Institution:
Leeds Metropolitan University

Unit of Assessment:
16: Architecture, Built Environment and Planning

a. Overview

The Unit's research is organised through research centres and clusters that focus on providing high quality research activity and outputs across a range of disciplinary areas. Research centres support the work of the following subject groups – *Architecture and Landscape Architecture*, *Civil Engineering and Construction Management, Planning, Housing and Human Geography, and Surveying* - with research linked closely to industry through partnerships and professionally supported activities. These centres are: *Centre for Built Environment (CEBE)* and the *Civil Engineering Research Facility (CERF)* and the *Centre for Urban Development and Environmental Managment (CUDEM – planning and human geography)*. In 2012 the Unit's research centres and activity were further strengthened by the establishment of the *Leeds Sustainability Institute* (LSi), under the directorship of Gorse. University investment in the Institute of over £250,000 has increased the number of experts and research capability within the sustainability and built environment field. As such, the Institute draws together expertise in sustainability research. These are:

- Sustainability: People and Places
- Sustainable Infrastructure
- Building Efficiency and Building Design
- Sustainable Business Practice and Energy Generation

The Institute also embraces the sustainable developments that have been undertaken through the University's estates department, as well as the Low Carbon Green Vision business engagement and enterprise networks developed through the Unit's *Centre for Knowledge Exchange*.

The research carried out by Unit staff is both pure and applied and seeks to generate knowledge that contributes to the creation and management of a more sustainable built environment. Sustainability is our research focus, but the approach to sustainability we take is diverse. Work stretches from developing low carbon and sustainable housing on one hand to theorising the way planners imagine sustainable space within spatial planning strategies on the other. The research we carry out is both theoretical and policy relevant. Where it engages with policy it is often practice guiding. For example, our low carbon housing research (Bell, Gorse, Stafford, Johnston), our adaptive urbanism work (Simson, Stoppani) and our patented geo-textile research (Pritchard) all demonstrate linkages between research and policy formation (taking us from theory to practice). Our work also demonstrates activity at a range of spatial scales: for example, water purification research carried out in Africa (Pritchard, Craven) and the European spatial planning research on the urban fringe illustrate our international perspective (see REF 3a and 3b). Other research has a different reach: for example, the business and industry engagement work undertaken by the Centre for Knowledge Exchange, the buildings energy performance evaluation work (Bell, Stafford, Johnston) and public art strategy evaluation (Strange) studies, all link directly to regional and local policy makers and users (see REF 3a and 3b).

Research trajectory: Since 2008 our trajectory has been upward. Indeed, on a range of indicators such as income, projects and outputs we have improved our position. For example, our income level has grown steadily year on year – in 2007 we generated approx £200,000, in 2008/9 this had risen to over £600,000. Overall, between 2008-09 and 2012-13 the Units total income totals just over £2,300,000. Equally, since 2008, our research outputs as submitted in REF 2 includes 34 journal articles, 1 authored monograph, 10 research reports for external bodies and 20 book chapters. The positive direction of travel across these indicators is noteworthy given that neither Built Environment or Town and Country Planning (as separate Units of Assessment) were entered into RAE 2008.

Policy Impact: Policy impacts are occurring across the range of work being carried out in the Unit, and our work underpins policy and practice in the built environment professions. Whether this work is on buildings sustainability and low carbon housing, or construction sector best practice or spatial policy analysis our research is being used, being talked about and helping to make and inform policy. The societal benefits of our work are also wide and can be seen through activity stretching from reducing waterborne diseases in Africa to new ways of modelling and constructing energy efficient housing.

