Institution: University of Greenwich

Unit of Assessment: (UoA 16) - Architecture, Built Environment and Planning

a. **Context**

Impact is assessed through the activities of the two research groups:

- Sustainable Built Environments Research Group (including the Sustainable Landscapes Group);
- AVATAR (Advanced Virtual and Technological Architectural Research Group).

The groups use a wide range of vehicles to ensure that their work has the greatest possible impact on their target audiences. These activities include: direct engagement of non-academic user groups in the research process; engagement of non-academic national and international subject experts on project steering/advisory committees; formal and informal presentations to government departments and local policy makers; presentations to business user groups; public engagement activities; local and national media presentations; patents; venture capital funding and commercial product development; industry focused 'how to' fact sheets; industry workshops; and government briefing papers.

To support these activities members of the group receive training in: commercial communication; technical bid writing; working with the press; network management; and web authoring. These are supported by a dedicated research support officer who manages day-to-day relationships with external parties and the groups' networks (including the web). Through these approaches the groups influence: industry; policymakers, national and international; local and national government; the third sector and not-for-profit organisations; and professional practitioners. Through direct involvement with these user groups and the membership of national and international commercial networks (eg CIRIA, EUROFM, etc.) the groups' research has directly benefited UK plc. and the general public, the ultimate target of the groups' work.

b. Approach to impact

The research structure is based on an approach to impact delivery that includes:

- the formulation of well-structured research projects based on clear theoretical and methodological questions and underpinned by rigorous methodology;
- dissemination of findings to the most appropriate audience: academics, users, funders, policy makers and other stakeholders in the community;
- general dissemination of the activities of the research groups through public engagement and interaction in the wider community.

This approach forms the basis of mentoring activities in the research groups and is based on research experience and staff development, and matched by institutional resources to provide training courses, conferences and support through Greenwich Research and Enterprise (GRE), a university central office whose objectives are to encourage research and enterprise and to provide resources and support for these activities. Within the structure of the two research groups, the approach to impact during the assessment period which has been applied is as follows:

The Sustainable Built Environment Research Group: SBERG

SBERG employs a wide range of activities to ensure its research achieves its desired impact. Over the assessment period the group has been involved in three large, multidisciplinary, multi-university EPSRC projects (GR/T04878/01, EP/F035861/1, EF/G000395/1) that have all had impact, and pathways to impact, which were completed as a key activity funded through their grants. These impacts are of at least international standard as evidenced by the award process for research council funding and the dissemination of the results in appropriate international refereed journals. These projects have all adopted the same strategic approach to enduring impact:

- The inclusion of industry, policy, and professional body representatives on their steering groups, both to advise on the project directly and also to feed the results back to their stakeholder groups (includes some 40 organisations including EoN, GLA, DECC, DEFRA, DCLG, LSx, Arup, RSLs, local and central government and business organisations) ;
- Direct engagement with industry, policy, and 3rd sector organisations through stakeholder facilitated 'how to' workshops for invited members from each stakeholder community (eg Arup organised five industry workshops where University of Greenwich researchers presented their findings to some 50 industry representatives);

- Presentations of non-academic versions of the research to national and international industry conferences (eg National Housing Federation Annual Conference, EUROFM) ;
- Joint Road Shows/Exhibitions to explain the significance of the research (eg the example given in the impact case study)
- Briefings to national and local policy makers (eg an invited presentation to the Parliamentary Science and Technology Committee as part of IDCOP);
- Media presentations (see impact case study for example) and,
- Practical 'so what' advice sheets sent to stakeholders (eg two sided fact sheets sent to all UK RSLs/LAs on Sustainable Social Housing Maintenance).

To ensure the impact from GR/T04878/01, an EPSRC Public Engagement project (EP/F066554/1) was undertaken to engage the older community in more sustainable living. During this year long project:

- presentations (through the University of the Third Age) were made to 1,125 people;
- information sessions/stands at exhibitions engaged 479 people;
- discussion groups at various Age Concern (and other) drop-in centres engaged 79 people;
- focus groups through care homes engaged 38 people;
- 15,050 newsletters and publications specifically targeted to the older community were distributed through Age Concern, London; and
- a booklet was distributed to 3,000 people.

The effectiveness of this engagement was specifically measured, as a requirement of the grant, with 54% of people surveyed making some change in their lives, as a consequence of the engagement activity (impact report available on request – there is a journal paper currently in press).

In addition to their public funded research, SBERG also undertake commissioned work for industry. Whilst many of the outputs from this work are specific to an organisation, their outputs never the less have an impact on a wider audience. A current project, which builds on EF/G000395/1, has taken the generic learning from that project into the workings of SEGRO, one of the largest commercial property owning/managing organisations in the UK. As a consequence of hearing of the EPSRC project, the organisation sponsored SBERG to develop and test practical workplace interventions to reduce CO2 emission at the work desk. This work has been fed back to the organisation, who are making changes to their workplace strategies, and has been shared with other European property organisations through presentations at EUROFM (a commercial/academic network for European Facilities Management organisations) and through a 'so what' fact sheet.

