual property that may benefit society."
- "We observed that many programmes emphasised established groups, performing more conservative research, but did not observe many younger researchers doing high-risk, high-pay off research. We recommend more two-tier funding: larger grants for established groups of demonstrated excellence, and smaller grants for younger investigators with creative, but higher risk, projects."
- "We noted the wide-spread perception that engineering, computer and materials researchers are paid proportionally less in the UK than in other industrialised countries. We recommend that this perception be studied, and either the perception or the actuality be corrected to help preserve the economic competitiveness of the UK."

2. "Report on the UK's University Engineering Research Base", Engineering and Technology Board (2009)

http://www.etechb.co.uk/_db/_documents/5684_ETB_Green_RAE_5_for_pdf_280509.pdf

This report is the ETB's analysis of, and response, to the 2008 RAE. It notes that the top rated disciplines were Civil Engineering and Chemical Engineering with 71% of research activity rated 3* or 4*.

The report also commented:

"The competitiveness of the UK in terms of high level research in engineering is further evidenced by the UK's citation share within the G8 holding up at 4th behind the USA, Germany and Japan."

3. "A National Infrastructure for the 21st Century", UK Council for Science and Technology (2009)

http://www.cst.gov.uk/cst/reports/files/national-infrastructure-report.pdf

This is a report by the CST into the current state of the national infrastructure (NI), making a number of recommendations. Of particular relevance is Recommendation 5:

"Government departments, the Regulators, the Research Councils and bodies such as the TSB need to incentivise the infrastructure operators to connect better to the science and engineering base to develop innovative solutions using best technology. They should come together to address the following core questions:

- Whether there should be more, or more effective, Innovation Platforms, Knowledge Transfer Networks and other types of collaborative R&D projects between infrastructure operators, academia and the other stakeholder?
- What technologies are available now and are they being exploited effectively within NI?
- What are the barriers to deployment e.g. the need for technology demonstration?
- What are the priority areas for underpinning R&D?
- How to encourage more cross-disciplinary research to clarify the interconnections and interdependencies of infrastructure components, including human dimensions?
- What scenario planning is needed?
- What roles the professional bodies and learned societies might play?

4. "Safeguarding our Future: The Importance of Construction Innovation and Research", Institution of Civil Engineers (2004)

http://www.ice.org.uk/knowledge/document_details.asp?Docu_id=755&faculty=9

This report by the ICE highlights the achievements and importance of innovation and research in civil engineering using case studies from a number of large projects. The follow are selected quotations from the report:

"Most civil engineering projects are innovative. Almost every project is unique and different. There are no off-the-shelf designs and solutions…"

"[The projects highlighted] would not have been possible without the ongoing progress made by the UK's scientific and engineering research organisations and universities…"

"Construction research is not simply something that benefits a single project. It is a continuous and cumulative process that underpins civil engineering and constructions as a whole. [Innovation in construction] is often a progressive combination of research undertaken by many people in universities and throughout the industry."

"The amount of investment funding available for construction research has been steadily declining in recent years."

5. "Innovation Process in the Construction Sector: An analysis of the views of a selection of senior executives from the sector" by John Findlay, Loughborough Centre for Innovative and Collaborative Engineering (2009)

http://www.lboro.ac.uk/cice/docs/innovation_process_in_the_construction_sector_report.pdf

This is a report undertaken by John Findlay of JDF Works, supported by Balfour Beatty, Vinci Construction and the Institution of Civil Engineers, produced in collaboration with Loughborough University. It is based on a survey of the views of a selection of senior executives from the construction sector on innovation.

The following is a selection of survey questions from the report with a summary of the findings from each one:

Question H: To what extent does formal research, whether with your own or outside resources, form a component of developing innovations?

"A high proportion do some sort of formal research (86%) and just over half (57%) have done so with academia with a reasonable proportion of them doing so regularly (63%). Most of those who do think they should do more in regularity and intensity.

