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 Dr Miles Willis, Project Director, College of Engineering, Swansea University



relevant experience

Swansea University framework and Science and Innovation Campus, with special focus on the Energy Safety Research Institute.

Client: Swansea University

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Contract Start date: Framework began September 2009

Contract completion: Framework completed 2014 (University in process of renewing). All Bay Campus projects completed by August 2015

Construction cost: £60m (Engineering quarter), Singleton Framework projects £11m. Energy Safety Research Institute £9.1m

Services: Full RIBA Stage 0-7, landscape design, Interior Design **Consultant team:** Arup (M&E, Acoustics, Fire); WSP (Structures & Civils); AECOM (Cost and CDM); Provelio (PM)

Relevance to BCU: Multiple complex new-build and refurbishment projects in existing and new campuses.

Introduction

The Energy Safety Research Institute (ESRI) is a £9m BREEAM Outstanding research facility at Swansea University's Bay Campus. It was the final project to be delivered through the 2009-2014 capital projects framework at Swansea University, and it represents the best of the processes that the multi-disciplinary teams developed with the University over that period. The building accommodates scientific testing and experimental laboratories, high quality offices, communal areas, meeting rooms, research offices, and a showcase lecture theatre.

The framework covered projects at both the existing Singleton Campus and the new £240m Bay Campus site east of Swansea docks. Our work at Singleton involved various refurbishment interventions to the existing 20th century building stock, including redesign of the external spaces of the Grade-II listed Abbey; the recladding and internal refurbishment of the Faraday Lecture building for the College of Engineering; Rehousing of the SMaRT Materials testing faculty 30 miles to a new facility at University; reglazing of the Keir Hardie building (resulting in a 44% reduction in building CO2 emissions) and the refurbishment and services upgrade of the LIC (Library and Information Centre).

In addition to the Energy Safety Research Institute, our work for the Science and Innovation Campus at the new Bay Campus has involved £60m of major new build projects comprising the £22m Innovation Hub, the £21m Manufacturing facility, and the £6m SMaRT Building. We were also responsible for sitewide landscaping.

Challenges met and solutions provided

- Achieving BREEAM Outstanding. Essential to target and achieve innovation credits. We suggested the use of Impact Software, linked to our BIM platform, to measure life cycle costings.
- Dealing with multiple 3rd party stakeholders (Princes Foundation, Planning Authority, St Modwen). We engaged and pushed the process, using our Cardiff offices to bring parties together.
- Fast track programme: we used intensive briefing and regular workshops to keep client and consultant teams aligned.

Lessons learnt

- Dealing with contaminated sites - ensure SI information is complete
- Spend time at outset clarifying which 3rd parties might influence the design
- Ensure the supply chain tendering process is open to the whole design team - this was essential to ringfencing certain BREEAM credits



“Swansea University is undergoing deliberate transformational change and requires Estates and Facilities Management to remain ‘fleet of foot’ to develop programmes of work to consistently deliver within the changing and challenging HEI Sector. There is no doubt that the University would have struggled to deliver the recent extensive project portfolio without the dedication of University staff and the added value and collaborative working ethos which comes from the framework.

Craig Nowell Director of Estates and Facilities Management

ESRI had extremely demanding technical and programme requirements:

- Its funding (UK Research Partnership Investment Fund through Central Government) was contingent on achieving a BREEAM Outstanding rating (which would make it the first Education building in Wales to do so).
- The building was high profile. It was to be the centrepiece of Swansea University’s research into renewable and alternative energy production, and would provide a focus to its work in this innovative and important field.
- The Institute was to be supported by industry sponsors to focus on the safety issues surrounding the development and expansion of existing energy processes, as well as the safe deployment and integration of new ‘green’ energy technologies. This built on the existing long-term strengths within the College of Engineering in the area of petroleum and chemical processing, particularly in terms of computational science (rock fracture modelling) and corrosion. It was supplemented by more recent research success in marine energy, nuclear, tidal, advanced water treatment (‘fracking’ post-treatment and separation), materials, crisis management and more novel areas such as photovoltaic (PV) and nanotechnology.
- It was also the last of the Bay Campus projects to start and yet had to be the first to finish (again, a funding constraint).

