



Faculty: Engineering
Department: Civil and Environmental Engineering (CEE)
Module name: Soils and Engineering Geology
Degree: Across all CEE programmes
Level: Undergraduate Level 5 (year 2)
Format: 2 taught modules, and a 5-day field course
Approximate number of students: 90
Delivery mode: In-person (current and pre-covid).
Fieldtrip cancelled during COVID
Duration: Module runs over all 3 terms. Fieldtrip takes place during the Summer Term over 5 days. Module has been running in its current form since before 2016
Weighting and credit: 80% exam, 20% coursework (80% of coursework is assessed fieldwork, 20% of exam pertains to knowledge taught during fieldwork. There is a total contribution of 32%).
Module ECTS: 5
Module type: Core

Insights colour key

Educational Developer

Inclusivity

Learning Designer

Registry

Careers

Geology Fieldtrip

Assessment overview

This case study focuses on field trip delivered as part of Year 2 Soils and Engineering Geology module. The 5-day residential fieldtrip to Somerset, is held at the beginning of the summer term and is designed to test practical geological skills, such as field sketching, geological observation, structural measurements and practical soil analysis. As part of the assessment the students perform an assessed mapping exercise, submit their field books and deliver a group presentation based on a poster. The learning outcomes of the fieldtrip include the ability for students to make systematic observations and interpretations of their surroundings by making notes, taking measurements and by drawing sketches and working and data gathering safely in non-customary environments. Students should be able to identify geological features and recognise their relation to civil engineering problems.

Design decisions

Assessment rationale

The overall fieldtrip is aimed to introduce students to geological concepts that they may encounter in their future careers, and provide students with insight into the work that geotechnical engineers do. More broadly, it also helps students to appreciate the importance and quantity of work that goes into fields adjacent to their specialised area. In the example of this module, Geotechnics is a crucial part of any Civil Engineering project. A neglect of geotechnical expertise can, and have caused engineering disasters.

The trip helps the students appreciate the challenges they may face in the future in collecting and collating data in an outdoors environment, which is an environment Civil Engineers may encounter. By the end of the fieldtrip, students should also have an understanding of risks involved with being in the field from both a personal and engineering perspective.

The fieldtrip also trains students in soft skills, including time management, teamwork and presentation skills. In particular, this fieldtrip offers them a chance to independently manage their time to prepare a day in the field. These skills are important in any industrial discipline.

Design of the field trip

The field trip lasts 5 days and takes place in Somerset. Previously the fieldtrip ran over approximately 2 weeks each year, with only a half or third of the year group going to Minehead every week. One year, a booking issue at Butlins meant that the entire cohort had to take the fieldtrip together, unlike previous years. This format proved to be less intensive and less expensive, and so was retained.

One of the main considerations around fieldtrips is ensuring that suitable alternatives or reasonable adjustments are available for students who might not be able to attend due to health or even cultural reasons. Some approaches could include using data collected in previous years so students are still using real life data sample from the field even though they can't physically go there and collect it themselves.



If there are students with physical disabilities on the module, they would fall under the higher category of reasonable adjustments, i.e. individual adjustments because physical needs of for example wheel chair users or students with visual impairments would be very individualistic and dependent upon the risk assessment done.

Each day on the field trip serves a different purpose. Days 1 to 3 are focused on geological observation. The students begin on day 1 with a journey from London to Minehead in Somerset. It is here where they have initial practice at basic field skills: sketching at Cheddar Gorge, taking dip and dip direction measurements, and using the Schmidt hammer. Day 1 is aimed to familiarise students with the basic skills required for geological fieldwork. Day 1 is held at a geologically distinctive area with good locations to sketch and analyse. Cheddar Gorge also lies on the way to Minehead, and so time is used efficiently.

The second day begins with a practical demonstration of a hand auger, with students invited to handle the equipment for themselves. Students get more experience with sketching on the second day, and learn about the practical side of soil mechanics.

