



School of Civil and Environmental
Term 3, 2020

GMAT4150 FIELD PROJECTS

COURSE DETAILS

Units of Credit	6		
Contact hours	Average 4 hours per week		
Class	Friday, 9 – 1pm	Room CE201	
Course Coordinator and Supervisor	Craig Roberts	email: c.roberts@unsw.edu.au	office: CE 412 phone: 9385 4464
Supervisor	Bruce Harvey	email: b.harvey@unsw.edu.au	office: CE 207 phone: 9385 4178
Supervisor	Craig Roberts	email: c.roberts@unsw.edu.au	office: CE 412 phone: 9385 4464

INFORMATION ABOUT THE COURSE

This course builds on previous courses in years 1, 2 and 3. You should have already passed or been exempt from those courses. If you have not passed any of the year 1, 2 or 3 GMAT courses then you should contact the course convenor for advice and permission to enrol in this course.

This course changes considerably each year with new projects to challenge and educate students. In 2020 there are two separate projects, each with an academic supervisor. The projects are described below.

Prerequisite: GMAT3150

Monitor the class web site at moodle.telt.unsw.edu.au and your university email regularly.

HANDBOOK DESCRIPTION

www.handbook.unsw.edu.au/undergraduate/courses/2020/GMAT4150.html

OBJECTIVES

The objectives of the course are to broaden and deepen your knowledge and experience of data acquisition and surveying instrumentation, field methods, and surveying software, by conducting your own surveys at a site remote from the UNSW campus or on it. The aim is to involve you in management aspects of field surveys, report writing as well as gaining more experience in measurement, fieldwork design, and analysis, and to give you confidence in your ability to do surveys of a type that you may not have done before at University or in employment.

This course is a capstone course in your degree.

Linking the objectives with the program outcome attributes and the assessment strategies for this course:

Objectives	Program outcome attributes	Assessment
Broaden and deepen surveying or geospatial knowledge and experience	Undertake field surveys without detailed instructions	Quality of survey results. Quantity of survey results. Report writing.
Management of surveys	Group work organised and lead by students. Ability to 'cost' the projects based on time spent on the tasks	Discussed and described in reports
Design	Design and plan the survey, test the design by implementation	Discussed and described in reports
Self-Assessment	Each student to write a report that evaluates their performance in the course	A small component of the final mark is based on a student's self-assessment report.

This course provides an environment that fosters in our students the following attributes as listed:

the skills involved in scholarly enquiry	Significant
the skills for effective communication	Significant
an in-depth engagement with relevant disciplinary knowledge in its interdisciplinary context	Significant
the capacity for analytical and critical thinking and for creative problem solving	Significant
the ability to engage in independent and reflective learning	Significant
the skills to locate, evaluate and use relevant information (Information Literacy)	Significant
the capacity for enterprise, initiative and creativity	Significant
an appreciation of and respect for, diversity	Significant
a capacity to contribute to, and work within, the international community	Some
the skills required for collaborative and multidisciplinary work	Significant
an appreciation of, and a responsiveness to, change	Some
a respect for ethical practice and social responsibility	Significant

TEACHING STRATEGIES

Different types of projects will be offered each year. Some projects may appeal more to students interested in Cadastral and Control Surveying, and others to Laser scanning, or GNSS or GIS projects. As far as possible, students will be given the chance to decide which of the projects they will do at the week 1 class (see below). However there are limits to how many students can do some projects so some adjustments might be necessary. Once the project has been selected, the teams of students will be expected to work closely with the project supervisor, who will monitor progress, and give advice on what assessment tasks will be submitted.

The supervisors will play the role of client and specify what tasks the supervisors want students to complete. The supervisors won't give lectures or extensive handouts describing in detail how to do the tasks. So the course is considerably different to GMAT3150. However, the supervisors will be available to give advice to students before, during and after the fieldwork.

