Your name and title	UCD email address	Web page	Title of PhD project	Short Abstract
Prof Michael Bruen	michael.bruen@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/michaelbruen/staff,98193,en.html	**Flood forecasting and the use of hydrological and hydraulic models and remotely sensed data, particularly radar.**	
Prof Michael Bruen	michael.bruen@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/michaelbruen/staff,98193,en.html	**River water quality modelling and catchment management decision support systems, especially related to Nitrogen, Phsphorus, sediment.**	
Prof Michael Bruen	michael.bruen@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/michaelbruen/staff,98193,en.html	**Impacts of water quality on thenatural environment and the valuation of ecosystem services.**	
Prof Michael Bruen	michael.bruen@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/michaelbruen/staff,98193,en.html	**Water related natural disasters, risk evaluation and mitigation**	
Prof Michael Bruen	michael.bruen@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/michaelbruen/staff,98193,en.html	**Multi-criteria decision methods in Engineering applications.**	
Dr Yaqian Zhao	yaqian.zhao@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/yaqianzhao/staff,98300,en.html	**Development of constructed wetland microbial fuel cell (CW-MFC) for simultaneous electricity production and wastewater treatment**	Microbial fuel cell (MFC) is a relatively very new technology which is gaining lot of attention among researchers because of its bioelectricity generation potential during wastewater treatment. MFC consists two chambers i.e. anaerobic and aerobic where oxidation and reduction take place. Constructed wetland (CW) is a low-cost and promising technology for wastewater treatment. This project is a challenge with the aim to develop the CW-MFC for electricity production and wastewater treatment.
Dr Yaqian Zhao	yaqian.zhao@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/yaqianzhao/staff,98300,en.html	**Design strategies and pathways of integrated constructed wetland (ICW) system for wastewater treatment and pleasing landscape**	Constructed wetlands (CWs) have been recognised as green technology and have been increasingly applied for various wastewater treatments worldwide in recent years. More importantly, in recent years, a new concept of integrated constructed wetland (ICW) has been applied for designing CW system with consideration of local surrounding environment to make pleased landscape. This project aims to study the designstrategy and pathways of the ICW system for a typical domestic wastewater treatment. AutoCAD and some digital drawing skilled should beadopted for the study.
Dr. Patrick J. Purcell	pj.purcell@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/pjpurcell/staff,98292,en.html	**Modelling performance of integrated constructed wetlands**	Integrated constructed wetlands are increasingly being used to treat waterwater from small to medium sized communities. The project would examine field data and investigate the modelling of the hydraulics and processes occurring in these systems
Dr. Patrick J. Purcell	pj.purcell@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/pjpurcell/staff,98292,en.html	**Low energy wastewater treatment**	Conventional wastwater treatment plants are significant consumers of energy. There is considerable scope both to reduce energy input to plants and to recover energy for subsequent reuse. This project would gather full-sclae plant data and examine the potential for modelling processes to optimize energy usage.
Dr. John O'Sullivan	jj.osullivan@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/johnosullivan/staff,98291,en.html	**Microbial source tracking at catchment scale using deterministic rainfall-runoff models**	The quality of coastal waters is heavily dependent on catchment rainfall-runoff processes in which faecal indicator bacteria (FIB) is transported from land, through river and stream networks and delivered to coastal zones. FIB in this regard typically includes waste from ruminants and sheep. However, in urbanised or urbanising catchments, FIB from human sources (resulting from sewer misconnections or septic tanks) can also be present in rivers and streams. With recent advances in DNA tracking of microbial pollution, it is now possible to quantify the individual contributions of catchment FIB from ruminant, horse and human sources. The ability to model the transport and fate of these FIB sources at catchment scale would present catchment managers with a diagnostic tool for identifying 'hotspots' where different FIB originate within a catchment. Such knowledge would allow catchment managers take mitigating actions to reduce FIB entry into the river and stream systems and thereby improve the water quality of coastal zones for the betterment of bathing and aquaculture. This project will develop a catchment model to accurately predict the transport and fate of FIB from these various sources. The project will be based on an instrumented test-bed on the east-coast of Ireland and the existing dataset will be augmented by microbial analysis of water samples collected from within the catchment-coastal system.