On the third day, the students travel to Meldon, where multiple man-made and geological features can be studied, including a trestle bridge, a quarry and a reservoir. Students have further practice taking geological measurements and drawing field sketches.

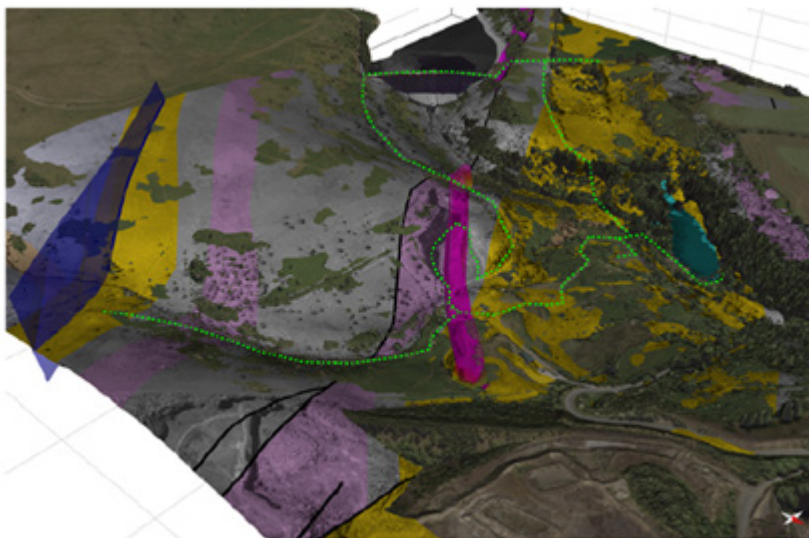


Figure 1: Geological model of the Meldon area, showing the cooling joints (blue) that were exploited by tin and copper miners, oriented parallel to the aplite intrusion (purple). The route followed by the students is shown in green (starting close to the dam near the top centre of the image). Other geological units shown are: the Meldon Shale (pink) and Quartzite (grey) Formation; Teign Chert (yellow) and Limestone (cyan) Formation.

(Image taken from Ghail and Standing, 2020)

Geology Fieldtrip

On the fourth day, students are taken around the Minehead coast to create a geological bedrock map of an area named Culver Cliff. Students work independently of the staff, in pairs to fill out the rock types and geological structures in the area. This activity is not assessed.

On the fifth day, students stop off at Portishead on the way back to London, where they complete an assessed mapping exercise with the same format as the one on the previous day.

All the main outcrops throughout the fieldtrip are reasonably accessible to students. No student has ever turned back from any of the outcrops apart from because of health issues, however, one of the aims of the trip is also to challenge students and to take them outside their physical comfort zone, as it develops confidence in the students and gives them a sense of achievement.

At the end of each day, the lecturers give a short, 15-minute presentation summarising the geology the students have seen. This is done through a resource developed using Move software which provides a 3D visualisation of the landscape, with structures and stratigraphy inputted, and measurements superimposed. The visualisation was implemented in order to help the students better visualise the geology, and provides a bigger perspective to what the students have seen at outcrop level.



Doing tasks under time restrictions is aligned with skills needed in the workplace. If you are out in the field as a geotechnical engineer, you'll have to report back at specific times, especially if you're working internationally and you'll have to do it under quite considerable time constraints.

Note taking, especially on the spot note taking, can be challenging for students with dyslexia and dyspraxia. There should be an option for audio transcription of notes with facilities and times put aside for redrafting and transcribing afterwards. Another alternative would be to have digital solutions, such as iPads in the field with the software attached to the iPads where notes can be taken and automatically transcribed. This will help students foster independence rather than rely too much on the notes of others.

Asking students to present a summary of learning at the end of the day as a form of assessment is an excellent way of combining assessment with peer learning opportunities.

Geology Fieldtrip

The daily itinerary of the fieldtrip is somewhat flexible due to unpredictable weather conditions. The itinerary and safety for the following day are discussed so the students are kept informed and to improve safety.