Learning methods will be discussed at our class meetings and in the field. A significant aspect of this course is the group work and management by students. Part of the learning will include self-assessment because it

is important that professional surveyors and engineers are able to assess their abilities and performance reliably.

The CE201 computer lab has been booked from 9am each Friday during Term 3 and a 4 hour timeslot has been set for the course so that extended field work can be carried out without clashing with other classes. Students should meet the supervisor at 9am in the lab each Friday (or online as advised) and describe their planned activities for the day. It is possible to do field or computer lab work on other days as well as the timetabled class.

The teaching strategies that will be used and their rationale.

Private Study	<ul style="list-style-type: none"> • Join Moodle/ BBCU discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle
Assessments	<ul style="list-style-type: none"> • Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving
Laboratory Work	<ul style="list-style-type: none"> • Hands-on group work, designing and carrying out surveys • Collaborative report writing

Some quotes that relate well to this course:

I hear and I forget. I see and I remember. I do and I understand.

By three methods we may learn wisdom: First, by reflection, which is noblest; second, by imitation, which is easiest; and third by experience, which is the bitterest.

Confucius Chinese philosopher & reformer (551 BC - 479 BC)

For example: Imitation is the way lectures run (we try to teach you good ways to do things and get you to copy or implement them). Experience is what happened to you when you found that the RTK GPS can't be just picked up and used (the equipment needed to be setup and practiced). Or you had wrong scale factor entered in the EDM etc. Later in the course you can try the reflection part - when you write your report think about what you did before, at and after fieldwork; what would you do better if you were to do it again or do a similar survey elsewhere?

EXPECTED LEARNING OUTCOMES

By the end of this course you will have some experience at tackling new projects and working as part of a team. Further outcomes are listed or described in the project descriptions below.

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

Example:

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. <i>Apply surveying/geospatial knowledge learnt so far in the program to design surveys using a range of equipment to solve challenging problems.</i>	<i>PE1.1, PE1.5, PE2.1, PE2.2, PE3.3</i>
2. <i>Manage a team to solve problems, meet deadlines with appropriate outcomes and communicate these results in report form and/or via a</i>	<i>PE1.5, PE2.4, PE3.2, PE3.5, PE3.6</i>

	<i>presentation to “clients”.</i>	
3.	<i>Analyse and assess data and produce suitable geospatial products that are client ready.</i>	<i>PE1.2, PE1.3, PE2.3, PE3.4</i>
4.	<i>Provide a thorough and critical self-assessment of individual performance and provide this to supervisors.</i>	<i>PE1.6, PE3.1, PE3.3</i>

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

COURSE PROGRAM

During the week 1 class, students will choose group members and which of the Projects (described below) they will work on. There will be activities to perform in week 1, so make sure you attend.

The timetabled class is Friday 9am onwards in CE201 each and every week. The 4-hour timeslot is intended so that you can do fieldwork and or lab work for this project on some days (not necessarily every week) without interruptions from other classes. Of course, you are encouraged to spend some other time on meetings, calculations, report writing, etc. Descriptions of the projects, site photos and maps, WH&S forms, etc., will be discussed at the meeting in week 1.

The field surveys will be conducted as group work. Students within a group do not necessarily all do the same tasks. For example, one student might take on management duties and organise logistics while other students concentrate on design, pre-fieldwork calculations and preparations, etc. It is up to the groups to ensure all students contribute appropriately, as discussed in ENGG1000. The course coordinator may assign different marks to individual students, at their discretion, based on student activity in the field and in the lab.

Survey Store Equipment

Students wishing to collect survey equipment from the survey store must give a detailed written list of requirements to their supervisor at least one day before its required use, or more as specified by project supervisor for field trips. There is no person permanently in the survey store so students will need to organise times of collection and return of equipment carefully. The supervisor will not be able to come and go from the store frequently during the day or at short notice.

