



HWU

CVE DEGREE SHOW

REAL-WORLD PROJECTS SOLVING GLOBAL CHALLENGES

GUY WALKER

Director of Learning and Teaching,
School of Energy, Geoscience,
Infrastructure and Society (EGIS)

"Civil engineering is not just a hugely important part of the School of Energy, Geoscience, Infrastructure and Society, it is right at the centre of today's global grand challenges. Welcome, then, to the first Heriot-Watt University Civil Engineering Degree Show. It is time to showcase the next generation of civil engineers. These are the people to whom society is looking to solve some profound problems like sustainability, climate change, transport, housing, energy, and more. This is why all the projects on display are real ones. Students went out into the world to find clients and stakeholders, develop their own project brief, and deliver real impacts for communities. All of the projects are passion-led and represent the culmination of five years training in the essential skills of civil engineering. Not just core theories but also engineering leadership. They are now ready to be global changemakers."

4 April, 2024



**INNOVATION
LEADS THE
WAY WITH
TRANS-
FORMATIVE
SOLUTIONS**

SOUTHWEST EDINBURGH TRAM EXTENSION PROJECT

The Southwest Edinburgh Tram Extension Project aims to extend the Edinburgh Trams network by connecting Edinburgh Park to Western Currie via the Heriot-Watt University campus. Sustainability and cost-effectiveness are priorities to ensure efficiency and reduce congestion on existing infrastructure. Key objectives include integrating an active travel corridor with the tramline and existing network, while aligning with the area's public transport infrastructure, including existing bus routes and the Hermiston Gait Park & Ride.



**CONNECTING
THE FUTURE:
INTEGRATING
ACTIVE TRAVEL
FOR EFFICIENCY**



PUBLIC TRANSPORT INTEGRATION:

BUS AND TRAMS

TRAM ROUTE EXTENSIONS

The route has been designed to provide better public transportation links the regions to the Southwest of Edinburgh from the centre of town. This has been achieved by running a tram line between Edinburgh Park Station and Heriot-Watt University before traveling on to Currie. This involves tunnelling under the A720, in line with the existing railway tunnel, crossing onto Gogar Station Road, and following the road over the existing bridge to pass the M8 motorway. The route then continues until it reaches Riccarton Mains Road, crossing the two associated roundabouts and forming the first station at the expanded Hermiston Gait Park & Ride. The line then enters Heriot-Watt campus and passes through an open woodland area before stopping again at Heriot-Watt academic buildings. The route then exits the campus on the Western side before heading south beside Curriehill road, until it reaches Curriehill train station. There is a third stop situated here, before the route crosses the railway line and continues to follow the railway line until it reaches western Currie where the line terminates. There is also an intermediate stop between here and Curriehill to increase the catchment area of the tram.



TRAMOLOGY

L-R:

Farhan Jaffry
Gregor Malone
Ziad Naja
Charlie Kerr
Joe Smith
Marcus Herr
Callum Blincow



KINEMA BUILDING REFURBISHMENT PROJECT

The Kinema Refurbishment Project aims to enhance the social and recreational value of urban spaces by proposing two innovative concepts: a social hub and a buffet restaurant in Dunfermline. The social hub would serve as a gathering space for community members to interact and participate in various activities, fostering a sense of belonging and community engagement, focusing on food infrastructure.

On the other hand, the buffet restaurant would provide a unique dining experience that incorporates sustainable practices and locally sourced ingredients, promoting environmental consciousness and supporting local businesses. The proposal will assess the feasibility of these proposals and analyse their potential social, economic, and environmental impacts. Our display will showcase both design proposals and highlight the benefits they can bring to the community



**ELEVATE URBAN SPACES WITH
SOCIAL RECREATION ENHANCEMENTS**

“ I would love to have it restored, allowing it to once again operate as a functional restaurant. The main things I would be considering are incorporating sustainable materials, ensuring value for money, engaging with the community, and highlighting its rich historical significance. However, if you could think of something new that could help me generate income then I would consider it too.”

— Yanli Zhao, Client, Oct 2023

The client's requirement is communicated and prioritised throughout the design. Both of the design options have a focus on community and sustainability. For the renovation of the building for both options, the plan is to have solar panels installed which in the long term will reduce the overall electricity bills. The restaurant will largely function similarly as before but will have more of a focus on sustainable practices like locally sourced food and food waste recycling. The social hub plans to have a kitchen located on the ground floor that will provide the opportunity for culinary experiences to the local community as well as on the mezzanine floor, there is a small library to provide a space for learning about food and the local community history.