In writing this case study, we discussed with our Provelio Project Manager the factors that helped the team manage the process successfully:

- External PM 1st appointment, so was involved in selection of all consultants to ensure right team and key individuals were engaged to meet the specific demands of the project; the qualifications and experience were evidenced within the Contract data part 2;
- Consultants employed via framework which set out clear schedules of coordinated duties and deliverables through each milestone (for consultants and client team);
- Robust Risk Management techniques employed throughout – in line with the ECC contract;
- Robust clear brief;
- Robust gateway process / timely sign off (minimised post contract changes);
- Robust cost management / optimising available budget;
- Thorough reliable programme produced by PM with buy in from team; regularly reviewed and updated with remedial measures taken where necessary; a fast track programme given fixed end date, hence need to minimise change and to get it right first time;
- Early and inclusive engagement in BREEAM and appreciation of the commitment required to achieve the Outstanding rating;
- Early client building user group meetings driven by design team allowed a fast track project to succeed with engaged and motivated stakeholders.

It is worth exploring some of these in more detail.

Detailed briefing

Between December 2012 and May 2013, detailed briefing workshops were held with the end College of Engineering user groups. These sessions focused on the academic requirements, particularly of the ground floor laboratory spaces. The outputs of these sessions were captured using a tracker process. The sessions included regular conference calls to Rice University in Texas with future ESRI leader Professor Andrew Barron.

Design Review

- As part of our ISO 14001 QA process we carried out several internal stage reviews:
 - The first, two months into the project, highlighted issues with the plan that might have stopped us achieving some of our BREEAM daylighting credits. It also put the design team in touch with the contractor that had achieved zero waste to landfill on a previous project.
 - The next review, before submission of Reserved Matters, provided insights from previous projects on the detailing risks around enhanced insulation thicknesses.
- We instigated a full Design Quality Indicator (DQI) process with workshops including the Pro-Vice Chancellor with responsibility for science and engineering. This helped us understand the importance of designing for social interaction. It also consolidated the decision to use steel-frame and composite-metal-deck solution (cheapest of all of the proposed solutions and the highest Green Guide rating of A+).

Process

- Framework training and team building days; framework partners quarterly meetings to discuss performance and areas of improvement; working groups established to address prioritised areas for improvement.



innovation



Innovations in briefing

- Our work at the Bay Campus began in 2011 with responsibility for the sitewide Briefing document, covering strategy overview, space schedules, architectural and MEP criteria, ICT requirements, Outline Specifications and fully coordinated room data sheets. This followed a 6-month liaison with Deputy Director of Estates and members of the Facilities Management and Estates team, during which we carried out a series of workshops with end-users from the Engineering Department, College of Business and Learning Resource Centre.
- As innovations into the process we introduced Design Quality Indicators to the briefing; introduced 3D modelling of adjacency optioneering and developed simplified Room Datasheet processing, dynamically linked to the masterplan.



Innovations in the BREEAM process

- BREEAM innovation credits were targeted and we suggested the use of Impact Software, linked to our BIM platform, to measure life cycle costings.
- STL staff attended Impact Software training at the BRE in Watford.
- The Impact Software provided outputs to inform the Lifecycle costing and services replacement regimes for the University Estate FM team over a projected 60 year period, including cost in use and replacement cost profiles for key operational equipment.
- Not only did this achieve a number of essential innovation credits in the BREEAM assessment, it has helped the university evaluate particular cap-ex / op-ex issues in detail.

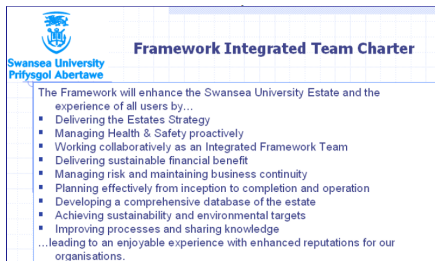


Public realm

- ESRI demonstrates innovation in its relationship to the public realm. From the earliest stages of the project our landscape architects worked to integrate an external classroom into the public realm to the south of the entrance. This was conceived as a doorway to the natural world for children, university staff, visiting businesses and community members in three forms: as a setting for lectures and group discussions, as an opportunity for hands-on engagement with natural elements, and as a setting for relaxation and restoration. We helped to bring the Down to Earth community and outreach group into the ESRI project, where they have applied their expertise to building the Oracle Teaching Pavilion.

BIM

- All the Bay Campus projects operated on a BIM Level 2 platform, using a common Revit basis and BIM execution plan that we developed in collaboration with Arup (MEP) and WSP (Structures and Civils). This was the first time Swansea University had used BIM.
- Formal model sharing and clash detection procedures reducing errors and changes on site.