PROJECT A

This project will be supervised by Craig Roberts. This project will provide height control for a research project at Thirlmere Lakes being undertaken by the Water Research Lab (WRL) in the School of CVEN and UNSW. WRL have established 24 piezometers in and around the 5 lakes that comprise the Thirlmere Lakes system and they are trying to analyse groundwater flow and recharge and response to changing seasons and rain events. To do this, they need to measure the lake height using a scientific relationship between water pressure (measured by the piezometers) and water level. Therefore, the heights of the PVC piping housing the piezometers needs to be well known and all 24 need to be linked on the same height datum. Ground water engineers would like the heights to be better than a cm if possible.

Presently the piezometers relate to AHD and locations and heights have been recently measured using RTK GPS. This exercise will seek to improve those heights by using more rigorous techniques and establishing a control network that can be more conveniently used for future research work.

Previous airborne lidar and UAV surveys of the lakes have also been undertaken in recent years. Students will try to access this data and then plan and design new flight plans for the 5 lakes. The best UAV from the school’s fleet will be selected by students and flown by Yincai Zhou (Chief pilot at CVEN). We also have access to an airborne lidar in a UAV with an external survey company and possibly airborne lidar from a plane with the school of aviation. Students will process all of this data.

Due to Covid-19 restrictions, we will not be able to run this course as a camp. Instead, we will make regular day-trip site visits on Fridays. It is anticipated that the entire task will take 1 day of reconnaissance and 2 – 3 days of planned field work to complete. The exact timing of these site visits will be determined by the group based on the scope of the work proposed by the group. A suggested timetable is given below. It is recommended for around 15 students.

Proposed tasks to be carried out at the camp*

- 1) Students will search for SCIMS control around the site.
- 2) Students will undertake a literature review of various documents relevant to the tasks such as: ICSM SP1 (v1.7 & v2.1), Surveyor General's Directions no. 1, 2, 4 & 12, GDA technical manual and develop their survey design in concert with these documents.
- 3) Existing control will be assessed and new control will be proposed, established and measured in accordance with documentation above in part 2.
- 4) Measurement techniques such as static GNSS, NRTK, PPK, leap frog EDM height traversing, digital levelling, reciprocal trig levelling will be investigated as suitable to the proposed project.
- 5) Techniques such as AUSPOS, PPP, virtual RINEX and the AVWS will also be considered as part of this project.
- 6) Design of locations for photo control will be required when flight planning for UAV and airborne lidar surveys are carried out.

** Proposed tasks may change depending on circumstances*

Proposed week-by-week activities:

Note these week-by-week activities may change at the agreed discretion of the group. During down times in early weeks, students should commence SCIMs searching and literature review in preparation for the site survey as well as familiarising themselves with the operation of equipment (GNSS and total station) and software (such as Leica Infinity, Pix4D and Waypoint) in preparation for processing and plan preparation after the completion of field work days.

Week 1: Explanation of projects, agreed division of responsibilities, preparation of documentation (WH & S, time sheets), desktop reconnaissance, preparation for design of surveys, begin literature review of relevant documentation on techniques and practices.

Week 2: Continue literature review and extract relevant sections as pertains to the design of the survey. In partnership with the client/supervisor (Craig and folks from WRL), assign locations for new control, quality of control marks, parameters defining its location (to assist during reconnaissance) and rough plans on how to perform control survey. Contact relevant surveyor for their experience in this procedure. Discuss fieldwork logistics and communications and prepare equipment lists. Practise using specific equipment on campus (Leica GNSS/ perhaps RTS for leap frog EDM). Check how Leica Infinity can accept different forms of data (Digital levelling/ leap frog hts, UAV point cloud, LiDAR data, RTK GNSS). Prepare logistics for site visit. Allocate groups for various lakes.

Week 3: Field visit for reconnaissance. Familiarise with the site. Decide on locations and place new control marks in suitable locations for on-going control survey. Design survey to bring reliable AHD height into the project area. Discuss issues with heighting/ geoid.