Overall, we see our research as adding value. Our work is timely and future oriented, with opportunities for continued activity. The Unit's research is recognised and used widely within the sector, industry and beyond. Our income is growing and sustainable. Our level of user engagement is strong, while the reach and scope of our research is extensive, with work operating at international, national, regional and local scales. Moreover, we are working with a wide range of partners across these scales in a key area of research that is both academically and practically significant.

b. Research strategy

Our objective is to pursue high quality planning and built environment research that underpins our core strategic aim to pursue work that contributes to the creation and management of a sustainable built environment. This approach will maintain us on the upward trajectory of research developed over the REF audit period. To facilitate future research, the centres and the Leeds Sustainability Institute have a forward research plan designed to help track research growth that is both achievable and sustainable. These plans outline the key research objectives, the resources required, and the outcomes and outputs to be achieved. The decision to form the *Leeds Sustainability Institute in 2012* has also helped to sharpen the strategic direction of research and provided a visible and secure home for sustainability research. Indeed, its creation has increased the number of experts and capability with a research focus on sustainability and built environment to the extent that the *Leeds Sustainability Institute* forms the umbrella organisation through which the Unit's research activities are deployed, marketed and disseminated. This strategy is already producing results with three projects funded by the Technology Strategy Board and one by the Department of Energy and Climate Change (of £500,000) secured in the latter half of 2012, all of which involve researchers within the *Institute* and REF Unit.

Building and enhancing a research culture is at the heart of our University's Strategic Plan 2010-2015, Theme Three (see Theme 3 of the Strategic Plan at http://www.leedsmet.ac.uk/strategicplan/Leeds-Metropolitan_Strategic-Plan_2010-2015.pdf). This states that our primary objective in research is to be a *'catalyst for social and economic progress in and for our region'* and beyond. This objective informs our research strategy and the work undertaken by staff within the Unit. Through the centres, clusters and the *Institute*, the Unit will continue to pursue high quality planning and built environment research with quality outputs that underpins a core aim to provide research, education and training, focused on the creation and management of a more sustainable built environment. In addition, our research will be designed to further enhance our external profile and reputation through providing research support to the construction industry and built environment professions. In particular, we will aim to signal and highlight the impact of our research within professional areas more widely through the *Leeds Sustainability Institute*. In pursuit of these aims, we set ourselves the following strategic objectives:

- To continue the process of strengthening and improving the quality of the research outputs of individual staff members.
- To maintain a team of research active staff within each research centre and to use the Leeds Sustainability Institute as the vehicle through which research activity, outputs and impact is transmitted to our research partners, users and beneficiaries.
- To further develop the value (financial and academic) and range of external research income, with clear plans for dissemination of research projects and their impacts.
- To establish a strong 'community of researchers' and vibrant research environment. This would include members of academic staff but also the growth of research student numbers,

including students from overseas as well as the UK.
- To continue to develop research collaborations nationally and internationally exploiting, in particular existing links with institutions and partners across Europe, in Africa and South East Asia.

c. People, including:

Staffing strategy and staff development

Staff are our key resource and hence staff development lies at the heart or our research activities. This recognised and encouraged by the School's, Faculty's and Universities commitment to promoting research, as reflected in its policy and practice for staff recruitment, staff development and support and progress monitoring. The Unit has 3 Professors (Gorse, Khosrowshahi, and Strange), 1 emeritus Professor (Bell), 5 Readers (Bingel, Johnston, Pritchard, Simson and Stoppani), while the majority of remaining staff are senior lecturers. There are currently 3 early career researchers as defined by HEFCE (Craven, Peat and Stott) submitted in the Unit.

The majority of most of these colleagues' time is focused on undergraduate teaching. This means that the unit has had to think carefully about how to support and enable research for colleagues whose workloads are often focused elsewhere. The ethos we have developed is that of the 'virtuous circle', in which teaching activity and research is brought together wherever possible. This ethos includes undergraduate programmes in these subject areas at Leeds Metropolitan, which are all strongly research-led, and all our courses have been developed to enable the individual lecturer to have space in their deployment that relates their teaching to areas in which they are also conducting research. We regard this as a virtuous circle because the research enriches the teaching while at the same time being enriched by the process of dissemination to its audiences in the classroom before being more widely published

In the selection of new appointments, the candidates' potential to have and/or develop a successful research trajectory is considered a significant criterion. All new staff take part in an induction programme facilitating their introduction to the School, Faculty and University. This includes:

- Central Induction – a day-long introduction to the key elements of the role, which takes place very early after appointment and which helps colleagues to orient themselves.
- Local Induction – a meeting on the colleague's first day with their line manager (head of school) in which the key local personnel are introduced, and local orientation takes place.
- Workload policy. For early career colleagues, the university states as policy that the colleague should not be burdened with a full teaching load to the tune of 500 hours remission across their first academic year in post.
- Our university also runs a series of research training activities, which all researchers are free to attend.