Prof Eugene OBrien	eugene.obrien@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/eugeneobrien/staff,98286,en.html	**Bridge Damage Detection Using Fractal Dimension of EigenModes**	Bridge inspection is currently done visually – trained inspectors look for signs of distress such as cracking. There is a lot of research going on to develop more reliable and automated approaches using the dynamic properties of the bridge as an indication that damage has taken place. In a dynamic analysis, the signal can be broken down to determine the natural frequencies and the mode shapes or eigenmodes. Recent advances with cameras means that it's now feasible to monitor eigenmodes much more accurately than before. This project will test a new concept – the 'fractal dimension' to measure changes in the eigenmodes and use them as indicators of bridge damage.
Prof Eugene OBrien	eugene.obrien@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/eugeneobrien/staff,98286,en.html	**Shape Optimisation of 3-D Printed Struts**	Structural Optimisation has been around for many years but the choices of geometry were constrained by manufacturing techniques – it has been impractical to manufacture highly complex member geometries. With the advent of 3-D printing, this situation is changing rapidly. It is now possible to conceive highly complex structural shapes that are far more resistant to buckling than regular practical shapes. In this project, it is proposed to design columns that are much lighter than anything conceived today. The project will involve geometrically non-linear analysis of truss structures, combined with shape optimisation.
Prof Eugene OBrien	eugene.obrien@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/eugeneobrien/staff,98286,en.html	**Bridge Weigh-in-Motion and Damage Detection**	Bridge Weigh-in-Motion (BWIM) is the idea of using an existing bridge as a weighing scales to find the weights of trucks passing overhead. BWIM has been around for quite a few years now and is used commercially (including in Brazil) to find truck weights and to help police to catch overloaded trucks. In this project, the BWIM concept will be used to identify what trucks are crossing the bridge at a given time. The truck weights will be then used to determine the bridge's 'health', i.e., if it is damaged. This will be done by placing sensors and examining acceleration signals on the bridge and finding out if they are consistent with the truck weights. Any inconsistency between truck weights and measurements will indicate that the bridge is damaged.

Prof Eugene OBrien	eugene.obrien@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/eugeneobrien/staff,98286,en.html	**Traffic Loading on Long Span Bridges**	Much is known about the statistics of traffic loading on short-span bridges. A bridge is generally designed for the worst combination of trucks that can be reasonably expected to cross it in its lifetime. 'Reasonably expected' is defined by a return period – for example, the American AASHTO code assumes a 75 year return period, i.e., the bridge is designed for the worst combination of trucks that will occur just once in 75 years. Much less is known about long span than short span bridges. Whereas a short bridge may have one or two large trucks on it, a long span bridge may have dozens or more trucks. At present, designers assume long convoys of trucks jammed on the bridge with no cars between. This is not reasonable as (a) there are always cars and (b) traffic is rarely completely stopped – the more likely situation is that there is 'stop-and-go' behaviour, similar to the waves of congestion that happen in a city in rush hour. In this project, a technique known as Markov Chain theory will be used to simulate these stop-and-go waves of heavy trucks on long span bridges. This will be used to generate a load model that can be used for the design of long-span bridges.
Prof Eugene OBrien	eugene.obrien@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/eugeneobrien/staff,98286,en.html	**Overturning moments in cable-stayed bridge towers**	In recent years suspension bridges have fallen out of favour because of the difficulty of ever replacing the main cable. For longer bridges, multi-span cable-stayed bridges are now becoming popular. However, for these bridges, the risk of uneven loading between spans is resulting in large overturning moments in the towers. Designs are highly conservative because little is known about the phenomenon of uneven traffic loading, i.e., what is the probability of a large concentration of traffic on one span at the same time as light loading in the next span? In this project, we will develop a traffic load model for the design of multi-span cable-stayed bridges. The project will involve micro-simulation modelling of traffic on bridges, i.e., simulating the random behaviour of individual drivers.
Prof Eugene OBrien	eugene.obrien@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/eugeneobrien/staff,98286,en.html	**Using Drones to Monitor the Health of Bridges**	Unmanned aerial vehicles (UAV's) or drones are being increasingly used to do visually inspect those parts of bridges that are not easily accessible. In this project a new use for drones is proposed. In the monitoring of smaller bridges, the biggest challenge is power – it is generally considered too expensive to install mains electricity on site and all the data acquisition electronics to download and store data from the sensors. In this project, a power-free bridge monitoring approach will be developed. Energy harvesting smart sensors using the bridge's own vibrations as a power source, will collect and store data on the bridge behaviour. Auto-piloted drones will periodically visit the bridge to download the data from the smart sensors and to perform a visual inspection if there is any cause for concern.