Week 4: Prepare a group report detailing the preparations and proposed tasks for submission by Friday of week 4. The report will also include the WH&S documentation, time sheets and a description of each of the tasks. Practice using the Pix4D software and sample data in preparation. Practice using the new Waypoint software and sample data in preparation.

Week 5: Field visit for control survey. Based on feedback from group report 1, make adjustments to the plan for the control survey and arrange all necessary unfinished logistics.

Week 6: Individual student interviews with supervisor. Process data from field work using Leica Infinity. Each group should individually produce a network adjusted set of numbers and compare with the original survey from 2019. Consider using FIXIT4 for comparison. Look at weaknesses in the network and improvements that could be made. Consider AUSPOS, PPK, virtual RINEX and repeat levelling runs. Prepare for follow-up field visit.

Week 7: Field visit for UAV/ airborne Lidar and extra survey work as required.

Week 8: Process UAV data and confirm the height of the output accords with AHD. Compute the LiDAR data set using Waypoint and confirm the height of the output accords with AHD. Download RTK data and cross reference with the UAV and LiDAR models. Combine all data sets (RTK, UAV, LiDAR) using Leica Infinity (or other suitable software). Determine how to best present the various datasets. Compare and contrast the various techniques graphically.

Week 9: Write up a group report detailing the various techniques. This group report will comprise various individual components allocated to individual students. Students will be assessed on their individual parts but all parts will combine into the group report. Discuss strengths and weaknesses, expected accuracy and precision and how it compares with the original survey. Give an assessment of which techniques are most suited to this environment and the confidence you have that marks are not moving or otherwise. Include WH & S documentation and time sheets. Write a short individual surveyors report of your opinion on how accurate researchers can monitor ongoing movement of the piezometers.

Week 10: Project write up, time sheets and self-assessment. Submission of group project report, individual cadastral assessment report and self-assessment for the whole course.

The reports should be in **electronic form** as a single MS Word format document that includes at least a title page, contents, summary, results, report, plans, input and output files. Spreadsheets, FIXIT4 input files, laser scan data, UAV files or Magnet Office/ Leica Infinity files where relevant can be in separate files. Name the files clearly. Field sheets (if applicable) and any other paper documents should be scanned for submission. The report should be professionally prepared for the client and copies may be given of the report or parts of it to people from WRL or even outside of UNSW.

Group reports are required for the first two assignments. Each group report however needs to include a breakdown of which individual student performed which task. This will be accompanied by a signed sheet from all group participants agreeing with their specific contribution to the final report. An individual self-assessment report is required.

PROJECT B: Urban Cadastral Survey (Supervisor: Bruce Harvey)

This cadastral project in 2020 has been designed to require students to think about how to tackle a problem that they might not have worked on before or to work on it in a way different to what they might have experienced in part time employment. The cadastral survey tasks are designed to give practice at doing an urban boundary survey. This project would be most relevant for those students considering becoming a Registered Surveyor with Board of Surveying and Spatial Information, NSW.

This project in 2020 has been designed to have a flexible implementation. Several options and tasks are described below. Some of those tasks will depend on how much field work we are allowed to do, how much equipment we can access, and whether we can meet as a group on campus in our computer labs.

Students doing this project must have passed GMAT3420.