REVIVAL

L-R:

(Jia Xing Yau, Jia Min Ooi, Yu Jing Yeo, Mariah Magonda, Chung Kwan (Kirsty) Wong, Rachael Atkinson)

revival.
 invigorating
 solutions

since
 2023

SHE ENGINEERING

Designing Scotland's First Energy Island

INVESTIGATING THE SUSTAINABILITY OF SCOTLAND'S WIND ENERGY

SHE Engineering approached the challenge of investigating the true sustainability of Scotland's wind energy sector. After consulting with a variety of industry professionals, the project team found that onshore wind farms raise a variety of concerns that hinder Scotland's goal of reaching Net Zero by 2045.

SHE Engineering proposed to construct Scotland's very first energy island, acting as a hub for offshore renewable energy and storage. An energy island is an ambitious, large-scale project that provides an opportunity for Scotland to completely power itself - and to connect with other countries - with renewable energy, helping provide energy security and better reliability on the grid.

ENERGY ISLAND:

UNLOCKING SCOTLAND'S RENEWABLE POTENTIAL?

Our study centres around an options appraisal for two energy island proposals, one which utilises an existing, uninhabited island in Shetland to home the energy hub, and the other that takes advantage of existing offshore infrastructures in the North Sea.

The fight against climate change requires new sustainable energy solutions, as individual sources such as onshore wind, solar, wave etc. will not be sufficient. For both proposals, our overall vision is to help transition Scotland away from oil and gas, helping reduce carbon emissions from the sector as much as possible. Our energy island proposals provide Scotland with an opportunity to expand offshore renewable energy production for a future that is cleaner, greener, and truly more sustainable. Through the concept of the energy island, we strive to achieve sustainability objectives that align with the government's goals, as illustrated below.



Shetland Energy Island

2030 11GW capacity of Scottish Offshore Wind Production

2045 Scotland is Net-Zero Carbon

2050 The North Sea is Net-Zero Carbon



The North Sea Energy Island: 4 platforms to be retrofitted with energy infrastructure

For more information: www.she-engineering.com

SHE ENGINEERING



Elle Drummond, Brooke Stein, Abby Cruickshank, Yee Swen (Ricco) Ho, Imogen Houston, Annie Maclean

MUSSELBURGH FLOOD PROTECTION SCHEME



As graduating students who will soon be going into industry, sustainability has been a key learning focus over the past 5 years. We need to be the change in the industry which incorporates sustainable design into civil projects. The BJMA team have a deep interest in sustainability how we can plan and carry out infrastructure projects that not only guard against the potential effects of climate change, but also do their part to help combat it. Due to our close ties to the Edinburgh and Musselburgh areas, we have decided to carry out a case study and independent review of the Musselburgh Flood Protection Scheme (MFPS).



**INCORPORATE
SUSTAINABLE
DESIGN IN
INFRASTRUCTURE
PROJECTS**

SUSTAINABLE FLOODING SOLUTIONS THROUGH NATURE'S HARMONY

09

We aimed to present independent solutions to the flooding problem in Musselburgh, in a more sustainable manner, by utilising combined natural solutions and flood plain creation. Through this process, it allowed us to carry out an unbiased review of the methods, conclusions, and solutions that the action team were providing, and give our take as young engineers coming into the industry on what we think could have been done differently.



BJMA CONSULTANTS

L-R:

(Matt Richardson, Bradley Borland, Joey Patsalos, Mehdi Zaidi, Angus Bonthron, Matthew Dakin)

Connecting Alba was founded to support island communities in improving connectivity. Connecting Alba is formed of 5 Heriot-Watt University masters students, all with the same ambition of using engineering to aid development within communities. Our Professional Design Project as part of the Year 5 Civil Engineering course is focused on improving transport connectivity in Shetland by assessing the current transport infrastructure and developing a solution to benefit local people. The culmination of our project has been the development of a fixed link road tunnel between the two most Northerly Islands in Shetland; Yell and Unst.



CONNECTING ALBA

L-R:

(Sarah Duff, Tamara Brett, Harriet Smith,
Becky Parris, Ross Dunbar)



SHETLAND ISLANDS CONNECTIONS FIXED LINK DEVELOPMENT STUDY



(AI Generated Image with Viking Mural celebrating Shetland Heritage)

The project began with an extensive review of Scotland to discover isolated communities most in need of improvements to their transport infrastructure. After deciding on Shetland to become the focus of our project, we began working on a Case for Change which highlights the ways the current transport infrastructure is lacking in Shetland, how this affects its communities, and how improvements could help the local people. We began working with Transport Scotland to learn more about their appraisal guidance and planning objectives and began working using their STAG criteria to create a Preliminary Options Appraisal and a Detailed Options Appraisal. Based on this, we found a fixed link tunnel between Yell and Unst to be the most appropriate and applicable solution.