Signing up to the Framework Charter, 2010.

A team ethos

ESRI must be seen within the context of Swansea University's award-winning capital projects framework.

The framework had set out to deliver on a charter that all parties had authored and signed up to in 2010. This set out a number of targets, such as delivering sustainable financial benefit and achieving environmental goals, but it was structured around a common understanding of what constituted realistic programmes, budgets and timescales; consistent briefing procedures and so on. We put in place processes such as the KPI framework, quarterly framework review, project lessons learnt reviews, and establishment of core client-side briefing groups.

The clarity of this inclusive strategy was recognised with the Constructing Excellence Wales 2012 Integration & Collaborative Working Award, for which Stride Treglown represented the design team. The citation read:

“It was clear to the judges that there is a strong relationship between the client and the end user. Indeed, the project framework integrates the students into the process with a strong emphasis on people and relationships. The four year consultant and contractor framework is a case study in nimble, intelligent, non-confrontational approaches to dealing with the University's accommodation needs”.

This culture of collaboration and mutual support led to strong trusting relationships between the PM and Contractor's Site Manager and between the Contractor team and the Design / Client team. It was a one team approach, even when things went wrong: when there was an initial failure of the air-tightness test at the end of the job, the team rallied to investigate possible causes.

The Soft Landings process was useful in engendering a culture of good communication and accessibility and contactability of key university personnel. This helped to the smooth working of the early warning process (for example when unsurveyed ground obstructions were discovered).

This illustrates that the success of ESRI is really the culmination of a five year process that can be traced back not only to the structures we put in place in 2010 but also to the spirit of the framework charter "...an enjoyable process with enhanced reputations for our organisations".

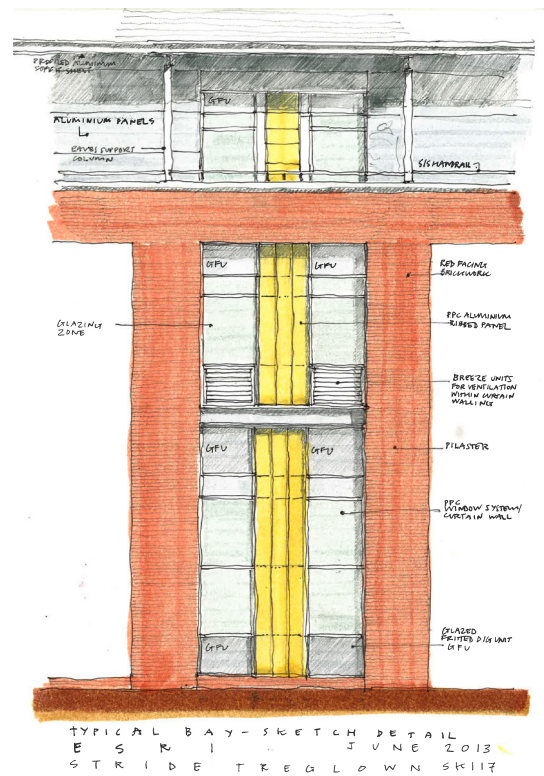
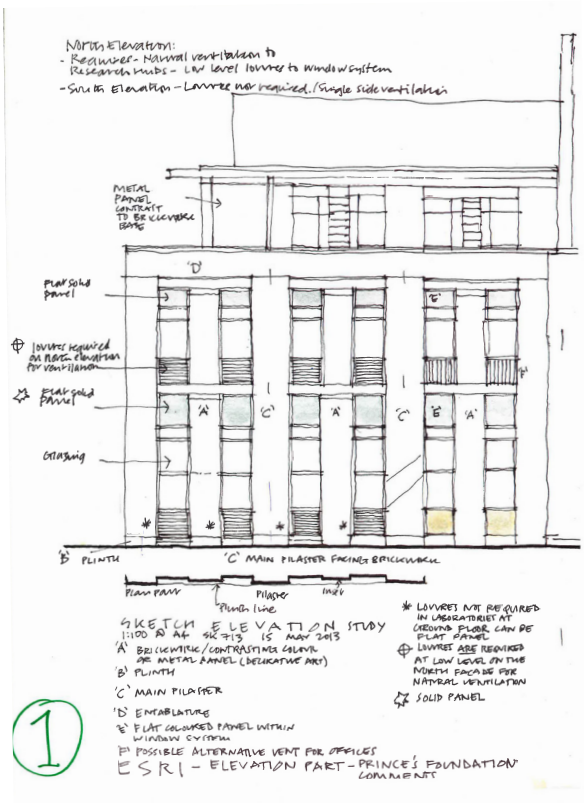
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College of Engineering

Collaboration with third parties

One of the key partners for the University in the development of the vision and character of the Bay Campus was the Prince's Foundation for Building Community. They were active during the masterplanning stages and were retained by Swansea University to help provide consistency and continuity during the design phases of RIBA. It was important to the smooth running of the project that the PFBC's views were understood and assimilated quickly, while maintaining within the cost envelope and the design direction we had agreed with the client.