Dr. Amanda Gibney	amanda.gibney@ucd.ie	http://www.ucd.ie/research/people/civilstructuralenvironeng/dramandagibney/	**Low Energy Pavement Material Investigation**	Low energy mixes for road construction offer an attractive sustainable porposition. Climatic conditions have a major influencing effect on the development of the properties of these materials over time. This project will review the design and testing methodologies used in specifications internationally along with identifying linkages to in-situ performance. Laboratory and field testing will be undertaken with a view to furthering knowledge on performance prediction.
Dr Arturo Gonzalez	arturo.gonzalez@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/arturogonzalez/staff,98218,en.html	**Characterization of Loads Applied to a Structure via Inverse Dynamics**	When assessing an existing structure, load statistics can be more accurately specified from measurements on site. In some cases, the direct measurement of loads can prove to be difficult and these need to be obtained indirectly from the structural response. The latter requires the fitting of a mathematical model to the measurements using an inverse dynamics algorithm, i.e., based on dynamic programming with Tikhonov regularisation (applications include calculation of traffic loads from bridge measurements). The presence of noise, the lack of agreement between reality and theoretical models and the limited number of available measurements are sources of inaccuracy that this project aims to minimize through the development of a more robust algorithm.
Dr Arturo Gonzalez	arturo.gonzalez@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/arturogonzalez/staff,98218,en.html	**Bridge Monitoring Using Model-Free Methods**	There are a number of model-free approaches for damage detection of bridges using long term monitoring data: Moving principal component analysis, robust regression analysis, neural networks, ARMA models, etc. In this project, the deterioration of a bridge structure will be simulated under different loading and temperature conditions. The results will be used to compare and propose improvements on the available approaches in terms of both damage detectability and time to detection.
Dr Arturo Gonzalez	arturo.gonzalez@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/arturogonzalez/staff,98218,en.html	**Impact of Climatic Changes on Transport Infrastructure**	In the last decades, climatic changes have brought the occurrence of unexpected extreme floods, earthquakes, temperatures and other environmental effects that has hit transport infrastructure throughout the world. In some occasions, the impact of these extreme climatic events has led to severe deterioration of bridges and even their failure. The statistical trend of the environmental loads within the last few decades is clearly different than in the last century. There is a critical need to adapt to the climatic change that this project will address by assessing the consequences of more variable and uncertain environmental loads on the transport infrastructure stock.
Dr Arturo Gonzalez	arturo.gonzalez@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/arturogonzalez/staff,98218,en.html	**Monitoring Dynamic Characteristics of the Structural Response Using the Hilbert-Huang Transform**	A specific bridge is excited differently depending on the type of vehicle traversing it. The total response varies with respect to that obtained if the vehicle was positioned statically on the bridge as a result of the vibration of the bridge that results from the inertial forces of the bridge and the interaction with the vehicle. When recording measurements due to traffic load for structural health monitoring, the true characteristics of the underlying bridge can be masked by the applied load or environmental effects. This project aims to provide a clearer picture of the bridge using advanced signal processing tools such as the Hilbert-Huang Transform that will allow capture instantaneous frequencies, separate periods in free- and forced-vibration and detect structural changes at an early stage
Dr Paul Fanning	paul.fanning@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/paulfanning/staff,98211,en.html	**Strength & Ductility of Mechanical Timber Joints**	Mechanical joints are the most common in timber construction. These joints must be ductile enough and strong enough. Internationally codes of practice use relatively simple two dimensional models to ensure adequate joint strength and ductility in design. By definition these two dimensional models do not adequately capture the three dimensional stresses in these joints. The objectives of this research are to i) develop and validate robust three dimensional modelling approaches for timber joints and ii) update current simplified models for strength and ductility predictions. The research will also consider the implications for the design of timber joints under both static and cyclic loading and evaluate a range of existing and novel joint arrangements.