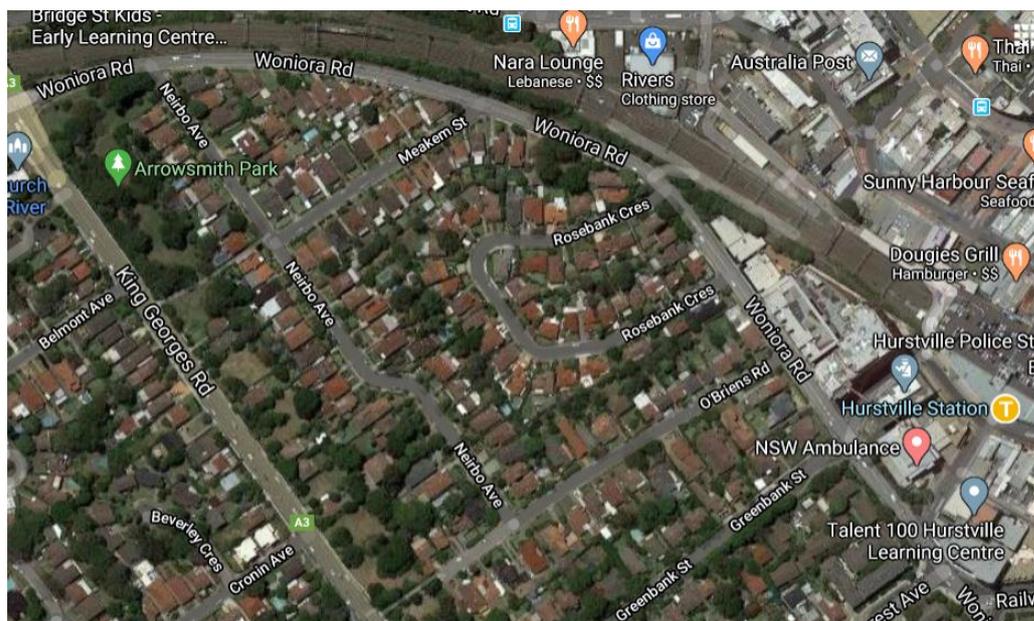
It is expected that many students will choose Project A (described above) and that only a small number of students will do this urban cadastral project. This project builds on GMAT3420 and GMAT3150; good marks

in those two courses are a prerequisite for this project.

This project will not include a residential field week, but will spend about one full day per week during term working on the project, in the office some days and in the field some days. Additional time will be spent by students preparing reports producing plans and analysis. A total of almost 150 hours is expected.

This project builds on considerable work done on this site by several thesis students in previous years and by some GMAT4150 students in 2019. We continue to work on this site because we have many DPs already purchased and much of the boundary dimensions are already in FIXIT input format.