We managed this process through a series of collaborative workshops with Ben Bolgar, the PFBC architectural representative, from May to July 2013, looking particularly at evolution of the façade design.

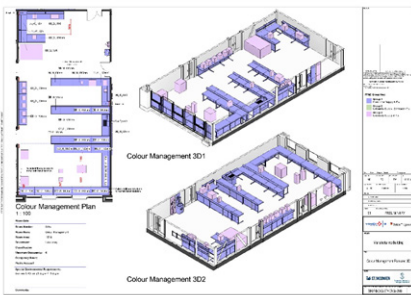


Designing to high sustainability standards

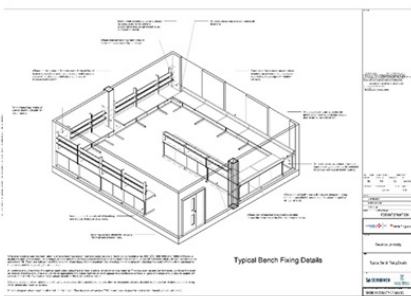
- ESRI achieved BREEAM Outstanding at design stage and at PCR stage.
- High environmental performance was fundamental to the design. In order to minimise the ESRI building's overall energy usage and CO2 emissions to achieve the BREEAM 'outstanding' rating, a three stage approach to the design of the building and its associated mechanical and electrical systems was adopted:
 - Passive design – reduce the need for energy
 - Maximise energy efficiency
 - Use of renewable/LZC technologies
- The passive design stage is crucial in helping to achieve a low energy ESRI building as it looks to reduce the need for energy to be generated in the first instance:
 - The building's orientation, layout and natural ventilation help to achieve passive low energy.
 - The design has looked to improve the building thermal envelope performance through passive design (reducing air permeability, U-values and g-values) primarily and has subsequently included additional options to reduce energy consumption and to use and recover energy efficiently.
 - All areas except the lecture theatre are naturally ventilated with a combination of opening windows or acoustic passive ventilation units to the main open plan research hubs in response to the traffic noise from the busy main road into Swansea.
 - A series of ventilation stacks within the centre of the plan allow for fresh air movement and daylighting to mid plan spaces.
 - This strategy aimed to halve the energy use of an equivalent mechanically ventilated solution and thereby significantly reduce the building's carbon emissions.
 - A displacement ventilation distribution system provides conditioned air for the lecture theatre.
- Following this passive design stage, options to reduce energy use and to recover and use energy efficiently were appraised and included. The ESRI building uses:
 - High efficiency lighting systems (including LED) and appropriate artificial lighting levels.
 - Lighting controls with perimeter areas switched separately from internal areas possibly with daylight linking.
 - Strategies to improve the utilisation of plant and systems.
 - Strategies to improve control and flexibility of the installations including provision of local user controls.
 - Energy efficient equipment including the use of premium efficiency motors with variable frequency drives where practical (e.g. fans, pumps, lifts etc.).
 - High efficiency, low NOx gas fired condensing boilers.
 - Specification of high efficiency chillers with Turbocor compressors.
 - Zoning of equipment to allow plant to be turned off or enable out of hours setback in appropriate unoccupied spaces

- High efficiency energy recovery for ventilation systems where practical
 - Provision of a building management system (BMS).
 - Low velocity pipework / ductwork and low pressure air filters to reduce fan and pump power consumption.
- To meet the BREEAM targets, a significant contribution from low and zero carbon (LZC) technologies is required. The following LZC technologies reduces the ESRI buildings carbon emissions in excess of the baseline requirements of BREEAM “Outstanding” and Part L of the Building regulations:
 - Solar Photovoltaics
 - Micro combined Heat & Power unit

Designing to high compliance and safety standards



For the £60m quartet of new buildings for the Engineering Department at Swansea University's Bay Campus development we have been working since 2011 with end user specialists to define the exact parameters of their requirements for Nanotech labs, SEM and TEM facilities, Rheology labs, Wave flumes, CREEP labs and more. It has required a high level of industry-specific compliance knowledge from our staff, and an overhaul of our methods for constructing integrated Room Data Sheets with our structural M&E engineering partners. Below is an example of the process we used at Swansea University in conjunction with our engineering partners Arup, that we would look to adopt at BCU.