Design of the assessments

Assessment revolves around 3 components:

- Field notebooks
- Field maps
- Verbal presentation

Students record all observations and measurements in their field notebooks. There is a limited amount of time at the end of every day for students to summarise and polish up their field notes. Maps and notebooks are handed in at 4:00pm at the end the fifth day of fieldwork. The main emphasis of the assessment is the work done in the field, and therefore notes should be reflective of that. This is good practice for preparing students for industry roles, where fieldwork is time limited. Additionally, this measure prevents students from overworking themselves after-hours during the fieldtrip.

The high achieving nature of Imperial students sometimes means that they put in disproportionate amount of time into the tasks that do not require that amount of effort. Giving students an indication of how much time should be spent on the task, or putting mechanisms in place that naturally lead to spending appropriate time on a given task can help them distribute their efforts better and prevent overworking and being overwhelmed.

At each locality, the cohort of 90 students and 6 GTAs is split into 3 groups, so that each group contains 30 students and 2 GTAs (with the intention of having 1 male and one female GTA). Until 2017, students progressed through the fieldtrip as an entire year group without the use of subgroups. The implementation of 30-person subgroups improved the quality of support students received, and the logistics of the fieldtrip and communication as the lecturers didn't have to address all 100 people in one go. Groups are rotated around each activity, with each activity being led by an academic member of staff. During student work, the staff wander around the group and examine the students' notebook work in order to give advice. Academics focus on teaching, whereas the GTAs provide extra support, answer student questions, and are also responsible for keeping time. All groups work within line of sight and so coordination between each group is simple. Working in subgroups prevents overcrowding at rock outcrops, and the distribution of groups ensures that staff attention towards the students is equal. Staff are able to support the students even if they do not ask for help.

Every evening after dinner, a new group of 15 students are randomly selected from the year. The team is given 3 hours to prepare a 15-minute verbal presentation, with each person speaking for 1 minute, accompanied by a paper poster which summarises the day's geology. The presentation accounts for roughly 10% of the fieldtrip's mark, with



When introducing tasks with added time pressure it is important to consider students with learning difficulties. Some of those students don't feel comfortable to disclose this to the group and therefore might struggle to meet the pace and certain standards that others are imposing on them. Outside of making working in diverse groups part of group work preparation, there should also be mechanisms put in place to identify where groups are struggling and what support and adjustments could be put in place. Tasks with time pressure can be useful if the ability to respond to tight deadlines is one of the learning outcomes of the module or an important soft skill that the module aims to develop. This is where this time pressure shouldn't be removed but rather students should be scaffolded to learn how to navigate around it. If this is not the case, then it is important to consider whether the short time frame unnecessarily puts additional stress on the students. Essentially the consideration should be given as to the value of creating a high pressure environment for student learning.

the remainder being assessed by their notebooks and field maps. The purpose of the presentation is for the students to demonstrate an understanding of the geology observed on the day, reinforce the days learning for the rest of the cohort, develop presentation skills, [teamwork](#) and the ability to work under time pressure. Two groups present each night. The weighting of the poster presentation is not fixed, as the teaching staff understands that the students' performance day-to-day may be inconsistent, e.g. affected by adverse weather.

Previously the assessment had required the students to produce a report with a 2-week deadline. This assessment was dropped because it was not necessary, as it does not directly reflect the students' work in the field. This also means the course is completely self-contained. Once the trip is over the students do not have to worry about the trip or course work again.

Fit with other assessment methods on the module

The Soils and Engineering Geology module is split into 3 components. The Soil Mechanics and Geotechnical Analysis components are taught in the classroom during the Autumn and Spring Term respectively. The third element is the fieldtrip. 20% of the total module mark is assessed by coursework, and 80% by an exam. The fieldtrip is considered coursework, and comprises 16% of the total module mark. There is also a mini project on geotechnical analysis, which comprises 4% of the total module mark. The exam is a single 3-hour exam sat in the summer term. It is composed of 5 equally weighted questions: 3 questions on soil mechanics, 1 question on geotechnical analysis and 1 question on engineering geology. The engineering geology question pertains to knowledge taught during the fieldtrip, and is weighted at 16% of the overall module mark. In total, this means fieldwork knowledge accounts for 32% of the total module.