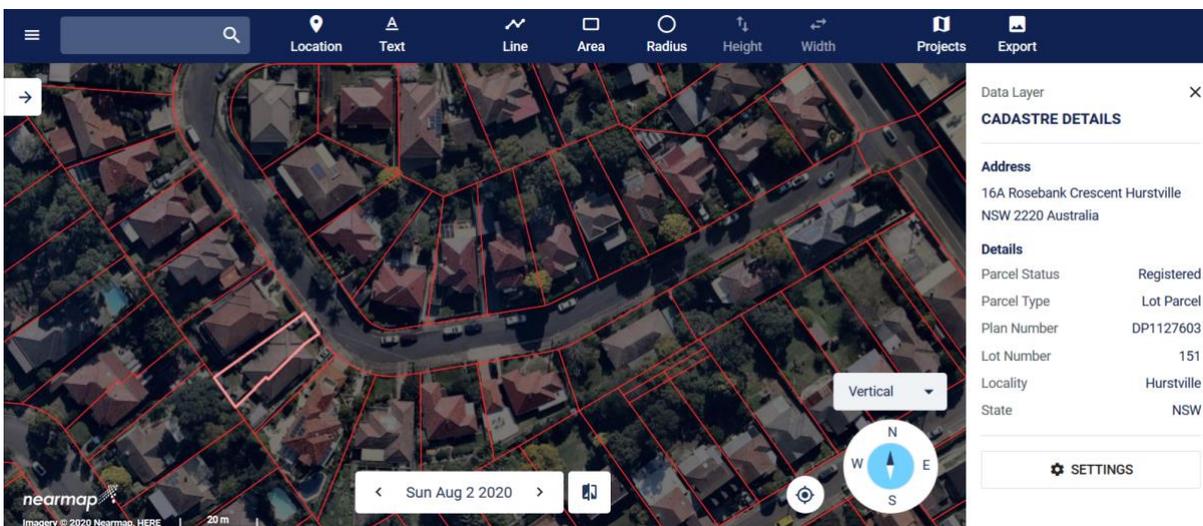
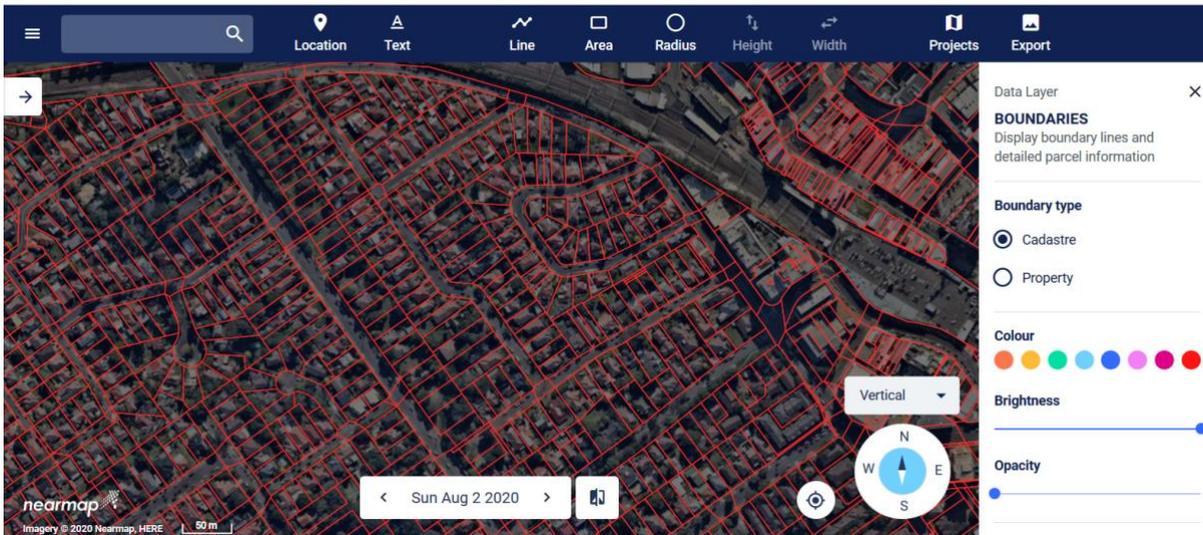
The main site in 2020 is Rosebank Cres Hurstville, a loop formed with Woniora Road, and the lots enclosed within. It is very close to Hurstville Railway Station. It is the site of the DP used in GMAT3420 mid-term test in 2019. If time permits or more students are involved we might also do surveys in O'Briens Rd (both sides), Neirbo Ave (eastern side) and Meakem St (southern side).



Depending on what we are allowed to do, the equipment we use will be: individuals using smart phones with GNSS apps; pairs of students using RTKGNSS; and or groups of three using total stations. The accuracies of the surveys will obviously differ but some of the cadastral boundary issues can still be learnt. We will survey road frontage boundaries, not the rear boundaries of lots.

Proposed Project Outcomes

- 1 Obtain MGA2020 coordinates of lot corners
- 2 Check the accuracy of Nearmap's cadastral overlay which is based on the PSMA cadastral database.



- 3 Determine how close the old brick fences are to lot corners (offsets or joins). Determine the joins from unidentified survey marks to nearby lot corners.
- 4 Possibly, prepare a draft DP and LandXML file for the area surveyed. Understanding that the accuracy of our measurements may not meet NSW Regulations (because of the equipment we may have to use).
- 5 Prepare reports. Some group work and some individual work.