It was reported that Specialist contractors were approaching 50% more likely to do formal research than General contractors. Although Specialist contractors had the highest proportion having used academia (78%), Consultants were the most likely to do regular research with academia (83%)."

Question I: Where would you expect formal research to provide key inputs (e.g. capture, articulation, context or evaluation etc.)?

"Most start with clear expectations (61%) and over one third (36%) insist on a clear brief. Behind this the most common expression was of using academia as a critical friend who can ask and suggest answers to awkward questions.

An overview member did not want academia to observe, they must get involved to be of value. Some were concerned about the different criteria between the academia and organisations in judging success. Consultants were less likely to start with clear expectations and on insisting on a clear brief."

Question Q: Do you recognise the value of more highly trained people within your organisation (e.g. EngDs)?

"Although highly trained people are valued by three quarters (73%) it is within the context of a balanced approach across the employees and with concern about diversity. Half (50%) state they know how to use highly trained people but about a quarter (23%) would not or don't want to use.

General contractors were the least likely to admit to knowing how to use highly trained people. Many organisation sought out the brightest and had taken advantage of vehicles such as KTPs and many had relationships with academic institutions to build deeper relationships, one aspect of which was to get to the best people. Those familiar with EngDs generally say they are valued but many were concerned about how well they provided a long term career path that corresponded to the certainties for project managers. A number were concerned about recognition of business drivers and that common sense might be more important than intellect."

Question R: What do you think about dissemination and deployment of publicly funded research?

"The general view is that people think you can find material if you want to but it is not as easy as it should be. About two fifths (39%) believed they could access and find what they wanted easily. A fair proportion (21%) relies on intermediary research organisations to distil material.

Perhaps not unsurprisingly Consultants are about twice as likely as the average in believing they could get to wanted material. Specialist contractors were the most likely to look to intermediary organisations to provide material."

The following are selected extracts from the Commentary section of the report:

"Looking for disruptive innovations was not something that came across as exercising the controlling minds of organisations. Broadly the thinking is overwhelmingly dominated by the lifetimes of and need for reliable outcomes associated with the projects that the majority of the organisations are delivering. Even the more service orientated businesses or those with large streams of service business are still linked to artefacts that need to be reliable and have longevity. Thus where interviewees talked about looking at strategic innovation as compared to those arising from day-to-day operations they were by a large majority to do with issues that would directly progress efficiency and effectiveness in project delivery. Some recognised a different dynamic in the service side of the business and the need to think about issues of the marketplace and what would make a difference to the client."

"The response to the first two prompts brought out an observation that 'innovation' 'research' and 'R&D' as words sit remarkably uncomfortably with the sector. The very concerns about recognition of innovation that the NESTA report highlights were writ large. It is not an exaggeration to say that 'R&D' initially conjures up an image of white coats and a laboratory for a large number of the interviewees. It is not that they don't recognise other 'research' as being worthy of the name 'research' but the former description is the first mental image. Many interviewees discussed precisely the argument put up by NESTA concerning whether something was an improvement or an innovation. Because many had trained as engineers there was a tendency to

err on the side of caution and use the label of improvement more often than those from other disciplines probably would think sensible."

"For a sector that is labelled as being low in research intensity, the links to academia shown in response to Prompt H were quite strong in this sample with more than half having done research with academia and with a high proportion of those who did, doing so regularly. It has to be noted it is likely that this sample is not typical of the sector as it is taken solely from the larger end of the sector. With about 60% starting with a clear brief according to responses to Prompt I, it could imply that using academia for disruptive thoughts may not be sought as frequently as might be possible. For Consultants the proportion is rather lower but this may in part be because academia is quite often involved as part of subconsultancy team where the brief already exists. However, all organisations were prepared to be challenged and a common expectation was for academia to act as a critical friend."

"Not surprisingly from Prompt R there seems to be plenty of opportunity to improve the access from the construction sector to the scientific base. Part of this function should be met by the MBE KTN."