We designed a number of key Bio and Nano science spaces for the new Bay Campus facilities. These spaces range from basic research labs through to level 2 bioscience facilities and include for clean room facilities for Nano research.

In order to best deliver these complicated laboratory spaces a comprehensive and detailed parametric building model was created to allow for detailed laboratory equipment and services to be fully coordinated. The information included in this model is equal to and in many cases exceeds that required for BIM level 2, allowing for a fully interrogable architectural model.

This resulted in a dynamic RDS sign-off process which allowed end users to fully envision the final layout of their work and research spaces. This has included for servicing requirement for individual labs, location of safety equipment, benching and secondary services layout, access and most importantly operator safety to be fully coordinated.

These individual room data sheets are supported by detailed benching layout and design options allowing for cross-building and campus coordination for ongoing maintenance and user indication and orientation.

These key benching drawings allowed for services distribution to all labs to be coordinated, allowing lab users transferring from one facility to another



to be familiar with the basic principles of all lab spaces. This includes the location of emergency shut off, safety equipment such as drench showers and the location of all alarms and their meaning.



To this end a number of additional safety features have been developed with the end user groups based on feedback from recently completed projects. These have included the development of specialist safety stations for both personal and building protection. These emergency stations have been designed to support lab users and most importantly to ensure that all building users are able to orientate themselves quickly in any lab in case of an emergency. The location and layout of these stations are uniform wherever possible throughout the building and also are designed to contain specific information relating to laboratory specific hazards. These stations are also linked to the emergency monitoring station which will alert emergency personnel to any detection alarm activation. As part of this process we worked closely with sub-contractors to procure a mock-up of this station for sign off. These building models have also been used to sign off colour and finish requirements to labs. This has included designating worktop colour based on lab activity (high and low contrast) as well as ensuring equipment above and below is coordinated with lab activity



For ESRI we were able to take all of the development information including staff work areas, offices and laboratory spaces and produce a full interactive walkthrough for the building which not only allowed end users to explore the proposed building at will but also allowed them to click on and interact with building elements such as specialist equipment and benching types. This model is supplied through a third party product which is available as a free download to all end user requirements who require access.



Cleaning and Maintenance Strategy

We developed our guidelines for cleaning and maintenance in conjunction with our in-house CDM advisers. This helps us ensure that all current COSHH and HSE legislation is complied with.

Secure by Design

Natural Surveillance

We designed the ESRI building to form a public court to the south facade to foster natural surveillance over this space. The main entrance to the building is formed from this courtyard as a central control point. The building provides protected access through coordinated door entry systems to restrict unauthorised access but also allowing efficient movement of users.

Public Lighting

The lighting design for ESRI is coordinated with CCTV installations and landscape design and protected where vulnerable to vandalism. The lighting scheme avoids abrupt contrasts between lit and unlit areas. The

lighting design aims to create no dark shadows and provide good colour rendering to support formal and informal surveillance of the area. Lighting for roads and footpaths complies with BS5489-1, 2003.



Site Security

The Campus features clearly defined circulation routes with a recognisable hierarchy of interconnecting spaces. This theme has been continued through in the design for ESRI. A primary street connects to the principal public realm court in front of ESRI with easy access for pedestrians and cyclists. The site road continues from the entrance from off Fabian Way around the ESRI site to provide good access to the Manufacturing Building service yard. Street lighting and landscaping create safe streets and pathways providing well lit routes for pedestrians and cyclists to the building. The site layout has sought to avoid hiding places, dark corners and dead ends with an open and wide public space for people to meet central to the design.

Building Safety

In line with the BREEAM Outstanding criteria the Security Strategy follows the principles of 'Secure by Design'. We developed a list of recommendations from advice received from the Crime Prevention Design Advisor (ALO) from South Wales Police for the ESRI building with the following general requirements:

- Controlled access
- CCTV
- Removal of features that aid climbing.
- Waste disposal areas remote from the building to prevent the risk of arson
- Windows and doors to PAS 24 2012, LPS1175 SR 2 or equivalent with laminated glazing to ground floor areas.

