Institution: Plymouth University

Unit of Assessment: C16 Architecture and Built Environment

a. Context

The School of Architecture, Design and Environment was formed in 2009, bringing together related subject areas that were previously located in different faculties. These have been formed into the research clusters from which our two case studies are drawn: '*Simulating Buildings' Performance'* relates to the effect of climate change on the built environment and is drawn from the advanced building materials and construction research undertaken by the *Environmental Building Group* (EBG); '*Building Monitoring and Preservation*' focuses on sustainable construction and is drawn from the work of the *Centre for Earth Architecture* (CEA); a sub-cluster specialising in earth building that spans EBG and Architecture (design). Devon is the centre of the UK's rich earth-building tradition and the CEA is geographically well-placed as an internationally-recognised centre for research into old and new earthen architecture. The work of the EBG and CEA is complemented by that of the *Culture Theory Space* (CTS) research cluster, established in 2009. CTS research focuses upon the architectural humanities and critical studies within the fields of architectural history, cultural theory, human geography and urbanism. The activities of all clusters are coordinated and monitored at School level.

A focus on the relationship between architecture, building construction and the environment underpins a range of research projects that have an in-built and intentional engagement with regional, national and international non-academic partners. Industrial partners include Cornish Lime, Lead Lease, Loft Genie, Wates Construction, C3 Resources, Gaia Architects, Nicholas Grimshaw Architects, Associate Architects and Hukseflux (Netherlands). Non-profit partners include Sovereign Homes, Joseph Rowntree Foundation, and the Carbon Trust, while professional partners include the Institute of Historic Building Conservation, International Building Performance Simulation Association, Association of Researchers for Construction Managers, Institute for Social Science Research (ISSR), Royal Institute of Chartered Surveyors (RICS), and Chartered Institute of Builders (CIOB). We also have established partnerships with governmental organisations, such as the UK Met Office, Plymouth City Council, Cornwall County Council, Devon County Council, English Heritage, Centre for Research and Application of Earth Architecture (France) and the International Council on Monuments and Sites. Our research has benefited these partners in diverse ways, from the development and implementation of new historic building preservation monitoring and regulatory procedures in association with Devon and Cornwall County Councils and English Heritage, to the development of sustainable building and monitoring methods with C3 Resources, Wates Construction, Joseph Rowntree Foundation, and the Carbon Trust or measuring the impact of digital technologies on social networks in Cornwall (Superfast Cornwall).

b. Approach to impact

Within the framework of an overall research impact strategy, the School's approach to impact is project-based, i.e. overseen by the School Research Committee and supported by cluster leads, there is a flexible and tailored approach to the identification, implementation, and monitoring of impact by staff. The School's research strategy requires the potential impact of a project to be made a consideration at the outset and a plan for impact monitoring and verification must be produced. Learning from the case studies, impact is now continually monitored for all current projects, rather than relying on retrospective data gathering, and impact and engagement activities are reported to the School Research Committee. Staff are required to consider impact plans when discussing new and on-going projects during their annual one-to-one research review, which is conducted by the Research Lead for each cluster, and a statement on potential or on-going impact is also a requirement for applications for internal research funds. The anticipated impact for an individual project has to be appropriate and realistic for that project. With appropriate support and guidance, project leads are best placed to assess the impact potential of their research. As a School we have found that the best evidence of impact comes out of planned causal links between the research and its subsequent impact and through clear relationships with external partners. For example, from 2005 to 2010 the School ran a collaborative project with the University of Pennsylvania and Plymouth City Council funded by the Kress Foundation (New

York). Plymouth researchers carried out extensive site investigations into the eighteenth-century designed landscape and garden structures at Mount Edgcumbe Country Park (Cornwall). By revealing previously unknown construction features and decorative paint schemes, this work has significantly contributed to – and altered - the preservation and management strategies of the site, benefitting non-academic heritage partners. Research was conducted on Plymouth campus and with field stations equipped with tools and IT by the School and UPenn collaboratively. Researchers were allocated time in their work load models to conduct research and to act as project managers. Impact, in terms of real benefit to Plymouth City Council, was the anticipated outcome of the five-year project and a key aim from the outset for both academic and non-academic partners and the funding body. In this case, activities and subsequent impact were documented in detailed annual project reports disseminated to all partners.

Resources are available at University and School -level to support impact-based research. These are coordinated and disseminated to staff through the School Research Committee. The University's Research and Innovation Division runs training sessions on impact skills and oversees the internal peer-review of project proposals and their pathways to impact. Subject-specific sessions are run by the School itself, together with one-to-one mentoring by staff with experience of impact-based research, seed-funding for projects and the employment of research assistants to assist impact data gathering. Project leads are required to make use of these resources when planning their work and this use is monitored by the School Research Committee. For example, an impact-based partnership-project with Superfast Cornwall by researchers in CTS on the social impact of broadband use in Cornwall secured seed-funding of £4000 from the School for teaching relief and research assistants and with internal peer review, mentoring and support from knowledge exchange advisers in Research & Innovation, were able to translate this into a three-year project funded by an EU Marie Curie Integration Grant of £80,700. The project is expected to deliver recommendations for significant improvement in the integration of online social networks with place-based communities in order to overcome digital divides. With on-going monitoring, this will impact the future activities/strategies of project partners, including ERDF, BT, Citizen's Online and various community organisations.