Collectively, the Soils and Engineering Geology module is designed to prepare students with the knowledge and skills for the third year of their degree. The field course is self-contained, so the students are not assessed on work done in the field after the trip has ended. However, the final exam will always contain a question pertaining to the learning outcomes fieldtrip, in the form of a picture prompt, with the student being required to give a description of the associated geotechnical hazards they have learnt about in the field.

Practicalities

Preparation of students

Preparation before the fieldwork:

There is a week-long fieldtrip during first year in which the students practice surveying, however students enter this module with no prior field experience in geological field skills, and so skills must be comprehensively taught from the basics.

Geology Fieldtrip



Geology Fieldtrip

Before the fieldtrip, a personal safety risk assessment is completed for all the students, which is then signed off by the Civil Engineering Department's Health and Safety Officer. A risk assessment is also completed from a geotechnical perspective (e.g. sea defences, slope stability).

A 90-minute introductory briefing takes place around a month before the fieldtrip begins. During this briefing, students are run through both risk assessments, briefed about the Civil Engineering code of conduct (expectations of the behaviour of staff and students when working outside Imperial College), and given information on health and safety, including information about field skills and appropriate field gear. This briefing is done page-by-page in accordance with the field guide, a document which is also distributed to students by email for their future reference.

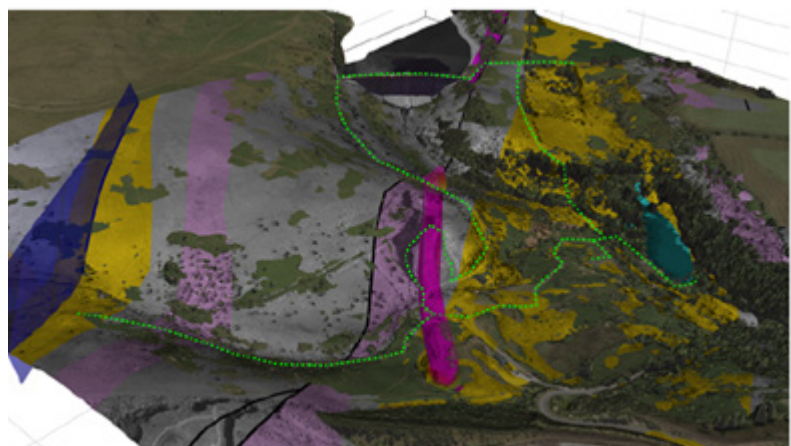
If a student has a question about the trip, staff will post both the anonymous question and the answer on Teams publicly, for the sake of other students who may have shared the same question but have not asked.

When preparing students for assessment, outside of reinforcing the content that should be covered, it is also important to ensure they know how to approach each format. This is especially the case for the presentations that have time constraints and for which students are chosen randomly. There might be a perception that if presentation style is part of the assessment criteria, those students who are chosen at a later stage have an advantage of learning how to approach the assessment method better. Therefore giving guidance to all that makes marking criteria clear and prepares students for the format is also important.

Preparation for assessment:

Before the fieldtrip, details of the fieldtrip including the assessment requirements are distributed by email, and in the students' field guide. The field guide has stayed consistent through the last 10 years, and aside from the assessment details, the booklet also contains an itinerary of the fieldtrip, and gives best practice advice for notebooks and good field skills.

There are also 2 or 3 class sessions, around 2 hours each, on geological map reading, borehole drilling and interpretation, and stereonet plotting. These sessions are followed by a 1-hour practical, where students are able to briefly practice the skills taught in the lecture, with the assistance of the lecturer and GTAs (graduate teaching assistants). Because creating stereonet and collecting borehole data are geological activities which civil engineers are not expected to encounter in their day-to-day jobs, the learning outcomes state that it is sufficient for students to be able to read, understand and interpret geological information should it ever appear.