Proposed project Tasks

- 1) **Search.** Many Cadastral DPs that were collected for this site a few years ago will be supplied. Students will search to find if there are any new DPs or SPs (we will use base location plan only of any strata plans) for the site. Other information to be gathered includes: Google Earth; Nearmap; SIX maps; Google Street view; 1943 air photos; get MGA2020 coordinates of SCIMS marks; and Trove historical photos of the houses, fences and streets.

There is more involved in “reading” a DP than holding it in your hand and looking at it. This task involves studying the collected information and preparing for the survey. If only a few students do that and you are not one of them then you will wander around the field not knowing “what is going on and why”. My advice is to investigate the evidence thoroughly. Try not to rush to conclusions. Don’t just use the latest DP. Otherwise, when you go to the field you may not look in the right places and might have other problems with your redefinition of boundary. Remember to consider the original intentions and the hierarchy of evidence.

- 2) **FIXIT Office.** Start with previous students’ FIXIT input files for a large area that includes this site. Remove parts of the file not relevant for our 2020 survey. Check the observations are

correctly entered (ie the input file matches the DPs). The distances in the input file should be the same as on the DPs and that is ground not grid. A global scale factor should be included in the file. Calculate MGA2020 coordinates of all corners, monuments and reference marks. Maintain the existing point numbering system.

- 3) **Field preparation.** Organise for transport of equipment to site and prepare for the site fieldwork. Organise the work roster and logistics for the site fieldwork. Practice using the equipment and software.
- 4) **Field GNSS.** Use RTK GNSS and above derived MGA coordinates to find and then survey reference marks and SCIMS marks on the site. Marks will need to be surveyed twice at different times. Survey the position of all significant (eg brick) occupations. This can be done in groups of 2 with equipment provided by supervisor on site. Use tape to check short distances between nearby marks. It may be necessary to use the hidden point method with tape distances for some marks. If RTK is not allowed then use the HandyGPS app and the NSW Survey Marks app. Perhaps use RTK and phones.
- 5) **Field traverse.** If allowed, use total stations to traverse and radiate all marks. Most of this site has healthy trees on footpaths that will make traverse design challenging. All radiations are to be reliably checked and evidence recorded. In 2020 we will place temporary traverse station marks at all setups and we will carry coordinates and bearings in the field. We will not be entering private property. Take photographs, and annotate them, of the marks and new monuments measured. When traversing with total stations for a cadastral survey it is important that any radiations to marks (pegs and GIPs etc) are checked – not just repeat the observations. Even better is to use an existing reference mark or potential new reference mark as your traverse station, but I know that is not always possible due to line of sight blockages.
- 6) **Office calculations.** Adjust all field measurements in FIXIT. If RTK or phone GNSS are used then point positions with suitable std devs are to be entered.
- 7) **Office calculations.** Combined adjustment of field measurements, SCIMS coordinates and DP boundary data in FIXIT, on MGA 2020 bearing and grid distances.
- 8) **Office plans.** Export the adjusted coordinates from FIXIT to Magnet Office or Civil3D and produce a plan. Optional: Draw a DP with the many new monuments. Use the brick corners of houses, garages and fences as new long lasting reference marks for our corners because they have existed for many more years than the original corner marks and marks placed in concrete footpaths or kerbs. Create a LandXML file from the plan. Create a kml file of the boundaries and reference marks. Include coordinate information and photos in the kml file. Make a video walk-through of the site
- 9) **Office Boundary definition.** Discuss and decide what to do when our measurements do not agree with PO dimensions or when existing DPs do not 'fit together'. More discussion about boundary definition is given below and discussions with the supervisor will occur during the project.
- 10) **Office report.** Write a thorough report of the project and archive all data.

Finally, students will be required to submit a formal documented self-assessment and a log sheet showing the number of hours spent on this project including meetings, travel, on site and post processing. The final report should include the total hours spent by students and a hypothetical costing of the "job". Students are expected to have regular meetings amongst themselves and with the client (academic supervisor).

ASSESSMENT

There is no final examination in this course.

Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are set out below for each project separately.