Finally SBERG has also funded PhD studentships through bursaries, giving opportunities to exploit impacts arising from the students' projects. Wherever impact is identified, the PhD student is provided with training (internal and external) to exploit the outputs from their project, benefiting the output and career development of the researcher. One example of this is a wireless detector used to monitor the performance of oil pipeline distributions systems. The PhD student doing this project was given guidance in filing a patent and in writing business cases for venture capital funding (£58k received through two proof of concept awards). Following from these, a major international oil company (Shell) has taken up the project and is currently developing a prototype for field testing in 2013. If successful, this device could provide early warning on imminent pipeline failure that could save both money and, more importantly, protect the environment from pollution.

The Advanced Virtual and Technological Architectural Research Group: AVATAR

The AVATAR group investigates the full range of impacts of emerging and new technologies on architectural design and encourages a critical mix of cultural, aesthetic and social agendas through design. The research group is directed by Professor Neil Spiller and is being organised into five sub-specialties with a co-Director appointed to each: digital technology & surrealism, synthetic biology, film & video, interaction and digital manufacturing. The group has built up a rich portfolio of high profile, international, interdisciplinary partnerships that actively contribute to the research including the Cronin Group, University of Glasgow; the European Centre for Living Technology (ECLT) Ca' Foscari, University of Venice; and the Centre for Fundamental Living Technology (FLinT), Southern University of Denmark, and is forging links with BIRLA Institute of Science and Technology, India.

AVATAR has generated a number of high profile research projects including: Communicating

Vessels (drawings, publications, exhibitions), Protocell Architecture (Exhibition series: Bio Fiction, Hylozoic Ground, Future Venice), Augmented Reality (design with industry) and Living Claddings (collaborative project with industry). New projects include an international collaboration with Korean artist Do Ho Suh on 'The Bridge Project' (design and publication), and a forthcoming architectural collaboration with international best-selling science fiction writers Jeff Noon, Pat Cadigan and China Mieville is currently under discussion.

AVATAR regularly publishes in peer review journals across disciplines such as *Protocell Architecture AD*, *Living Architecture TED Book*, *Kerb Journal* (RMIT), *Nature*, and *International Journal of Nanotechnology & Molecular Computing* (IJNMC). It has also guest edited an edition of *Architectural Design* on 'Protocell Architecture', has a chapter for publication in 'Future Nature' in press and has submitted a manuscript for a TED Book entitled 'Living Architecture'. AVATAR is researching online tools such as Klout, that may be useful in measuring the impact of the industrial applications of AVATAR's research include collaboration with the Cronin Group and two paint manufacturers regarding the design and development of carbon fixing paints for building exteriors, ship hulls and electrical equipment. AVATAR is also working with Astudio architects and Yuanda to design a range of model 'living claddings' that may be suitable in a commercial context.

c. Strategy and plans

The key impact strategy for the unit will be to:

- *Develop* the infrastructure and status of the research groups as internationally excellent groups to capitalise on their influence and impact through this impact strategy.
- *Collaborate* with external partners to ensure research outcomes are utilised in the external environment and to maximise impact particularly on policy makers, the Built Environment industry and its clients (see impact case studies).
- *Enhance* the impact of the research by the inclusion of external bodies in research planning, to advise on projects and disseminate results to their communities.
- *Disseminate* research findings effectively by presentations/exhibitions/road shows to non-academic audiences and monitor the application of the research.
- *Advise* stakeholders and policymakers directly on the take-up and application of research findings in their immediate environments.

As indicated in the Environment Statement of this submission, the focus of research in the unit is on applications to solve real-life problems experienced in the Built Environment. The first case study on *climate change mitigation* shows impact on household behaviour, policy development, environmental performance and public awareness. The second case study on *adapting buildings to climate change* shows impact on policy makers, the built environment industry and its clients. These case studies relate to SBERG. The second research group in the submission, AVATAR, also concentrates on applications to solve real-life problems experienced in the Built Environment by investigating the full range of impacts of emerging and new technologies on architectural design and encouraging a critical mix of cultural, aesthetic and social agendas through design.

d. Relationship to case studies

Two case studies are presented which exemplify the approach to impact set out in section b of this statement. These case studies are related to SBERG.

Case study 1 is *Climate Change Mitigation in the Built Environment*: here, the research developed a series of behavioural interventions to inform building users of the energy they were consuming and provided guidance on how this could be reduced. The socio-technical relationships were used in a public engagement programme to promote debate amongst the over-65s and interventions by Registered Social Landlords to support behaviour change and reduce energy consumption in domestic buildings. The outputs have also been used to inform Social Housing policy development.

Case study 2 is *Adapting buildings to climate change*: here the research team explored the issues surrounding adaptation of the built environment to climate change, and developed a new model of built asset management that integrates adaptation decision making into the building life cycle. The model is being used by facilities managers and surveyors to produce long term asset management plans, and by central and local government policy makers to develop adaptation strategies.