The Unit's research centres and the *Leeds Sustainability Institute* also provide a supportive and stimulating environment within which new academic staff can develop their research interests and capabilities, for example Bradley and Craven have developed their research profiles through funding at both Unit level and through University research awards, with Bradley securing £25,000 from the University's Research Leadership Awards initiative, a programme designed to help develop research leaders of the future. Indeed, Internal investment in addition to our external research income is an important contributor to increasing our internal structures, facilities and equipment, research profile, reputation and in the development of academic staff.

As an aid to the continued development and refreshment of staff research, the Unit has recently established an internal research funding process for the development of competency-based research clusters. To date, six new clusters have been identified across the Unit, with funding allocated up to the value of £5K per cluster. This funding is dependent on research plans that meet, what we call, the four Ps (*PhDs, Publications, Projects and Profile*). Overall, our approach to staff development is underpinned by mentoring, research partnering, team working and inter-

institutional collaborations. All staff participate as necessary in the University's well established staff development programme and research training support offered by the University Research Office.

Equal support is also given to research officers and research fellows as well as to academic staff, and this has allowed a number of research fellows to continue their education to doctoral level whilst working on research projects and producing outputs (for example the work developed by Craven, Peat). Research Mentoring is available to all colleagues according to need, whether they are early-career academics, or whether they are mid-career or senior researchers. This process is managed by the professors and reader across the unit and is available either as a request from an individual, or as a targeted action arising from a Personal Development Review (PDR) meeting (see below). In all our areas, research activity is flourishing with established research active staff working alongside and mentoring newer and aspiring researchers (for example the collaborative work of Pritchard and Craven and Bell, Miles-Shenton and Stafford). Indeed, a key element of our growth has been the degree to which new researchers have been supported in their career development through opportunities to co-work with senior colleagues on projects (leading to joint outputs – see REF2), as well as pursuing opportunities to establish themselves in their own right (through for example the award of internal promising researcher fellowships (Edwards) and PhD registrations (Bradley, Craven).

The Unit's approach to research monitoring is based on the principles of fairness and transparency across its research related activities. Our University is committed to the development of its staff, and operates in compliance with the Concordat and Researcher Development Framework. Through Human Resources (HR) and the University Research Office (URO) we enable our staff to deliver high levels of performance by promoting and providing development opportunities which are reviewed through our Performance and Development Review (PDR) process. All members of staff have an annual PDR meeting within which clear and achievable research objectives are set and embedded into the forthcoming years work activity. These reviews provide the basis for monitoring progress and identifying individual support needs, for example, the allocation of research time, conference attendance, and/or research training requirements. The PDR is therefore a key mechanism for monitoring the effective use of research time and outputs. Linked to the annual deployment round, which makes research a core part of academic workloads, time spent on research articulated through the PDR process is thus clear and accountable.

Research students

A key objective for the unit is to maintain and enhance its 'community of researchers' and postgraduate students. This includes retaining and recruiting research active staff, but also increasing research student numbers from current levels, including students from overseas as well as the UK. The Unit has experienced considerable success with their industrial, professional and community engagement in attracting students. Sectors previously outside the traditional research arena are increasingly interested in the Unit's research agenda. Part-time research undertaken in collaboration with partners is seen as a growth area. Many of our partners convert research interests into formal publication and postgraduate study. All research students take part in a University Induction programme on the commencement of their programme of study. As they progress, students are required to undergo a 'confirmation of registration' viva (4 months for FT students and 6 months for PT students) where their research proposals are considered and assessed. Each student also has an annual progression meeting where they are required to formally report on their progress to an academic panel.