We finished our project by exploring this solution in more detail by considering aspects such as the local geology, funding implications, social and environmental impacts, and a concept design and construction methodology. Through this process, we have worked with a variety of stakeholders relevant to the project including local members of the council, tunnel action groups, Transport Scotland, and tunnelling experts. We have also worked closely with industry academics at Heriot-Watt University, Malcolm Chrisp, Guy Walker, and Paul Jowitt. We would like to thank all stakeholders involved in our project for their continued support, invaluable knowledge, and welcoming attitude.

OUTDOOR EDUCATION CENTRE FIFE REDEVELOPMENT

The project is aimed at redeveloping a site with buildings becoming no longer fit for purpose, which lack aesthetics and current requirements, by designing a new, sustainable, and eco-friendly building that will meet the needs of the present and future demands.

The current buildings are designed to offer facilities and equipment to support users engaged with the education centre, primarily emphasizing water sports and various other activities. Due to the vast amount of equipment required and increasing popularity, available space is one of the biggest issues with the structures.



INGENIUM SOLUTIONS

L-R:

(Victoria Kirk, Fraser Grieve, Andrew Jamieson, Gary Smith and Ross Scott)



INNOVATION: COMMUNITY- EXCITING SOLUTIONS AHEAD

The presentation shown at this degree show outlines the key phases and procedures that we have taken for our initial steps in the project. One being our Options Appraisal section presents a series of options with specific focuses, based on the research conducted in the desk study to then be presented to the stakeholders. The Combined Option Proposal takes the feedback from the follow-up community engagement, to form a solution based on the presented options that the general community can be excited about, within this section exists a design specification, exploring the options for funding and a business development plan. The final section is a Supplementary Piece on Inspiring Design through AI Image Generation, as throughout the proposal we have utilized AI to generate our concept images, a tool which is yet to be fully and commonly utilized throughout the construction industry.



Future learning environments through the classroom with an integrated environment which benefits from the natural environment using double-glazing for windows.



The potential for children and young people to connect with the outdoor environment through learning about nature and their natural habitats through sustainable learning.



**CONNECTING
COMMUNITIES
FOR A BRIGHTER
FUTURE**

RE-OPENING KNOCKMORE LINE

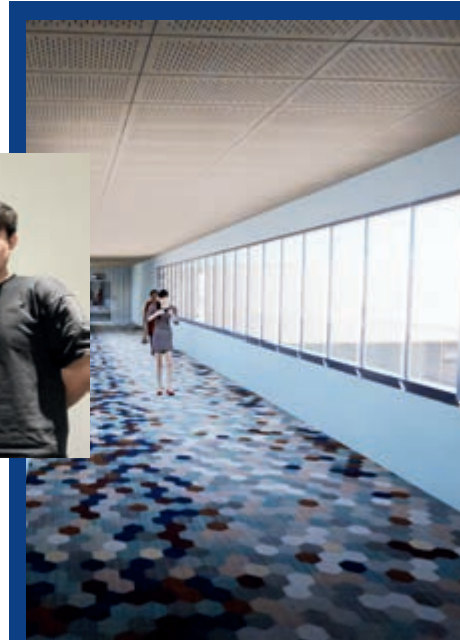
The island of Ireland once had an expansive railway network. Due to a variety of factors, including reduced demand and conflict in the area, many of these railways were closed in the mid-1900s, leaving rural communities isolated from larger economic hubs.

As the issues leading to closures have largely been resolved and the population continues to grow, there is now a strong desire to improve and expand the rail network throughout the country.



RAIL REVIVE NORTH

L-R:
(Andre Luison, Adam Roche, Francis Obonyo, Jia Hou (Marcus) Yap,
Hao Zhe Tan, Jun Ping Puen)





THE FIRST STEP TOWARDS IRELAND'S RAILWAY REVIVAL

To help achieve this goal, a comprehensive study has been undertaken by various companies, outlining the necessary steps to transform railways across Ireland. One of the key recommendations of this study is to re-open the Knockmore line and connect it to Belfast International Airport. Our group recognised that little progress had been made in designing this re-opening. So, we took it upon ourselves to outline the necessary steps in reviving this line and, in turn, jumpstart railway development across the nation.

The work produced includes our initial study on the line and its potential benefits, an outline of our engagement with many stakeholders invested in this project and our detailed conceptual designs for the implementation of this development.

We have worked closely with numerous stakeholders of this project, such as ARUP and FundTheNINE, Belfast International Airport, and The Department for Infrastructure NI, and would like to extend our dearest gratitude for the input that they have offered us throughout this year to allow us to develop a plan that caters to many stakeholder needs.



Crumlin Station

2024

HAWU

CVE DEGREE SHOW

Thank you for joining us at our degree show.
We truly hope you have a memorable experience.

Best regards,
HWU MEng Civil Engineering, Batch 2024