c. Strategy and plans

The merger of Architecture, Design and Environmental Building and the formation of a new School in 2009 provided the opportunity for the immediate development of a School-wide research strategy that could capitalise on these earlier successes and would allow us to develop and monitor emergent impact. The new School has provided the opportunity to learn from the experience of others and to ensure that good practice is embedded across the unit (in particular that the greater experience of Environmental Building in impact-based research also benefits researchers in Architecture). As a new School with a relatively high number of new researchers (12 new appointments since 2009 including 6 ECRs) a key priority has been to initiate a range of high-quality research projects with appropriate non-academic impact. Much of the impact from these projects will emerge post-2013. These projects build on the earlier successes of the EBG and CEA - including the two Impact Case Studies **-** which originated when the two groups were in separate parts of the University.

The School's strategy is to increase activity in three impact-related areas: partnerships with industry; informal (non-financial) partnerships with professional bodies and organisations that influence or dictate industry and government guidance; and research funding for projects with non-academic impact from major UK and EU funding bodies (see Relationship to Case Studies). These were identified in consequence of a review of impact-based research projects undertaken by the EBG and CEA prior to their merger with the establishment of the current School in 2009, including the early work of the two Impact Case Studies. The identification and focus on these, our strongest areas, is intended to benefit the development of successful research projects with embedded impact in different fields across the School. These strategic measures have resulted in the initiation of a range of new impact-orientated projects across the School such as the Superfast Cornwall social digital networks project and work with the Institute of Historic Building Conservation or the Joseph Rowntree Foundation. The following three examples are a sample of current live projects from across the School that demonstrate the success of this strategic approach in developing new projects (the emerging impact of all these projects is monitored through the School

Research Committee to ensure effective use of partnerships):

First, eViz, is an EPSRC-funded project awarded in 2012 and led by researchers within the EBG which pulls together industry, not-for-profit and academic partners, including C3 Resources Ltd, Carbon Action Network, Cornwall Development Company, The Energy Saving Trust Ltd, Plymouth City Council, Regen SW, Schneider Electric Ltd UK, Tekla and The Eden Project, to create and disseminate visualisations of energy flows with the aim of increasing energy reduction practices. The most effective visualisations will be used in field trials with UK and International partners to evaluate financial and carbon savings over time. The impact of this research is intended to be apparent on many levels with outcomes for individual users, companies, charities, government and carbon reduction targets.

Second, funded by the Joseph Rowntree Foundation, researchers in both EBG and Architecture's CTS research group, have since 2010 successfully developed a sustainable housing-design model for increasing air-tightness which will be used, as intended, by social housing associations and development companies to increase energy efficiency in new builds. A prototype has been constructed and evidence of impact is expected across the next 2 – 5 years.

Third, an AHRC Fellowship, awarded to a researcher in CTS from 2010-11 for an architectural history project on the Picturesque movement in domestic architecture, was able to incorporate an impact element that will inform the work of English Heritage and the National Trust in Devon and Cornwall and Plymouth County Council. The researcher is supplying these organisations with Advice Notes on the identification, presentation and preservation of picturesque cottages and hermitages that have the potential to impact the long-term management of these historic buildings. This project built on the previous collaborative project with the University of Pennsylvania and Plymouth City Council at Mount Edgcumbe.

Plans for the future include a complete review of new and current research projects in 2014 to assess their potential for impact and planning for impact monitoring. This will lead towards a new impact strategy to be implemented in 2014 that learns from previous experience, as demonstrated in our two case studies, but also looks to the future with an expected increase in impact-research produced by an expanded number of researchers in a wider diversity of fields.

d. Relationship to case studies

The School's approach to impact and impact strategy since its formation in 2009 has been largely informed by researchers' experiences with the projects contained in the submitted studies and these are used by the School as models for future planned research projects. Furthermore, analysis by the School Research Committee of the various interrelated projects within the two studies has also allowed the School to develop a set of three straightforward priorities in the development of future impact-based research projects; focussing on relationships with partnerships and funders as detailed above under Strategy and Plans. The two selected case studies exemplify the School's flexible, project-to-project approach to impact-based research: that impact-based research must be conceived and developed with impact in mind – not retrofitted - and that clear impact-orientated goals and good relationships with external partners must be established from the outset. For example, the first study 'Simulating Buildings' Performance' is focussed around an EPSRC-funded partnership between Plymouth and industry-partners such as C3 Resources, developing technology for monitoring buildings' energy use. This approach is continued in the emergent EPSRC-funded e-Viz project. The second study 'Building Monitoring and Preservation' considers the role of the CEA and EBG in the monitoring and preservation of traditional and/or sustainable natural building materials, such as earth and straw-bale, through partnerships with companies such as Hukseflux and organisations such as English Heritage and UNESCO (with various funders from the Carbon Trust to International Council on Monuments and Sites). Impact-based research into the management of earth building-rich landscapes is continued through the current EU-funded Cordiale project.