Research student training is accessed via a number of different routes. In addition to a centrally-run programme of events, including an annual conference in conjunction with colleagues and students at Sheffield Hallam University, there is a Research Training Programme delivered via the University Research Office. Initial training needs are identified as part of the Confirmation of Registration process. Students are alerted to the RTP events from their compulsory two-day induction onwards, and in consultation with their research supervisor they are also encouraged to identify other relevant training (all full time research students are provided with a laptop and office space and have access to funding for one conference visit per year during their period of

registration. Part-time students receive the same benefits, except for the laptop, on a pro-rata basis). Research students are also encouraged to attend staff research seminars provided by the research centres, as well as participate in the LSi Research Hub run via the Leeds Sustainability Institute. Postgraduate research students also showcase their work through an annual research symposium organised by the PGR student forum. Equally, research skills are developed through a personal research training needs analysis and programme. The Leeds Met Skills for Learning (http://skillsforlearning.leedsmet.ac.uk/) provides a collection of resources to support research, teaching and learning. It also offers Skills for Learning workshops and tutorials on academic communication, project management and working with literature sources.

We plan to build on our current level of postgraduate research students, and indeed our current number of enrolled research students has expanded rapidly in the last 12 months with 25 students registered for research degrees that cover the range of work undertaken in the Unit. In June 2012, the Unit was able to offer five PhD bursaries funded by the Faculty of Arts, Environment and Technology and these were awarded to students undertaking research in planning and civil engineering. While our total research student numbers are relatively small (but growing from a small base) our taught Masters numbers are large, with our Masters' course portfolio strong and in demand across the construction industry and the built environment professions. We have also been successful in selecting some of these Master's students to undertake PhD level research, with a number eventually becoming members of academic staff (for example Bradley and Craven).

d. Income, infrastructure and facilities

Income: Throughout the Unit the range and quality of research projects undertaken since 2008 has been substantial. These projects convey a research focus on work designed to enable better and more sustainable management of the built environment and its related professional and policy domains. The funding source of this work is from industry, central government departments, the European Union and charities and UK research funding councils (EPSRC). Over the REF period the unit has established a resultant critical mass of projects and researchers, demonstrating significant investment in our research (totalling over £2,000,000). Current projects are set to continue beyond the end of REF 2014 submission date. Indeed, through further commissions including those from the Department of Energy and Climate Change, the Technology Strategy Board, the Good Homes Alliance and the Joseph Rountree Foundation, funding of over 30 research projects have now been undertaken on buildings and estates in the North of England.

Infrastructure and Facilities: Each research area has a dedicated office research base, with staff based either in Northern Terrace or Queens Square at our City Campus. Those areas that undertake more technically-oriented work have direct control over a large amount of equipment for scientific field work and testing. This is particularly the case for work in *CERF* which has two laboratory facilities (approx. 535 m^2 of floor space in total), one of which is located off campus and dedicated for research and development projects, particularly for large-scale bespoke testing equipment. This testing facility provided an excellent showcase for the JBM re-accreditation visit in October, 2010. The Unit has equipment stock for housing research at replacement value to the order of £550,000.

Funding from external bodies has enabled new 'state-of-the-art' testing equipment to be purchased over recent years. This new equipment involves computer logging facilities such as data-loggers, probes, transducers, new/safer loading frames/devices for the triaxial and pullout tests as well as new soil respiration tests. This latter piece of equipment has introduced an element of laboratory work to a module which previously lacked practical work. Case studies and site visits have also been fed into the curriculum from current research projects, while industry partners regularly contribute to teaching and learning activities through acting as visiting lecturers. Such work helps to bridge the gap between academia and industry and has been praised by professional bodies during their accreditation visits.

Our University has invested in enhanced and quality assured IT research environment for increased research management and productivity. Symplectic is employed as a research

management system which collates research activities across the University for easy maintenance and enhanced visibility in the World Wide Web. The Leeds Met Repository (Open Search) facilitates easy access to research active staff and students' publications, while the "Find an Expert" facility helps researchers across and beyond the university to locate Leeds Met experts for collaborative research work. Leeds Met has subscribed and is promoting the use of the PIVOT database for identification of funding opportunities and also access to about 2 million profiles of scholars and researchers from around the world. The Leeds Met Library provides 24/7 library access to support research, teaching and learning and has more than 0.5 millions of journals and books (both e-copy and hardcopy). The state-of-the-art research facilities in our university are essential for the delivery of quality research and training programmes to support the university's strategic research priorities

e. Collaboration or contribution to the discipline or research base

Research Collaboration

A key objective of the Unit's research is to provide research support to the construction industry and built environment professions, as well as to the academic community. The unit has placed significant investment into a range of research and knowledge transfer projects, which attract significant industry and professional interest. This is evidenced by the considerable amount of project work undertaken since 2008 for UK central government and UK based industry.