Geology Fieldtrip

Student wellbeing and out-of-hours support

Students are supported throughout the field trip in several ways. Some staff and GTAs are first aid trained. Students stay in self-selected pairs, in accommodation booked at the Butlins holiday resort in Minehead. Breakfast and dinner is held as a year group. Staff do not need to worry about arranging catering for students with dietary requirements because meals are provided by Butlins, who cater for these requirements.

Although this is an intensive week students do get one evening of during the week. There is also free time after 9:30pm every day, where students can relax, and have the opportunity to chat to the lecturers and GTAs if they have any academic or wellbeing questions.

Students are provided with staff phone numbers in case anybody faces an out-of-hours emergency. There is typically one incident every year. Incidents are typically minor medical issues, such as illnesses, injuries and allergies. There have been no major incidents (requiring hospitalisation), either in or out of the field, since before 2016.

Marking arrangements

The staff and GTAs individually assess each presentation and assign it a mark out of 10, before coming together as a group to discuss the presentation. The final mark is weighted in favour of the staff's verdict, but marking is generally consistent and lies in the right ballpark. Student presentations are marked based on their understanding of the geology, their presentation skills, and the quality of their poster they produce, including creativity. The students are marked as a collective group. This is done due to the fact that students only speak for 1 minute, and because groups only have a couple of hours to prepare the poster and presentation, meaning there is little scope to stringently assess the performance of each individual student. This is reflected by the fact the presentation is weighted very little within the overall module. The presentation is more so intended to build students' time-management, teamwork and presentation skills, as well as recapping the day's geology.

GTAs are picked for the fieldtrip based on their geological background. Marking is overseen by the module lead. He distributes 15 field notebooks to each GTA, and each GTA takes around 30 minutes to mark each notebook. In total, it takes around 1 or 2 days for all the marking to be completed. The module lead then moderates each notebook personally, in order to double check the GTAs' marking.

The markers are briefed with guidance before they begin, and they are given an idealised map from day 5, good notebook guidance and examples of good and bad field sketches as reference. GTAs are briefed, as it may be their first time marking student fieldwork. The marking system is flexible because marks are not directly quantified, yet an upper and lower echelon of quality can be constrained for the entire year. This flexibility is important because the overall performance of the cohort varies year-on-year depending on environmental factors, such as fieldtrip scheduling and weather conditions.



Students not recognising feedback events as feedback is a common issue that many staff face. This could stem from certain preconceptions that students have about what feedback looks like shaped by their past experiences. This means that quite often they associate feedback with text written by a tutor on a feedback form and while it's one of the sources of feedback, in an environment that requires students to be independent learners, it is definitely not the only source of feedback. One way to prepare students for the different feedback events they might encounter in their studies is to have an open discussion around what feedback is according to them and how it compares to departmental practice and the kind of feedback that they will encounter in their professional lives. This will help them develop some aspects of feedback literacy such as appreciating feedback comes in different forms and different sources.

Assessment is weighted heavier towards the end of the week, with the mapping being weighted the greatest. However, there is no numerical standardisation. Practical geology is completely novel to the students. Students learn and improve at different rates and so a flexible marking system is beneficial.

The quality of notebooks is partly dependent on the weather conditions during the week and other external factors (coaches breaking down, traffic jams) which might shorten days. The Mapping brings together the range of skills learnt during the week. In cases when it is raining heavily during the mapping day or the students are late arriving at site, more emphasis will be placed on other elements of work. It so about ensuring the students mark is a reflection of their overall effort.

Feedback arrangements

Students receive verbal feedback in the field during the fieldtrip. This can be through informally asking peers, or through asking GTAs or teaching staff. Teaching staff may also give verbal feedback on notebooks in the field by wandering around and evaluating student notebooks when they are working. The safety is also discussed at every site.