Each student should include a time sheet indicating the time spent on this course – in much the same way as a business would use to charge a client for work on a project. It should include travel and meeting time. Students should not spend more than 150 hours on the course. However students should not ‘waste’ time doing idle activities merely to accumulate time for the project. Students will be required to submit a formal documented self-assessment on their participation in this course. Students who spend too few hours on this course have probably not contributed significantly; that affects their own learning and the group’s output. The main reason for including time sheets in the course is because some parts of industry report that some graduates are not experienced at recording total time spent on a project and the consequences for budgeting, and quoting for future projects.

As a management exercise, the final reports should include a hypothetical costing of the “job”. Students are expected to have group meetings regularly and keep minutes and action items of those meetings. Students are to prepare all necessary H&S documentation and to submit this to their supervisor.

Feedback for all reports will be given as soon as possible after submission. Details of the Self-assessment task will be given in a separate file on the class website.

Late work will be penalised at the rate of 10% per day after the due time and date have expired.

Project A: Thirlmere Lakes control survey

Assessment Criteria for Project A are as follows:

Project team (group) report (30%) (Due: 4pm, 9 October 2020) Will be assessed based on the following criteria

- Written presentation 5%
- Literature Review 5%
- Description of survey design, GNSS, vertical control, UAV and airborne Lidar 6%
- Evidence of Initial field testing and analysis 8%
- Project team working plan for Thirlmere Lakes project 6%

Final (individual) report and presentation (60%) (Due: 4pm, 20 November 2020) will be assessed based on the following criteria:

- Written presentation 5%
- Review of other work 5%
- Quality of project work (design and justification of the case study) 15%
- Results and interpretation 15%
- Conclusions and recommendations 10%
- Individual class presentations (10%) (Friday, Week 10, a separate document will describe the details)

Individual self-assessment (10%) (Due: Monday 4pm, 23 November 2020) will be assessed based on the following criteria:

- Insight of self-assessment 8%
- Written presentation 2%

Project B: Urban Cadastral Survey

Assessment Criteria for Project A are as follows:

Project team (group) report (30%) (Due: 4pm, 9 October 2020) Will be assessed based on the following criteria:

- Review of cadastral search (DPs, photos etc) 5%
- Review and edit of Fixit input files 8%
- Calculate MGA coordinates of all corners, monuments and reference marks from plan data 10%
- Field work logistics planning 4%
- Written presentation, on time, plagiarism statement 3%

Final (individual) report and presentation (60%) (Due: 4pm, 20 November 2020) will be assessed based on the following criteria:

- Description of field work issues encountered 10%
- Discussion of Boundary definition and or comparisons with Nearmap or DCDB coordinates. Discussion of agreement (or not) of the occupations with boundary 15%
- Pdf drawing of a new plans of the site (CAD, DP, kml file, or a LandXML file) 10%
- Conclusions and recommendations, including management and cadastral issues 5%
- Timesheet / log of hours spent on this project 2%
- Written presentation, on time, plagiarism statement 3%
- Individual class presentations (10%) (Friday, Week 10, a separate document will describe the details)

Individual self-assessment (10%) (Due: Monday 4pm, 23 November 2020) will be assessed based on the following criteria:

- Quality of self-assessment 10% (a separate document will describe the details)

RELEVANT RESOURCES

- Materials from previous GMAT courses that you have studied
- Additional materials provided on Moodle.
- Survey equipment from our store CE G7.

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

<https://student.unsw.edu.au/dates>

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

<https://student.unsw.edu.au/plagiarism>

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: [The Nucleus: Student Hub](#)
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at:

<https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice>

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving
	PE2.2 Fluent application of engineering techniques, tools and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (professional and lay domains)
	PE3.3 Creative, innovative and pro-active demeanour
	PE3.4 Professional use and management of information
	PE3.5 Orderly management of self, and professional conduct
	PE3.6 Effective team membership and team leadership