Research active staff are directly engaged with end users, not only through project work but through their participation on professional advisory boards, panels and committees, including for example the Building Research Establishment and Chartered Institute of Building (Research and Innovation panel), and the business engagement work undertaken through the Centre for Knowledge Exchange. Our work has also involved extensive collaboration with researchers outside the unit. This has included working with colleagues internally in the Faculty of Arts, Environment and Technology (planning and human geography), the Faculty of Health (planning and civil engineering) and Carnegie (planning and human geography) as well as externally at the University of Newcastle (planning) University of Leeds (human geography, civil engineering), Imperial College and UCL (surveying), The University of Malawi – The Polytechnic, University of Botswana Katholieke Universiteit Leuven, Ghent University, the Belgium Research Institute, National House Building Council, Engineering High School of Bilbao Spain, Building Research Institute and Hong Kong University. The link with Hong Kong has produced two international conferences on Asian cities in 2008 and 2010. CUDEM has also (Oct 2010) hosted the Urban Design Conference. Through *C*entre for Knowledge Exchange the Unit was also home to the *Yorkshire Forward* funded *Construction Sector Network* until December 2012. This network was designed to link key construction sector professionals and stakeholders across the Yorkshire region. From January 2013 this work has been continued through the Centre for Knowledge Exchange and its 'Greenvision' seminar series and business engagement activity.

Internationally, our work to develop construction education and research has also been progressed through involvement in TEMPUS (the EU programme supporting the modernisation of HE in neighbouring countries including the Middle East). Project 511320 (led by Khosrowshahi) is designed to set up a *Centre of Excellence for Research and Training in Construction and Environment* at Damascus University. This is also to act as a protocol for the subsequent establishment of similar centres in the Universities of Aleppo and Tishreen. Academics from those institutions are participating in the project which began in November 2010. The total value of the project is circa €455,000 with over 70% of those monies dedicated to the work in Syria.

Over the past 15 years a partnership between the Malawi Polytechnic and Leeds Met has been developed and there have been regular visits in both directions. The partnership is primarily engineering based, addressing the issues of potable water and infrastructure reliability. In 2012 an academic member of staff from the Malawi Polytechnic was awarded a PhD based on research carried out under this partnership. This collaboration work has been highlighted in the JBM: 2010 Good Practice annual report*: "The overseas links in Southern Africa are strong and have had a positive effect on course delivery and student engagement".* Interdisciplinary elements have also

been created within PhD projects by working with colleagues from different faculties, such as with microbiology within the Faculty of Health at Leeds Metropolitan University. This has introduced novel elements to these projects and has allowed research findings to be published across subject boundaries.

The Unit's work on energy efficient housing is also now developing an international dimension. The success of the UK based Thermal Performance studies research funded by Knauf Insulation has resulted in a European project commencing in partnership with Katholieke Universiteit Leuven, Ghent University and the Belgium Research Institute. The project, based around the full scale heat loss methodology, aims to identify methods of upgrading new and existing building stock by evaluating the performance of different thermal interventions and their hygrothermal effects. As a result of the initial partnership a further development is the sponsorship of work with the International Energy Agency evaluating the hygrothermal research methodologies associated with building performance testing. Research partners include: Lawrence Berkeley National Laboratory; Engineering High School of Bilbao / E.T.S. de Ingeniería de Bilbao; Frau Institute in Stuttgart; Fraunhofer Institute for Building Physics; Energy Efficiency in Building Unit, CIEMAT. Spain and Katholieke Universiteit Leuven. Over the last 12 months we have engaged with the International Energy Agency annex 58 (Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements) and we are the leading participant from the UK and have committed to take the lead of one of the task groups – this committment extends to 2015.