Dr Paul Fanning	paul.fanning@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/paulfanning/staff,98211,en.html	**Using Ambient Vibration Response Data to Predict Remaining Life of Post-Tensioned Bridges**	Post-tensioned concrete bridges are a commonly used bridge form. There is evidence in the literature to demonstrate that natural frequencies of post-tensioned bridges reduce over time. Studies have attributed this reduction to a reduction in stiffness of the superstructure – while it is believed that this reduction is due to deterioration (creep and /or corrosion) of the post-tensioning system this has yet to be proven using mathematical models which include deterioration models associated with the post-tensioning system. The objective of this PhD proposal is to develop a deterioration model for post-tensioning systems that can be included in numerical models of bridges to capture the reduction in frequency that is evident in these bridges over time. The deterioration model developed will be validated using frequencies extracted from ambient vibration response data measured at currently instrumented bridges.

Dr Mike Long	mike.long@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/mikelong/staff,98254,en.html	**Free fall cone penetrometers (FFCPT)**	There has been considerable recent effort in the investigation of the ground conditions on the sea floor for energy related projects. A major issue is the cost of such investigations and therefore much focus has been placed on doing the work as quickly as possible. One such recently developed rapid technique is The Free Fall Cone Penetrometer (FFCPT) which was developed to collect geotechnical data during route location surveys for seabed cable and pipeline installations. FFCPT is designed to free fall through the water column, then impact the seabed. On board acceleration and pressure sensors monitor the sediment penetration response. Some such data is available for several sites near Trondheim, Norway and the project will involve the analysis of the data comparisons between this data and existing information and an assessment of the usefulness of the FFCPT for future works and on the application of the data to offshore problems such as slope instability.
Dr. Ken Gavin	kenneth.gavin@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/kengavin/staff,98213,en.html	**Foundation Design Framework for Offshore Wind Energy Devices**	Design methods for offshore monopile foundations were developed by the oil and gas industry. Foundations for offshore wind turbines are of larger scale and are influenced much more by environmental dynamic loading. UCD are engaged in experiemental investigations of the behaviour of offshore piles at their geotechnical test bed-site and as part of the International PISA project (with Oxford University and Imperial College). This project will investigate the development of new CPT based design methods for offshore piles.
Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Auto-generating Urban-scale Models for Pollution Tracking by Application of Advanced Statistical Methods to Aerial Laser Scanning**	Predictions of pollution concentration for asthma risk and other airborne health hazards require highly detailed, large-scale models of the environment. The challenges involved in creating such models relate to the difficulties and costs surrounding the creation of neighbourhood- or city-scale models, as much as in the development of equations for computational fluid dynamics. Generating such models by hand is generally cost-prohibitive and inaccurate. However, recent breakthroughs in converting some remote sensing data (i.e. laser scanning) into computational models has opened the door for fully automatic creation of accurate city-scale models. Notwithstanding this major advance, critical research is still needed for small-scale feature detection (e.g. identifying cornices versus whole buildings). Identifying these features is crucial, as airflow is highly influenced by a building's profile and surface characteristics. The proposed project seeks to identify these features by employing the most advanced Bayesian statistical methods for small-feature detection within high-density laser scanning datasets. The project will be co-supervised between Civil Engineering and Statistics. Students may come from either discipline. The project involves highly interdisciplinary research on architectural feature detection from remote sensing data. A dense urban data set is to be mined combining advanced Bayesian statistical methods, computational statistics, spatial analysis, and machine learning. The goal is to fully automate feature detection within these irregularly populated data sets without relying upon any a priori knowledge. Candidates should have rudimentary programming skills or a willingness to obtain them and an ability to work in a cross-disciplinary team.
Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Complete 3D: a platform for a three-dimensional point cloud data management**	A large proportion of today's digital data has a spatial component. The effective storage and management of which poses particular challenges, especially with Light Detection and Ranging (LiDAR), where datasets of even small geographic areas may contain several hundred million points. Despite growing data availability, current spatial information systems do not provide suitable support for the data's 3D nature. Consequently, one system is needed to store the data and another for its processing, thereby necessitating format transformations. The project undertaken herein aims at a more efficient, seamless and cost-effective way for managing LiDAR data that allows for storage and manipulation within a single system by exploiting octree indexing for spatial database management technology. This project will be based in the Computer Science programme, but will be co-supervised in Civil Engineering, which will enable the candidate full access to new resources from an EU funded ERC grant.
Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Art Object Protection from Earthquakes and Manmade Vibrations**	This collaboration with the J. Paul Getty Museum aims to provide systematic, quantitative guidance on the protection of movable art objects from subsurface vibrations (both seismic and transport-induced). This will be done through a combination of experimental and numerical investigations. The project will have three branches: (1) develop fundamental relationships to describe the sliding, rocking, and overturning of pottery based on the object's shape, weight, centre-of-gravity, and interface frictional characteristics when subjected to both the sinusoidal loading from transport vibrations and the non-sinusoidal loading from seismic events; (2) implement a computational model based on (1) and verify the model experimentally; and (3) investigate mitigation strategies based on the physico-chemical properties of microcrystalline waxes with respect to their ductile response under dynamic loads. This project seeks a student with a master's degree in structural engineering with an emphasis in dynamics, an interest in art, and a strong grounding in chemistry. The student will be expected to undertake a highly interdisciplinary project between civil engineering and materials science, while being highly cognizant of the special needs and concerns of the art conservation community.
Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Creating a New Generation of Digital Inventories for Cultural Heritage**	Cultural heritage represents over 1/3rd of Europe's tourism and an area where Europe has dominated intellectual debate and training. Unfortunately, 21st century realities related to infrastructure renewal, mega-city needs, and climate change pose new threats to heritage landscapes and structures – threats that cannot be easily legislated into abeyance. Instead, new tools must be brought to bear. Critical to this is fully adapting existing technological opportunities to advance how heritage landscapes and structures are documented and monitored in the larger planning and permitting processes. This project unites world-class conservation with new spatial data infrastructure opportunities to help Ireland meet its EU obligations for inventorying its cultural heritage. Specifically advances in three-dimensional database hosting will be combined with existing geographic information systems to pioneer a new generation of digital resources for heritage documentation and protection. The project partners architecture, civil engineering, planning, and computer science with Ireland's National Inventory of Architectural Heritage. This project seeks a student with documented training or involvement in both architectural conservation and computer science. The project involves development of a prototype spatial data infrastructure (SDI) to archive, manage, and highlight heritage landscapes and structures by exploiting recent advances in three-dimensional databases and the requisite interfacing with traditional geographic information systems. The project will be done in cooperation with the National Inventory of Architectural Heritage and use the upcoming re-inventorying of Dublin under the Granada Convention requirements to create a prototype system that can be scaled to include all of Ireland as a resource for planning and tourism. Challenges relate to (1) streamlining and converting existing datasets to enable compatibility with new datasets such as laser scanning point clouds; (2) creating new indexing structures and algorithms that can be effectively used at multiple scales (e.g. building, block, neighbourhood, region), and (3) exploiting new 3D capabilities for effective visualisation.

Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Development and Verification of an Expansive Cement Cracking Model**	Increasing concerns regarding litigation and terrorism provide a strong dual motivation to decrease the use of high explosives in the construction industry. This project proposes the explansion of a 2D finite element model to a 3D model replicate and optimise the behaviour of expansive cements (also known as soundless chemical demolition agents) in concrete and rock. The ultimate goals of project include a commercially viable subroutine applicable to a wide variety of site conditions and a set of industry usage guidelines for consulting engineers for use near environmentally and historically sensitive sites. This constitutive model will include both the behaviour of expansive cements and crack behaviour of concrete/rock material based on standard experimental test data. The initial model will be verified by comparing the experimental results of 33 unreinforced concrete blocks (approximately a cubic meter each) of varying concrete strengths and stiffnesses that were tested in various temperature environments with differing expansive agents, confinement levels, and post-cracking treatments. The initial model will employ the highly detailed crack development records, including crack initiation, crack propagation, and crack patterns, as an initial means of benchmarking. Once the initial benchmarking is complete, the model will be used to predict behaviour of larger and disparate geometries. These will then be tested in the laboratory as further benchmarking. Once the expansive cement cracking model is validated, simulations to optimise the use of SCDA will be performed to improve the efficiency of these products with respect to temperature, confinement levels, and post-cracking treatments.
Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Total Energy Input as an Alternative to Peak Particle Velocity for Blasting and Vibration Limitations**	No consensus exists as to what constitutes an acceptable vibration level for blasting, construction activity, and heavy traffic. Various countries states impose different levels of restriction based on maximum peak particle velocities (PPVs). The absence of agreement is easy to understand, because the single parameter criterion fails to consider the total energy exerted. Instead of relying upon peak acceleration to characterize the magnitude of a dynamic event, a total energy input (TEI) approach considers the entire performance record during seismic loading. This came about because, while peak acceleration is indicative of the severest moment within an earthquake record, it is not reflective of the duration of the loading or how much significant acceleration may have occurred close to this peak level, and thus does not reflect the total power of the event. As such, for nearly a decade, the concept of TEI has been gaining credence in the earthquake community, as a more rigorous means to compare seismic events. However, it has yet to be applied to other dynamic events, such as blasting, tunneling, and pile driving, where peak particle velocity is employed because of ease of measurement, despite well-documented limits of its effectiveness. The proposed research applies an integrated work program of laboratory testing, field monitoring, and finite element modeling to evaluate the effectiveness of a TEI approach for a variety of typical, urban vibration problems that include heavy traffic, tunneling, pile driving and blasting. The result will be an objective set of criteria for vehicular and construction related vibrations through the application of recent advances in the earthquake community.
Dr Debra Laefer	debra.laefer@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/debralaefer/staff,98258,en.html	**Development of a New Analytical Model to Characterize Building Load Transfer during Adjacent-Excavation and Tunnel-induced Subsidence**	Deep Beam Theory considers a building only at a single moment in time, and that is at the peak loading just prior to the onset of cracking. The masonry material is treated as brittle, with no capacity for load redistribution. Smeared crack models (the typical FEM approach) offer a slightly more sophisticated scenario that employs a load transfer factor for cracks that have opened (0 to 1) and for those that have reclosed (also 0 to 1), but there is little experimental data to justify either the select of these numbers or the usage of a single value in all cases through the wall. This project will evaluate extensively unpublished laboratory work employing 1/8th scale masonry walls as a basis for developing new analytical models. The ideal student would have a strong analytical background in engineering mechanics.
Dr Ciaran McNally	ciaran.mcnally@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/ciaranmcnally/staff,98257,en.html	**Biomimicry in structural engineering**	There are numerous examples in nature of biological components that are incredibly advanced from a structural engineering perspective. From spider silk to toucan beaks to bird bones, we see elements with engineering properties that are far beyond what should be technically possible to achieve using the materials available. This project will seek to follow natures example to design complex structures and forms using a programming technique known as Grammatical Evolution. This will involve building on existing research that is currently taking place in the School.
Dr Ciaran McNally	ciaran.mcnally@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/ciaranmcnally/staff,98257,en.html	**Concrete design for 3D printing**	Advances are continuously being made within the field of 3D printing, but there are still significant challenges that must be overcome before we can print viable structures in concrete. A key aspect of this is optimisation of concrete properties that allow extrusion by a 3D printer while continuing to provide structural performance and other functionality. This project will investigate this developing technology through a combination of concrete performance testing and print optimisation trials and will build on UCDs current expertise in these fields.
Dr Aoife Ahern	aoife.ahern@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/aoifeahern/staff,98182,en.html	**Engineering Education : Future Challenges**	This PhD will focus on engineering education and critical thinking in engineering education. Much has been made of critical thinking as a required graduate attribute of many programmes, including engineering, with little awareness (in particular within disciplines) of what critical thinking is. This PhD will focus on developing a definition of CT in civil engineering, through consultations with academics, students and employers. It will then develop a definition for engineering of CT, with guidelines on how it should be incorporated into engineering disciplines and how it can be assessed and measured.
Dr Aoife Ahern	aoife.ahern@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/aoifeahern/staff,98182,en.html	**University Travel choices- the implications for policy and infrastructure**	Many universities seek to encourage smarter travel and more environmentally friendly travel in students. This PhD will build upon work already conducted by Dr. Ahern in UCD and Dr. Lisa Davison and Professor Hine in University of Ulster (UU) on university travel choices in the UK and Ireland and will look at policies that might be introduced to bring about more sustainable university travel. It is envisaged that someone embarking on this PhD will work with both UCD and UU, and spend time in both universities.
Dr Aoife Ahern	aoife.ahern@ucd.ie	http://www.ucd.ie/eacollege/csee/staffmembers/aoifeahern/staff,98182,en.html	**Valuing mobility for vulnerable groups: a case study of older men in rural Ireland**	Travel for older men in rural areas: This research will focus on the challenges that are faced by older men in rural areas when they make the transition from being able to drive to life without a car. Men are less likely to use existing community transport schemes and are more likely to have been car-dependent throughout their lives, so often find the transition from car dependency to a car-less life more difficult. This research will look at the travel patterns of older men living alone in rural areas, and will examine what policies or infrastructure developmentscan be put in place to ensure better and more sustainable travel options for this group.