Students also receive generalised feedback at the end of each day, where the tutors run through a half-hour presentation on the geology seen that day and give a brief evaluation of the day's student group presentation. After this presentation, students have an opportunity to talk with GTAs or staff members if they have any outstanding questions.

It has been noticed that students often do not realise that verbal comments given by the staff during the trip count as feedback. As a result, staff deliberately emphasise the fact that they are delivering feedback to the students when talking, e.g. by directly including the word 'feedback' in what they say.

Formal feedback on the marked notebook and map is given after the fieldtrip has ended. Aside from the numerical mark, the GTAs also write a short paragraph of written feedback, explaining what the student has done well and where they can improve. The lead is able to add or amend this feedback when he moderates the GTAs' marking. Students receive their maps, notebooks and feedback before the final exam.

The impact of COVID on the delivery

The COVID pandemic caused the postponement of the trips in the 2019/20 and 2020/21 academic years. No virtual replacement was made available during this time. The Department instead ran the postponed trips as 2 additional, identical fieldtrips on top of the ones normally scheduled during the 2021/22 and the 2022/23 academic years. These extra fieldtrips were for the then-2nd year students that missed out during 2019/20 and 2020/21 (and now take the fieldtrip in the in 4th year).

Geology Fieldtrip



An innovative approach to fieldtrips piloted in other departments involves the use of virtual reality. There are some accessibility issues related to VR such as it causing motion sickness for around 10% of people using the equipment hence going that route could be excluding some students from participation.

Geology Fieldtrip

Alternatives to postponement were sought at the start of the COVID pandemic, including PowerPoint presentations, and virtual fieldtrips held using the software 'ESERC', developed by Earth Science and Engineering. However, concern about the stringency of course accreditation by the ICE (Institution of Civil Engineers) and JBM (Joint Board of Moderators), meant that ultimately the decision was made to postpone the trips and hold them in-person at a later date. Because all students completed the fieldtrip by the end of their degree, there were no issues with accreditation.

Because geotechnical engineering was a relatively standalone portion of a larger module, student learning in subsequent modules was not affected by the postponement of the fieldtrip either.

Advantages of the assessment type

- It is a completely different type of assessment for the students and tests a new skill set;
- Although the fieldwork appears to be of low value, in terms of credits, one compulsory question in the exam is based solely of the fieldtrip and this takes a similar format each year. The students are given a photo and asked to do an annotated geotechnical sketch and some accompanying applied interpretation. Again a novel and unusual type of exam questions which is often praised by external examiners;
- The task aligns very well with what the students will be doing after graduation, therefore helps students develop skills needed to be successful in the industry;
- There is a good level of flexibility embedded into how the assessments are run and with considerations given to how the environment might influence students' day to day performance;

Limitations of the assessment type

- It is time consuming, but it is comprehensive;
- It can be a very fast paced environment, especially for students with specific learning needs;
- It can be difficult to move this assessment online, while VR alternatives can be built they are not suitable for every student

Advice for implementation

- It is useful to ensure that a briefing is organised after students' return from the fieldtrip to help them reflect on what they've learnt from it and incorporate it into future career thinking;
- Ensure that preparation for assessment also includes a briefing on working in groups and outlines the requirements of what the presentation is supposed to look like and how it will be assessed to help students appropriately direct their efforts
- A discussion around what feedback might look like, especially in the context of fast paced field work environment and the different forms and sources it might come from should help students recognise feedback events and help them make use of them better



Geology Fieldtrip

- Consider how important time pressure is for achieving the ILOs and/ or replicating an authentic working environment. If it is one of the goals of the module then students should be helped to manage it, if it is not necessary then the value of the time pressure should be reconsidered
- Ensure suitable adjustments are made for students unable to attend for whatever reasons
- Make sure that students with specific learning needs that might struggle with certain aspects of the field work, such as note taking are appropriately supported through offering time to draft and redraft or using technology.