Discipline engagement

Staff knowledge and expertise is also called upon regularly, with the majority of submitted staff acting as reviewers for academic journals and research councils. The former has included journals such *as Urban Studies, Town Planning Review, Planning Practice and Research, Housing Studies, Construction Management and Economics, Construction Innovation: Information, Process and Management Journal , The Australasian Journal of Construction Economics and Building, Construction Information Quarterly, Environmental Monitoring and Assessment, and The West Indian Journal of Engineering*. Staff also act regularly as expert reviewers on projects for the ESRC, EPSRC, DelPHE (round 5) as well as providing guidance and advice to government bodies and agencies. Similarly, senior staff (Bell, Bingel, Gorse, Johnston, Khosrowshahi, Pritchard, Strange) carry-out editorial panel duties for academic journals as well as advisory roles for professional boards and committees. Indicatively, these include: representation on the Construction Industry Council regional BIM HUB; representation on National Constructing Excellence Board Representation on Constructing Excellence Regional Network (CERN); representation on the UK Green Building Council Northern Members steering group; representation on the Board of the Association of European Building Surveyors and Construction Experts (AEEBC); representation on the Board of Building Smart - IAI UK; and representation on the Board of British Standards B555 Committee.

Staff representation within professional institutes and societies is strong, with the majority of submitted staff holding full or associate membership of their professional bodies. Such organisations include: *The Royal Town Planning Institute; The Chartered Institute of Housing; The Royal Institution of Chartered Surveyors; The International Masonry Society; The Chartered Institute of Building; The Association of Researchers in Construction Management; The Association for Project Management;* and, *The International Society for Environmental Geotechnology.*

Research Dissemination

We have sought to signal and highlight the results of research within our professional domains and more widely through engagement with research users and academic dissemination. The list of outputs for submitted staff demonstrates continued dissemination of research work across the Unit to both the policy-making and academic communities. The number of research outputs submitted overall is also strong and on an upward trajectory, with 34 journal articles, 1 monograph, 10 government reports and 20 book chapters put forward by submitted staff. Staff also regularly present research papers and keynote addresses at conferences in the UK and overseas.

Through the LSi the Unit has also worked to disseminate its research work. For example, LSi 'Greenvision' dissemination events take place monthly addressing Renewable Energy, Building Performance, Corporate Social Responsibility and other related topics. This series of presentations is sponsored by Squire Sanders, Fairsnape, RICS and the Chartered Institute of Architectural Technologists. The LSi, Centre for Knowledge Exchange, that lead the LSi Greenvison series is also assisting in the development of sister projects, such as the LSi TRUG ecology project – which focuses on local produced and sourced foods. LSi have also partnered with the Association of Researchers in Construction Management and the Chartered Institute of Building (CIOB) to run a series of Low Carbon Building workshops in Leeds, Reading and at the CIOB headquarters in ASCOT. Such dissemination events have continued to maintain our presence with high profile policy related organisations that are influential in feeding into Government research, policy and regulation. For example, we have a number of direct relationships with the Department of Energy and Climate Change (DECC) assisting DECC where possible. Working with AECOM, Unit research work links directly with the Department for Communities and Local Government (DCLG). Our association with the DCLG has ensured that our work has had a key input into improving Building Regulations, where our research groups have both assisted with the consultation process, that have fed directly into Building Regulation policy changes. Equally, our successes in working with the Technology and Strategy Board is influenced both by the quality of the research undertaken and the relationships that researchers have developed over time.

Researchers in the Unit have notable relationships with:

- Green Construction Board
- Technology Strategy Board
- Zero Carbon Hub
- Green Building Council
- Yorkshire Energy Partnership
- English Heritage
- Building Research Council
- Chartered Institute of Building – Innovation and Research Panel
- Low Carbon Futures

This range and diversity of activity both contributing to the research base of the discipline and the dissemination of research knowledge is supported by a range of measures within the Unit. Where possible and appropriate, remission from teaching is offered in support of contribution and dissemination work. Our university supports the infrastructural needs of colleagues via access to computing and other facilities; and we recognize our responsibility to this activity to support our subject areas in our ethos as well as in our University's mission. Overall, we see our research environment as vibrant and sustainable. We believe we have achieved a great deal over the REF assessment period resulting in a positive research trajectory, the majority of which has been achieved with relatively little cost and achieved through our commitment to the subjects and research activity that make up our Unit,